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Journal of Dental Specialities

From science of dentistry to technology of education

Prof. (Dr.) Vinod Sachdev,
Director-PG Studies, I.T.S Centre for Dental Studies and Research, Muradnagar.
Editor-in-chief

"To raise new questions, new possibilities, to regard old problems from a new angle, requires creative intelligence and marks real advance in science." – ***Albert Einstein***

Greetings!

Science, my friends, is a process of investigating. It is again impossible for a scientist to learn what he thinks he already knows, giving birth to a crystal clear context: train your mind like a parachute, for both work best, when open! And research in dental science demands a virtue as plain as common sense, as infinite as imagination, merciless to fallacies in logic. I thank, in this regard, to all my readers, for an over whelming response to our preceding issue and copious contributions consisting of high quality scientific literature.

Lately, there have been deliberations concerning educational reforms, particularly in the field of medical and dental education. Here, I would like to accentuate upon the educational experience in academic health centers. Learning, is an active process going on inside a student's mind and teacher's main role is to facilitate this learning process.[1] Problem-based learning, competency based curricula and evaluation have been researched and advocated on time-to-time basis to meet changing perceptions in educational realm. Objective Structured Clinical Examination (OSCE), Early Clinical Exposure (ECE) and Peer-Assisted Learning (PAL) are few instruments encompassing an array of unique philosophies, with proven effectiveness, in teaching-learning process.[2] However, the advent of multimedia technology and the internet have revolutionized educational technologies from cryptic legacy applications used by classes to mainstream applications adopted by masses.

The recent being, e-learning via Massive Open Online Courses (MOOC's), where a simulated lecture scenario not only helps to bridge the gap between delivery and receiving, but also exposes students in field of research and science to explore contents of their field from a global perspective. Human Patient Simulation (HPS) and Virtual Patients (VP) are some of concept frameworks that can be used to characterize educational technology applications. Concurrently, faculty empowerment strategies in domain of medical education technology too need to be implemented to teach the dentists of tomorrow with techniques of today! I am candidly optimistic about the bigger role, medical education technology has to play in future.

I shall promptly culminate from where I began, by recalling an epic quote from ***Louis Pasteur*** as **"*Science knows no country, because knowledge belongs to humanity, and is the torch which illuminates the world. Science is the highest personification of the nation because that nation will remain the first which carries the furthest the works of thought and intelligence.*"**

It is my earnest request that we, as dental fraternity, be in cahoots to contribute in every meaningful way to see our country as well as the world prosper, for the overall benefit of human community.

May the Light of Knowledge be with you!

With Best Wishes,

Prof. Dr. Vinod Sachdev
Editor-in-chief, Journal of Dental Specialties,
I.T.S CDSR Ghaziabad

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Consolidating graduate dental training with specialty education to fast-track the curriculum...is it time for changing the game?

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Introduction

I, came across an interview by the legendary cricketer Sachin Tendulkar, considered "child prodigy" in his teenage years and definitely the best amongst the best in the world of cricket till date. To my surprise he revealed the "***early days***" of his childhood were well spent on "***training hard***" with the ***ball and the bat*** and ***not*** really with learning ***trigonometry and Shakespeare plays***. Well, we all know what really helped him earn his bouquet of roses and rise through the ranks (when I say this I have no intention to belittle trigonometry or Shakespeare plays!). But, why do I talk about this? Somewhere in the interview, the words "***early days***" and "***training hard***" got imprinted in my mind and arose my inquisitiveness and also the topic of this editorial.

I dug deeper into the content of "training methods (in sports)" and came across two whipsaw methods- "***Early Specialization***" and "***Late Diversification***".[1] The common base for both the schemes is the "***exposure to general events***" and "***exposure to specialised events***" (analogous to ***graduate training*** and ***post graduate training*** respectively). What makes them ***distinct*** is the variation in '***length and density'*** of the event exposures by tuning the ***time point*** to separate the events.

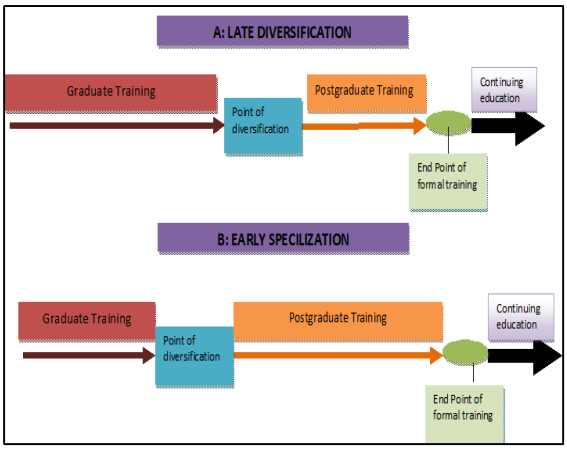

Fig. 1: Early specialisation vs late diversification distinguished by separate time point of diversification

I would not emphasise on the numerical value of the time point set. This, is because, I, am putting forward before you an "***alternate proposition in dental education***". Besides incorporating the aspect of ***"early specialization"*** in the curriculum, this suggested scheme is also characterised by the feature of "***mandatory post graduate program***" (in a particular recognised specialty). Thus one can caption this recommendation as "***Consolidated Fast-Track curriculum***" merging general dental training with specialty education and we can consider it as a "***Game Changer in the Dental Education Scenario***".

The current graduate dental education scenario…

The dominant model of undergraduate dental education in India consists of certain ***overstressed and other under stressed zones***.[2] Take for instance certain disciplines like implantology, geriatric dentistry, stem cell therapy, forensic dentistry and many more fall under the ***under stressed zones***. At the other end of the spectrum, dental materials and basic sciences acquire a greater deal of emphasis and classify under ***overstressed zones***.

Also the divorce between the basic science and clinical disciplines ***negates*** the development of "***problem solving ability***" in the students. Considerable volume of preclinical laboratory years over brimming with several exercises and lectures often leave the students ***exhausted and disgruntled***.[2]

The zone of transition from graduate onward…

This transition, once a student truly becomes a dentist, into "***what next***" is more often than not, turbulent. There are several lacunae depicted by negative outcomes that precisely need an (urgent) intervention and implementing the ***"alternate proposition".*** The opinion in this editorial may be one such intervention. The figure below represents a conventional route selected by students. It needs to be emphasised at this juncture that this is **one of the more common routes** that a dental student transgresses, however not an exclusive one.

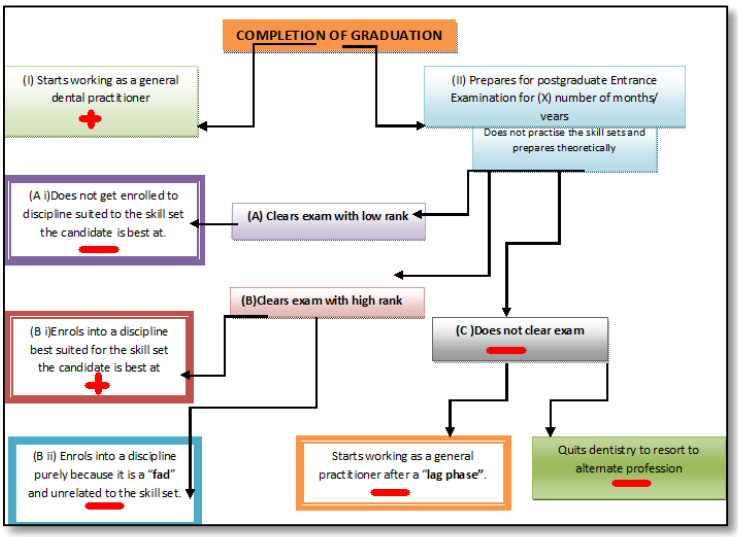

Fig. 2: Common routes taken by Indian dentists subsequent to graduation

So why should we give the "alternate proposition" a thought?

1. Dental education and curriculum of a country must be tailor made according to the prevailing oral issues encountered by the people of that region (societal backdrop).[2] For example, in India the changing demographics is manifested by increased life span due to improved medical facility. This cohort of elderly population is special in two ways. First, they usually display an array of dental work and materials in their mouth due to previous dental history. The second distinctive feature in this group of people, is the associated systemic illness. Our education system currently cannot fulfil with confidence the requirements of this set of people. Redesigning the system such that we have a larger pool of operators who can address the issues of patients requiring special care competently is need of the hour. Emphasising on specialty training will definitely increase the number of such experts, thus percolating dental expertise to people deprived and bereft of quality care.
2. Dental practice should assimilate recent advances in science and technology at the same pace as discoveries. Research and development attempts to solve the impending problems encountered in practice. However, implementing and incorporating the newer techniques will require dedicated training to yield larger number of experts, and, thus, require a shift of an emphasis towards specialty training. Clearly this calls for longer hours of specialty training and can be achieved by early specialisation.
3. Interestingly the consolidated curriculum emphasising on early specialisation promises greater respect towards parallel disciplines by restricting the performance of an operator to "exclusive" chosen discipline. This can be anticipated to be a result of increased dependency towards other disciplines and hence the respect. The same also ensures quality service delivery. Take for instance the following situation. A Prosthodontist encounters a fractured instrument in the canals of one of the prospective abutments for a bridge. A remote experience with broken instrument management during graduate training years of the Prosthodontist may not yield similar results/output to that of an endodontist working under a microscope to negotiate the same!
4. The system will be freed from the redundant information and entrance examination concept that are more based on "rote" ability and subject to negatives like "cueing".

5. Early entry into a specialty may also help strengthen research capacity of the nation by sowing the concept in young minds.
6. The concept will definitely shorten the length of training and the candidate enrolled will graduate and post graduate from the same dental college thus making him more familiar and sensitised to the setting and practise of that institute.

What may be a barrier in considering this proposition?

There are threefold issues that may be considered prior to giving this hypothesis a thought.

1. The students in India enrolling for a dental program are naïve and young at age, usually belonging to late teens. In many parts of the world students enrol after a previous (baccalaureate degree) thus preparing them more professionally prior to entry to a dental college. A young age as seen in Indian dental students is highly impressionable and likewise dangerous as any incorrect "impression" can subsequently lead to a wrong selection.
2. The second aspect is the resistance that may be encountered by existing faculty conservatism and rigidity of mind set leaning towards orthodox methods and tools of education.
3. To shape up such an education curriculum more resources will definitely be required to be invested in order to match the expected increase in rolled over number of students.

Conclusion

Redefinition of professional roles assures momentum in any profession, and dentistry is not exempted. An overburdened graduate dental curriculum, characterised by inclusion of several redundant information details needs pruning and restructuring is one way. Amalgamating the post graduate curriculum to the graduate curriculum, thus enabling the students to focus on what they are best at rather than to be all rounders, is the other way.

The editorial is '**not prescriptive'** or a '**cook book solution'**. Neither is it a polemic on general dental practitioners. It just offers an **alternate proposition to turn things around**. This may appear too dramatic and radical to many readers yet is one of the possible ways to address the impending situation and **delivering specialised patient based care** and not merely procedures to our patients.

Dentistry has come a long way from being "**just a prelude to apprenticeship" into "a comprehensive profession".**[2] This has been possible because we never maintained a "status quo" and **we kept the ball rolling**. Resistance and oppositions have always been overcome.

Like before we once again find ourselves at the cross roads. We need to "**reassess, review and renew**" with vigour in order to contribute to science and community. In today's time, we need to infuse a spirit of "***constructive consolidation"*** in order to best utilise the energy, time and passion of our students.

I sign by quoting the following: "***Experimentation and learning will help dentistry face one of its uncertainties- namely whether the future supply of dental practitioners and services will match, exceed or fall below the population requirements for dental care***."[2]

Lastly, "***It is not our abilities that determine us. It is our choices***." Sachin Tendulkar would have never made it as the world's best batsman had he continued doing trigonometry and learning Shakespeare plays.

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Effect of grape seed extract and sodium ascorbate solution on the shear bond strength of ceramic brackets bonded to bleached enamel

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Abstract

Introduction: To evaluate the effect of application of two anti-oxidants, sodium ascorbate and grape seed extract after bleaching on the shear bond strength (SBS) of ceramic brackets.

Materials and Method: Fifty freshly extracted human first premolars for orthodontic purposes were collected and randomly divided into five groups (n=10 per group), an unbleached control group (Group I) and four experimental groups bleached with 35% hydrogen peroxide as follows: Group II (immediate bonding post-bleaching), Group III (delayed bonding), Group IV (bleaching followed by application of 10% sodium ascorbate solution, then bonding) and Group V (bleaching followed by application of grape seed extract, then bonding). Polycrystalline ceramic brackets were bonded to all the teeth. Bond strength was tested with a Universal testing machine following debonding.

Results: Analysis of variance indicated a significant difference between SBS of the groups ($p<0.001$). The highest values for bond strength were measured in Group V (12.68±0.2) and the lowest in Group II (6.92±0.85). Group II (immediate bonding) had significantly lower bond strength than all the other groups. There was no significant difference between the SBS of Groups I, III, IV and V. Adhesive Remnant Index (ARI) scores indicated bond failure at the bracket/adhesive interface and within the adhesive.

Conclusion: Bleaching with 35% hydrogen peroxide significantly reduced the bond strength of ceramic brackets. Treating the bleached enamel surface with 10% sodium ascorbate solution or grape seed extract (5% proanthocyanidin solution) before bonding, reverses the reduction in bond strength and can be used as an alternative to delayed bonding.

Keywords: Bleaching, Bond Strength, Ceramic Brackets, Anti-Oxidants

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Introduction

Discoloration of teeth is a major aesthetic concern for dental patients. Bleaching is often used as a conservative method for whitening of teeth in adult patients. As a result, orthodontists are often required to treat patients who have had their teeth bleached. Tooth bleaching agents commonly contain hydrogen peroxide as the active ingredient, either applied directly or indirectly produced from sodium perborate or carbamide peroxide. Hydrogen peroxide acts as a strong oxidizing agent through the formation of reactive oxygen molecules which attack long-chained, dark coloured chromophore molecules and split them into smaller, diffused and less coloured molecules.[1]

Changes in the structure and composition of enamel induced by these bleaching agents may affect the shear bond strength of bleached enamel. Several studies have evaluated the effects of bleaching on the shear bond strength (SBS) of orthodontic brackets.[2-7] Some authors found no adverse effect of bleaching on SBS of orthodontic brackets [2,3,5,7], however, many others have reported a significant reduction in bond strength after bleaching.[4,6,8] This reduction in bond strength has been attributed to a delayed release of oxygen from the bleaching agent that could either interfere with the infiltration of resin into etched enamel or inhibit polymerization of adhesive resin.[7,9,10]

To overcome the problem of reduced bond strength after bleaching, several methods have been proposed such as removal of a superficial layer of enamel, pre-treatment with alcohol and use of adhesives containing organic solvents.[9] The most commonly recommended method is to delay the bonding procedure because the reduction in bond strength has been shown to be transient.[8,9] Studies have shown that the reduction in bond strength can also be reversed with the application of an anti-oxidant agent, such as 10% sodium ascorbate used either in the gel or solution form.[9-14] Grape seed extract is a natural anti-oxidant containing oligomeric proanthocyanidin complexes that have free radical scavenging ability which is reportedly fifty times more potent than sodium ascorbate.[15,16] However, to our knowledge, this agent has not been previously investigated for its ability to reverse reduction in bond strength of orthodontic brackets to bleached enamel.

Most of the studies evaluating bond strength of orthodontic brackets to bleached enamel have employed metal brackets, while only a few have evaluated the bond strength of ceramic brackets to bleached enamel.[8,17-19] It is quite likely that adult patients who

have had their teeth bleached would also be concerned with the visibility of their orthodontic appliances and opt for ceramic brackets. The aim of the present study was to determine the effect of bleaching on the shear bond strength of ceramic brackets and to evaluate the effect of application of two anti-oxidants, namely sodium ascorbate and grape seed extract after bleaching on the shear bond strength of ceramic brackets.

Materials and Method

Fifty human first premolars that had been freshly extracted for orthodontic purposes were collected, debrided, washed with water and stored in a solution of 0.1 % (weight/ volume) thymol till use. The criteria for selection of the teeth were intact buccal enamel, no pre-treatment with chemical agents and no cracks, caries or restorations. Each tooth was embedded in autopolymerising acrylic resin so that the long axis of the tooth was perpendicular to the base of the mould. The teeth were randomly assigned to 5 groups of 10 teeth each. Group I (control), in which teeth were not bleached before bonding; Group II, in which teeth were bleached and bonded immediately after bleaching; Group III, teeth were bleached and bonded after being stored for one week in artificial saliva; Group IV, teeth were bleached followed by application of 10% sodium ascorbate and then bonded and Group V, teeth were bleached followed by application of grape seed extract (5% proanthocyanidin) and then bonded.

In the four bleaching groups, a commercial bleaching material containing 35% hydrogen peroxide (Pola Office Bleach, SDI, Bayswater, Victoria) was applied according to the manufacturer's recommendations. The enamel surfaces were cleaned with pumice and water with a brush in a slow speed handpiece and dried with an air syringe before bleaching. The bleaching gel was applied and spread evenly over the enamel surface with a microbrush for 8 minutes. The bleaching gel was removed and reapplied three times. After the bleaching procedure, the teeth were thoroughly rinsed with water and the bleaching material removed with a soft toothbrush.

Bleaching was followed by application of antioxidant agents for the specimens of Group IV and V. In Group IV, after bleaching and rinsing, 10 ml of 10% sodium ascorbate solution was dripped on the enamel surface and agitated with a sterile brush for 10 minutes. The enamel surfaces were thoroughly rinsed with water for 30 seconds followed by bonding. In Group V, after bleaching and rinsing, the enamel surfaces were treated with 5% proanthocyanidin solution, which was prepared by dissolving grape seed extract powder in distilled water. The solution was applied for 10 minutes and then rinsed off, followed by bonding.

The same bonding procedure was used to bond polycrystalline ceramic premolar brackets (Ortho Organizers, CA, USA) to the teeth of all the groups. The teeth were cleaned with water and fluoride-free pumice before being etched with 37% phosphoric acid gel for 30 seconds followed by rinsing with a water spray for 15 seconds and dried until a characteristic frosty white appearance was observed. A thin uniform layer of Transbond XT primer (3M Unitek) was applied with a microbrush on the etched enamel surface and light cured for 10 seconds. Transbond XT plus adhesive paste (3M Unitek, Monrovia, Calif) was applied on the bracket base. The bracket was positioned on the tooth, pressed firmly to express the excess adhesive which was removed with a sharp scaler and the adhesive was cured with a LED light curing unit (Satelec, Acetone, France) for 20 seconds.

Each specimen was loaded onto a Universal testing machine (Banbros, WDB-5) with the long axis of the specimen kept perpendicular to the direction of the applied force. The knife edge was positioned in the occlusogingival direction and the shearing force was applied at a cross-head speed of 1 mm/minute to determine bond strength. After debonding, all the teeth and brackets were viewed under 10X magnification to assess the remaining adhesive and scoring was done according to the modified ARI.[20] The scoring criteria was as follows:

1. The entire adhesive, with an impression of the bracket base, remained on the tooth.
2. More than 90% of the adhesive remained on the tooth.
3. More than 10% but less than 90% of the adhesive remained on the tooth.
4. Less than 10% of the adhesive remained on the tooth.
5. No adhesive remained on the tooth

Statistical Analysis: Statistical analysis was done with SPSS version 16. Descriptive statistics including mean, standard deviation and minimum and maximum values were calculated for each test group. The Levene test indicated that the data was normally distributed. Hence parametric tests were used. One-way analysis of variance (ANOVA) was used to compare SBS among the groups. Multiple comparisons were made with the Tukey HSD test. The chi square test was used to determine differences in ARI scores. Significance for all the tests was kept at $p<0.05$.

Results

Descriptive statistics for the SBS (MPa) of all the test groups are presented in (Table 1) and as box plots (Graph 1). ANOVA indicated a significant difference between the groups ($p<0.001$) as shown in (Table 1). The highest values for bond strength were measured in Group V (12.68 ± 0.2) and the lowest in Group II (6.92 ± 0.85). There was a significant difference ($p<0.05$) in the SBS values of the groups. Group II (immediate bonding) had significantly lower bond strength than all the other groups.

There was no significant difference between Groups I, III, IV and V. The frequency distribution of ARI scores is presented in (Table 2). Chi-square analysis showed a significant difference between the groups. Most of the samples in Groups I, III, IV and V showed ARI scores of 2 and 3, whereas, Group II showed a greater number of ARI score of 4.

Graph 1: Box plots showing Shear Bond Strengths (MPa) of all the Groups

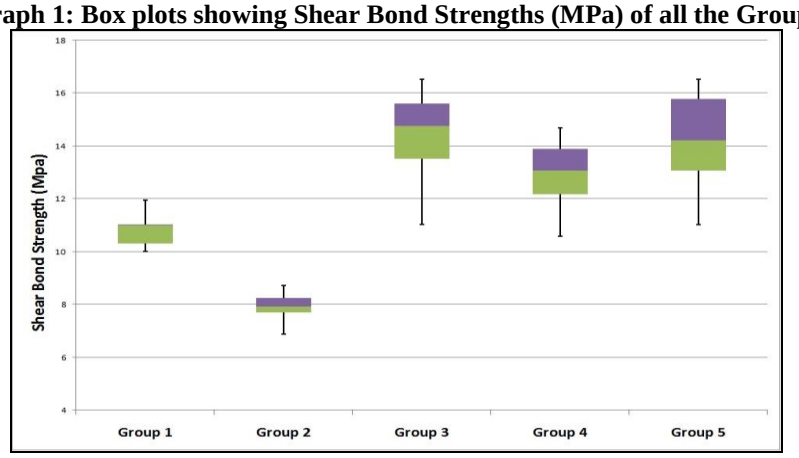

Table 1: Descriptive Statistics and ANOVA to compare SBS of test groups

Test Groups	n	Mean	SD	Std. Error	Minimum	Maximum	p-value
Group I[a]	10	11.7	0.26	0.08	11.24	12.09	0.000***
Group II[b]	10	6.92	0.85	0.27	5.92	8.09	
Group III[c]	10	11.95	1.03	0.32	10.51	13.16	
Group IV[d]	10	12.23	0.97	0.3	10.59	13.39	
Group V[e]	10	12.68	0.2	0.06	12.35	12.96	
The small letters indicate homogenous subsets							

Table 2: Frequency distribution of the Adhesive Remnant Index scores

Test Groups	n	ARI scores				
		1	2	3	4	5
Group I	10	1	3	5	1	0
Group II	10	0	1	1	6	2
Group III	10	0	7	3	0	0
Group IV	10	1	5	3	1	0
Group V	10	1	4	4	1	0

Discussion

The effect of bleaching agents on the bond strength of composite resin to enamel has been investigated in many previous studies. Several authors have reported a significant decrease in bond strength of orthodontic brackets to bleached enamel.[1,8,9,21,22] The results of the present study demonstrated a significant reduction in the bond strength of ceramic brackets bonded immediately after bleaching. Miles et al[8] also reported a significant reduction in bond strength of ceramic brackets after 72 hours of bleaching with 10% carbamide peroxide (CP) and suggested discontinuing of bleaching at least 1 week before bonding of orthodontic attachments. In contrast, Oztas et al.[17] reported that bleaching agents that contain 20 % CP did not affect SBS of metal and ceramic brackets when bonding is performed 24 hours or 14 days after bleaching.

Bishara et al[3], Mishima et al[7] and Uysal et al[5] contradicted the effect of bleaching on bond strength and reported no significant difference in bond strength of bleached and unbleached enamel when 10% CP or 35% hydrogen peroxide was used. This may have been due to the difference in the post-bleaching period, before the samples were tested for bond strength. Studies that reported no adverse effect of bleaching on bond strength evaluated bond strength after 24 hrs to 14 days post- bleaching which may have reversed any changes due to bleaching.

Delaying the bonding procedure after bleaching has been recommended to avoid the reduction in bond strength after bleaching, although investigators differ in the amount of time that should be allowed to lapse

before bond strength values return to the levels of unbleached enamel. A delay of 24 hours to 4 weeks has been suggested by various authors.[1] In this study, a delay of 1 week after bleaching reversed the decrease in bond strength, which confirms previous investigations by Miles et al[8], Bulut et al[9] and Mishima et al.[7] In contrast, Firoozamand et al.[18] reported a reduction in bond strength of polycrystalline ceramic brackets even after 14 days of bleaching.

Several reasons have been proposed to explain the reduction in bond strength to bleached enamel such as alterations in the morphology of the enamel surface like increase in the porosity of the enamel, loss of prismatic structure with a mild etching effect, loss of calcium, decrease in micro-hardness and alterations in the organic substance.[2,3,7,9] Presence of residual oxygen which interferes with resin infiltration into the etched enamel and inhibits polymerization of resin, has also been cited as a reason for the reduction in bond strength.[9-11,22]

This study tested whether the reduction in bond strength could be reversed by neutralizing the effect of residual oxygen with application of anti-oxidizing agents as proposed by Lai et al.[11] and Bulut et al.[9] Two antioxidants were used for this purpose- sodium ascorbate and grape seed extract. Application of antioxidants before bonding restored the bond strength to levels similar to that of unbleached enamel. This finding is in accordance with previous studies by Lai et al[11], Bulut et al[9], Turkun et al[10], Freire et al[12] and Muraguchi et al[13], in which sodium ascorbate (salt of vitamin C) was used as an antioxidant. The mechanism by which sodium ascorbate reverses the reduction in bond strength has been previously explained by Zhao et al[23] and Lai et al.[11] According to Zhao et al[23], peroxide ions replace the hydroxyl radicals in the apatite lattice producing peroxide-apatite. When peroxide ions decompose, the substituted hydroxyl radicals re-enter the apatite lattice, thus, eliminating the structural changes caused by the peroxide ions. Lai et al[11] stipulated that the incorporation process of peroxide ions might also be reversed by an antioxidant. They suggested that sodium ascorbate allows free radical polymerization of the adhesive resin to proceed without premature termination by restoring the altered redox potential of the oxidized bonding substrate and hence reverses the compromised bonding.

In their study, Lai et al.[11] immersed the bleached specimens in 10% sodium ascorbate solution for 3 hours which can be difficult in a clinical setting especially while using the solution form. In the present study, application time of sodium ascorbate solution was kept at 10 minutes in accordance with the study of Bulut et al[9], during which, time the solution was continuously refreshed and agitated with a sterile brush. This application time was found to be adequate to reverse the reduction in bond strength, in accordance with the previous studies of Turkun and Kaya[10] and Thapa et al.[24] Turkun et al.[25] suggested that using the hydrogel form of 10% sodium ascorbate would make it easier to apply since the patients could apply the gel in a bleaching tray.

However, using the gel form requires longer application times as it has a lower diffusibility into the enamel compared to the solution form. Authors differ in the recommended time for the application of the gel form, ranging from 2 hours, 3 hours and 10 hours.[25-27] In the present study, sodium ascorbate was employed in the solution form as it requires a much shorter application time of only 10 minutes which can easily be used in a clinical setting.

In this study, the grape seed extract (proanthocyanidin) group demonstrated the highest bond strength which makes it a viable alternative to sodium ascorbate. Proanthocyanidins are high molecular weight polymers that comprise the monomeric flavan-3-ol catechin and epicatechin. They are found in natural sources such as grape seed extract, pine bark extract, cranberries, lemon tree bark and hazel nut tree leaves in high concentrations. It has been proven to be safe for use in dietary supplements since it is a naturally occurring plant metabolite. The reversal in reduction of bond strength by proanthocyanidins has been attributed to their specificity for hydroxyl free radicals, the presence of multiple donor sites that trap superoxide radicals and esterification of epicatechin by gallic acid which enhances the free radical scavenging ability.[15,16]

ARI scores indicated that the most common site of bond failure was at the bracket/adhesive interface or within the 9 adhesive in all the groups except the immediate bonding group, which showed bond failure closer to the enamel/ adhesive interface and the difference was statistically significant. This was consistent with the lower bond strength values found in this group. The bond failure at the bracket/adhesive interface and within the adhesive seen in the ceramic brackets was similar to that found by Oztas et al.[17] and indicated that risk of enamel damage was reduced.

Conclusion

Bleaching with 35% hydrogen peroxide immediately before bonding reduces the bond strength of ceramic brackets. A delay in the bonding procedure by one week reverses the reduction in bond strength. Treating the bleached enamel surface with 10% sodium ascorbate solution or grape seed extract (5% proanthocyanidin solution) also reverses the reduction in bond strength and can be used as an alternative to delayed bonding.

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Knowledge, Attitude and Practice assessment of dental professionals towards diabetes : a cross sectional study

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Abstract

Introduction: Diabetes and its acute complications have become a significant health hazard worldwide, particularly in the Indian subcontinent. To date, there is no data on the awareness of dental professionals regarding the management of diabetic patients.

Aim: The aim of the study was to assess the knowledge, attitude and practice of dental professionals in India regarding the clinical manifestations and management of diabetic patients.

Materials and Method: The study was cross–sectional, comprising of 100 dental professionals, including dental graduates, post graduates, faculty members of dental colleges and private practitioners from the Delhi NCR region. Data was obtained by a self completion questionnaire which was pretested by conducting a pilot study, comprising of a fourteen item questionnaire aimed at assessing the knowledge, attitude and practice of dental fraternity regarding the manifestations and management of diabetic patients. In the questionnaire, nine questions aimed at assessing the knowledge, two questions assessed the attitude and three were for practice assessment.

Results: The results showed a clear cut knowledge deficit amongst dental fraternity regarding the manifestations and management of diabetics in dental practice.

Conclusion: The present study showed low level of awareness of dental fraternity regarding diabetes. Therefore, designing strong curriculum resources for oral health care providers, in order to enhance their awareness towards diabetes is the need of the hour.

Keywords: Dentists, Awareness, Oral Manifestations, Diabetes Mellitus, Dental Education

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Introduction

Diabetes mellitus is a metabolic illness characterized by hyperglycemia ensuing from defects in the insulin secretion, insulin action or both. The prevalence of diabetes mellitus has increased to an extent that it has taken the form of an epidemic in various parts of the world.[1] The current estimates by the International Diabetes Federation have shown that the number of adults affected by the disease in 2011 was 365 million which was projected to increase to 552 million by 2030. In India 61.3 million people were affected from diabetes till 2011 and it is estimated to rise to 101.2 million by 2030.[2]

Diabetes and its acute complications have become a considerable health hazard worldwide, predominantly in the Indian subcontinent. As per the World Health Organization, India had 69.2 million people living with diabetes as per the 2015 data, of these, it remained undiagnosed in more than 36 million people. With its rising incidence, diabetes has captured the interest of specialists and general practitioners equally in medicine and dentistry.

Medical complications commonly associated with diabetes include nephropathy, retinopathy, neuropathy, peripheral vascular disease and coronary heart disease.[3] Oral health complications seemingly associated with diabetes consist of tooth loss, gingivitis, periodontitis and soft tissue pathologies. Periodontitis is perhaps the most widely noted oral manifestation of diabetes.[4]

The dangers of diabetes have been recognized worldwide. To date, there is no data on the awareness of dental professionals regarding the management of diabetic patients. With the increasing longevity and effective diagnostic aids, the dentists will be treating more patients with Diabetes Mellitus in the near future. Therefore, it becomes essential for a dental surgeon to be aware of medical and dental management of diabetic patients. Thus, the present study investigated oral health attitudes, knowledge and practice of dental professionals regarding aspects related to diabetes amongst adults.

The aim of the study was directed towards the assessment of the knowledge, attitude and practice of dental professionals regarding the clinical manifestations and management of diabetic patients.

Material and Methods

The present cross-sectional survey was conducted over a period of two months (July, 2015 –September,

2015) at ITS College of Dental Sciences and Research, Ghaziabad, Uttar Pradesh, India. Approval for the study was obtained from the research and ethical committee of the institution. The study comprised of interns, final year post graduate (MDS) students, MDS faculty members working as academicians in various dental colleges of Delhi-NCR region and private practitioners in the same region. The total number of participants were 100; comprising 25 members in each group. The participants were selected by convenience sampling technique. Informed consent was taken from all the participants after informing them of the objective of the study. If the participants were not available for filling the questionnaire when visited by the investigator, two more attempts were made to contact them. Candidates who were not available even after three visits and the ones who submitted incomplete questionnaires were excluded from the study. A pretested, structured, questionnaire was used which had both open ended and closed ended questions. A total of fourteen questions were framed satisfying all the aspects of assessing KAP (Knowledge, attitude and practice) of dental professionals out of which, nine questions aimed at assessing knowledge, two questions assessed the attitude and three assessed the practice management.

A pilot study of the questionnaire was conducted on 20 participants (5 representatives from each group) to study the feasibility and validity before commencing the study. According to the pilot study, the prevalence rate for awareness and preparedness was found to be 59%. Keeping the population size as infinite, we applied the formula for sample size $N= z^2pq/d^2$, where z=1.96 @ 95% confidence level, p (prevalence) = 61.2% (determined from the pilot study), q=1-p (1-0.5=0.5), d (precision rate/ least permissible error) = 10%. The final sample size required for the study came out to be 100. Therefore, the study was conducted on 100 dental professionals.

Data collection: There was a single investigator in the study. Completely filled questionnaires were collected and the questionnaire was not left for filling for more than twenty minutes with the participants. The information obtained during data collection was kept strictly confidential. Only their professional designations were considered. The descriptive analysis of the collected data was done by statistical software using SPSS version 16.0.The responses for each question were given a percentage frequency distribution.

Results

A total of 100 dental professionals were approached in person for the study and all of them agreed to participate. (Table 1)

Table 1: The questionnaire with the results

Questions		Results
Question 1	You have a diabetic patient; will you take any precautions while scheduling an appointment for him?	76% stated morning appointments; 24% stated that no special precaution is needed
Question 2	Are you aware of the medications your diabetic patient might be taking?	50% aware of the medications; 50% had no clue
Question 3	What are the 3 cardinal signs of diabetes?	Results: 64% -3P's; 36% unaware
Question 4	Which is the most common *Oral manifestation* associated with diabetes?	83%- periodontitis 17% - caries, gingivitis
Question 5	Which is the most common *Oral mucosal lesion* associated with diabetes?	35% oral candidiasis. 20% oral lichen planus
Question 6	In a suspected diabetic patient which is the gold standard investigation?	20% Oral glucose tolerance test 70% -HbA1c, 10% Random BGL
Question 7	Do you have any device to monitor blood glucose level in your clinic?	42% had device to monitor blood glucose level 58% had no device
Question 8	Do you go for an antibiotic coverage before commencing any surgical procedure on a diabetic patient?	72% prescribe prophylactic antibiotics 18% do not prescribe
Question 9	What special measures will you take for controlling anxiety in a diabetic patient?	61% no special measures to control 39% take special measures
Question 10	What are the complications associated with dental treatment of uncontrolled diabetic patients?	65% aware 35% unaware
Question 11	Which is the major medical emergency encountered while treating a diabetic patient?	39% aware 61% unaware
Question 12	How will you manage the medical emergency?	35% aware, 65% unaware
Question 13	Do you counsel the patients regarding usage of oral hygiene aids?	87% do not counsel their patients; 13% counsel
Question 14	Have you attended any workshop especially tailored for	92% *never* attended;

	dental professionals on management of "diabetic patients"?	8% attended

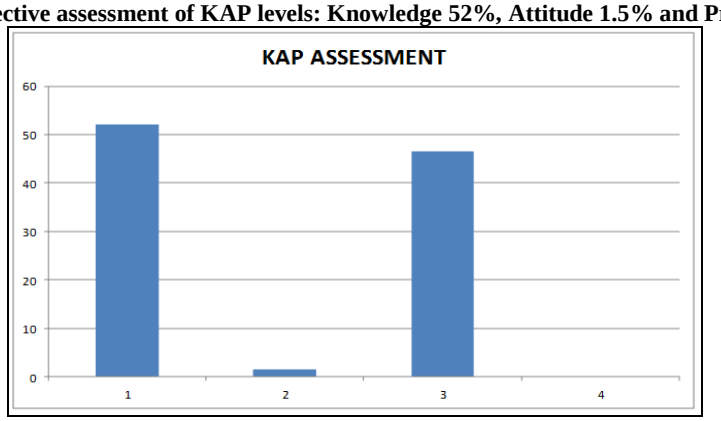
Knowledge assessment of participants regarding the manifestations of diabetes: A total of nine questions in the questionnaire aimed at assessing the knowledge of the dental professionals. When asked about the scheduling of appointments for diabetics, 76% of the dentists stated that morning appointments were best suited for diabetics and 24% stated no special precautions were needed while scheduling the appointments for a diabetic patient. Surprisingly, only 50% of the dentists were aware of the medications a diabetic might be taking. Only 64% of the dentists knew that polyuria, polydipsia and polyphagia are the three cardinal features of diabetes, while, the remaining 36% had no idea. On being asked about the most common oral manifestation and oral mucosal lesion associated with diabetes, 83% dentists stated periodontitis as the most common oral manifestation. 35% dentist stated oral candidiasis and 20% said that oral lichen planus was the most common oral mucosal lesion associated with diabetes. The dental professional were asked about the gold standard investigation which they would like to go for, in case they encounter a patient who is unaware of his blood glucose level and is suspected to be a Diabetic patient. In response to this question, 20% stated they would opt for an oral glucose tolerance test. 70% of the dentists said glycosylated hemoglobin estimation would be the investigation of choice and 10% were in favor of random blood glucose level. 65% were aware and 35% were unaware of the complications associated with the treatment of patients with uncontrolled diabetes. Only 35% dentists knew the most common medical emergency associated with diabetics and 65% were unaware of the medical emergency. 39% dentists were aware of the measures to be taken for controlling the emergency and remaining 61% were not. The respondents had ~~a~~ good knowledge of the manifestations of diabetes and the scheduling of appointments for diabetics. There was a knowledge deficit with regards to the routine medications taken by diabetics and the medical emergency associated with dental treatment of diabetics in a dental office.

Assessment of attitude of participants regarding the manifestations of diabetes: Two questions aimed at assessing the attitude of participants regarding manifestations of diabetes. Patient motivation is an essential step. Based on this assumption, a question was framed to find the proportion of dentists who routinely counsel their diabetic patients regarding usage of oral hygiene aids. It was found that only 13% counsel their patients regarding the usage of oral hygiene aids. The dental professionals were asked if they had attended any workshop especially tailored for dentists on management of diabetic patients. 92% of the dentists had never attended any program /workshop on diabetes which was quite alarming. This clearly highlighted the negligence of the dental fraternity towards diabetes as a systemic disorder with enormous oral manifestations.

Assessment of practice of participants regarding the manifestations of diabetes: The dental professionals were asked if they had any device to monitor blood glucose level in their clinical setting. Only 42% dentists had the device to monitor blood glucose level. It is a well known fact that the diabetics are immunocompromised and have increased chances of contacting infections. Based on this, a question was framed regarding the prophylactic administration of antibiotics to a diabetic before commencing a surgical procedure. It was found that only 72% of the dentists prescribe prophylactic antibiotics. The dental professionals were questioned about the special measures they would take for controlling anxiety in a diabetic patient. 61% dentists confessed that they never take any special measures for controlling anxiety, while the rest 39% stated that they take special measures, like scheduling early morning appointments and ensuring that the patient has taken his meal properly before the commencement of a procedure. Some even stated that they prescribe anxiolytic medications to their patients.

Results have been graphically depicted (Graph 1).

Graph 1: Collective assessment of KAP levels: Knowledge 52%, Attitude 1.5% and Practice 46.5%



Discussion

To begin with, for a diabetic patient, morning appointments are always advisable since endogenous cortisol levels are higher at this time. Cortisol increases blood glucose levels and decreases the incidence of hypoglycemic episode during the appointment. For patients having Type 1 DM (Diabetes Mellitus) and receiving insulin therapy, appointments should be planned such that they do not overlap with the peaks of insulin activity.[5] In the present study 76% dental professionals were aware that there is a need to take precautions while scheduling appointments for diabetics.

It is very significant for the dentists to take a good drug history of their patients. The recent blood glucose levels should be asked. The time of administration and dosage administered should be assessed. There are a variety of medications which might interfere with the glucose metabolism. Sulfonylureas, have a hypoglycemic action which may be potentiated by highly protein bound drugs, such as, beta blockers, sulfonamides. There are certain drugs which have a hyperglycemic action like epinephrine, thiazides, oral contraceptives.[6] Therefore, it becomes essential for a dentist to have knowledge of the medications a patient of diabetes might be taking.

As far as clinical manifestations are considered, polyuria, polydipsia and polyphagia are the three cardinal features of diabetes. When blood glucose levels become elevated, glucose gets excreted in the urine, excessive urination occurs as a consequence of osmotic diuresis (polyuria). Increased fluid loss leads to dehydration resulting in excessive thirst (polydipsia). The patient experiences increased hunger (polyphagia). These are the classical signs and symptoms of Diabetes Mellitus.[6]

Periodontitis, is undoubtedly the most common oral manifestation of Diabetes Mellitus.[7] DM, when poorly controlled, increases the risk of periodontitis. The etiology warrants the role of polymorphonuclear leucocytes, whose function gets altered, abnormal collagen metabolism, formation of advanced glycation end products (AGEs), which negatively affect the collagen stability and vascular integrity.[8] AGE bind to macrophage and monocyte receptors and result in increased secretion of Interleukin-1 and Tumor Necrosis Factor alpha, thereby, increasing the tissue destruction. Demmer and colleagues, investigated the association of periodontal disease with the incidence of Type 2 Diabetes in over 7,000 participants. It was reported that there existed a positive association between baseline periodontal disease and incident Type 2 Diabetes in a cohort study of individuals who were followed for a mean of 17 years. It was also seen that periodontal disease was significantly associated with 50–100% greater risk for Type 2 Diabetes incidence at follow-up.

According to several authors, diabetics are highly prone to oral candidiasis, which has been linked to poor glycemic control and the usage of acrylic prosthesis.[9] The condition may be further aggravated by reduced salivary flow. Burning sensation and taste disturbances have also been reported in patients with uncontrolled Diabetes Mellitus.

Petrou et al. have stated that the prevalence of oral lichen planus is significantly higher in Type 1 and Type 2 Diabetics in contrast to the control population.[10]

Diabetics have been shown to have more active dental caries than the control subjects. The reason cited has been increased salivary glucose levels and xerostomia.

The dental professional were asked about the gold standard investigation, which they would like to go for in case they encounter a patient who is unaware of his blood glucose level and is suspected to be a diabetic. Hjellestad et al [4] conducted a study to compare the oral glucose tolerance test (OGTT) and glycosylated hemoglobin (HbA1c) and concluded that HbA1c at a cut-off value of $\geq$ 48 mmol/mol (6.5%) had a 45.5% sensitivity to diagnose DM in patients with peripheral arterial disease. Pathologic glucose metabolism was significantly higher based on HbA1c values than OGTT.

According to Cox et al, oral glucose tolerance testing was started in 1922 and has been one of the diagnostic tests of preference for the past 80 years. It is presently considered the gold standard for diagnosis of diabetes probably because of its longstanding use. It has been suggested by WHO for diagnosis and has been listed as an alternative, in the American Dental Association (ADA) recommendations, but its use in the clinic remains controversial.[5,10]

HbA1c testing was first proposed as a measure of blood glucose control in 1976.[9] Since the mid-1990s, it has been accepted as the gold standard for therapy assessment and prognostication. In June 2009, the test was approved by the ADA as a first-line screening and diagnostic test for Diabetes.[10] In a study by Wilder et al.[11] it was observed that that general dentists rarely actively manage patients with Diabetes. In their study conducted on dentists in North Carolina, it was seen that 37% of the respondents did not ask about or record blood glucose levels or HbA1c, and only 8% were likely to assess patients for diabetes using a glucose monitor. In the present study, majority of the dental professionals stated HbA1c, as the gold standard investigation, for screening individuals for diabetes and only 42% had a device to monitor blood glucose levels in their clinics.

Glucometer, is the device which is routinely used in the clinical set up for measurement of blood glucose levels. Measurement of blood glucose levels (BGL), in susceptible individuals before commencement of dental procedure should be done without fail. Pre assessment of blood glucose levels is a must for patients with

familial history and individuals falling into susceptible age groups. It should be made a part of the routine investigative work up.

Diabetic patients have high propensity for developing oral bacterial infections which is attributed to their immunocompromised status. Several studies[7,8,9] have reported that patients with diabetes are more susceptible to deep neck bacterial infection as compared to the patients without diabetes.

Anxiety control forms a crucial part of the management of a diabetic patient. Pre treatment anxiety can be reduced by antianxiety drugs. Pain during procedure can be reduced by a potent anesthetic without adrenaline. The release of stress hormones such as adrenaline can cause a buildup of blood glucose levels in a diabetic patient. Stress hormones have an inhibiting effect on insulin release from the pancreas.

If the surgical aspect is considered, poor soft tissue regeneration and delayed osseous healing in patients with diabetes are known complications during oral surgery, making the management and cure of patients more difficult. It was reported[1] that delayed vascularization, impaired blood flow, compromised innate immunity, decreased growth factor production and psychological stress may attribute to protracted healing of an oral wound in a diabetic patient.

The most common complication of DM that can occur in the dental office is a hypoglycemic episode.[4] If insulin or oral hypoglycemic drug levels exceed physiological needs, patient might experience a severe decline in the blood sugar level. Initial sign and symptoms include mood changes, hunger, weakness followed by sweating, incoherence and tachycardia.

If the clinician suspects that the patient is under a hypoglycemic episode, he should at once terminate the dental procedure. Patient should immediately be given fast acting carbohydrates like glucose tablets, sugar candy or juice. In case the patient is not able to swallow or is unconscious, 25 to 30 ml of 50% dextrose solution or 1 mg glucagon should be administered intravenously.[8]

As healthcare providers, counseling a patient forms a part of our diagnosis and treatment planning. Oral hygiene aids such as usage of soft toothbrushes which in turn minimize trauma to oral tissues, tongue cleaners to prevent deposition on tongue surface, use of dental floss for prevention of food impaction, interdentally and using alcohol free mouthwash to minimize xerostomia should be prescribed to a diabetic.[10]

Lastly, the dental professionals were asked if they had attended any workshop especially tailored for dentists on management of diabetic patients. A large percentage of the dentists had never attended any program /workshop on diabetes. To ascertain the cause for the same, a retrospective data search was made and there was no data available on the number of workshops held annually for diabetes awareness amongst dental professionals in India. In India, approximately 25% patients visiting dental office suffer from diabetes and approximately 10.62% of the patients had suffered a hypoglycemic attack during a dental procedure. This clearly highlights the dire need for increasing the awareness amongst dental professionals regarding the management of diabetics in a dental set up.

Limitations

The present study was done on a small sample size and the results were not tabulated on the basis of various subgroups to ascertain the level of knowledge amongst dental fraternity. Similar studies can be carried out on a larger sample size covering larger geographical areas and including other aspects of diabetes.

Conclusion

The present study showed low level of awareness of dental fraternity regarding diabetes. The knowledge aspect of the questionnaire clearly depicted that the dental professionals had theoretical knowledge about certain aspects of diabetes but lagged behind when it came to the management of medical emergencies in the dental office. There is a need to implement the use of Blood Glucose Level (BGL) monitoring devices on a routine basis, prescribing prophylactic antibiotics to diabetics and counselling patients for using oral hygiene aids.

In order to increase the rate of awareness amongst dental fraternity for diabetes, there is a need to develop curriculum resources for oral health care providers. There is a need to create inter-professional learning experiences to cultivate an interdisciplinary approach for diabetes care. More number of workshops on diabetes should be organized for the dental fraternity to keep them abreast of the latest developments in the trends for the patient management. This would definitely help them to provide a better cure for a diabetic patient and minimize the incidence of the dental emergencies associated with dental treatment.

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Relationship of dental fear with oral health behaviour among 12 and 15 years old school children of Muradnagar

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Abstract

Introduction: Fear to visit the dentist is a common observation in adults & children.

Aim: To study the relationship between dental fear and oral health behaviour of 12 and 15 years old school children of Muradnagar, Ghaziabad.

Materials and Method: Two Hundred school going children aged 12 and 15 years were evaluated for children's fear survey schedule dental subscale (CFSS-DS) and oral health behaviour by a questionnaire. Level of dental fear was assessed on 5-point likert scale from 1 "not afraid at all" to 5 "very afraid" covering 15 items and their behaviour towards oral health. Data analysis was done by SPSS version 18.

Results: Out of 200 respondents, 142 were boys & 58 were girls.7 had scores equal to or greater than 38 & were classified as having "high dental fear". High dental fear was present among girls and was found absent among boys.

Conclusion: Reported association between oral health behaviour and dental fear should not be overlooked by the dentist for children.

Keywords: Dental Anxiety, Dental Fear, Oral Health, School Children

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Introduction

For behaviour management strategy, it is very important to know about the reason of dental fear and uncooperative behaviour in a child patient. In an Indian scenario, effects of environmental factors are less likely studied.[1]Dental fear and anxiety towards a dentist are major problems for a sizeable proportion of children and adolescents. The prevalence of dental fear and anxiety varies in various countries and in some countries it is considered to be dental phobia.[2] Children usually have a phobia towards injection and drilling sound in a dental setup. Thus, people with dental fear tend to address dentists only in case of an unavoidable dental problem. This aggravates the dental problem and such patients are usually not satisfied with the dentist's work.[3] Dental fear has been recognized as a difficulty in patient management for many years, which further leads to dental avoidance in adolescents. The reason for dental fear has been attributed to patient's dental phobia and a response to certain specific stimulus. Among children, dental fear is an issue of concern for both dentists and the parents. Dental fear is common to children of different age groups and manifests in different forms.[4]

Anxious situation prior to frightening situation may affect a person's capacity for work (longer period of inability to work) and social activity thereby boosting the usage of medicines.[5,6]

The Dental Subscale of children's Fear Survey Schedule (CFSS-DS) was developed to assess dental fear in children. The scale consisted of answers in form of 5-point likert scale having 15 items including injection, and drilling. The main aim of the study was to determine the relationship between dental fear and oral health behaviour of 12 and 15 year old school children of Muradnagar, Ghaziabad.

Materials & Method

A cross sectional survey on school children was conducted to determine the relationship between dental fear and oral health behavior among the school children of Muradnagar, Ghaziabad.

The study area was schools of Muradnagar, Ghaziabad. Ethical clearance was obtained by the institutional ethical committee. Voluntary written consent from school authority, and parents of children was taken in the study to avoid any inconvenience and to ensure full cooperation. Prior scheduling of the study was done before conducting the survey and the data collection was done between July 2013 and August 2013.

Pilot study was done on 20 (10%) subjects in the month of July 2013, before starting the main study to check the feasibility of proforma and the validity of questionnaire (Cronbach's alpha =0.76). The necessary modifications were then made in the final pro forma.

Before starting the survey, the principal investigator was calibrated in the Department of Public Health Dentistry, ITS- CDSR, Muradnagar, Ghaziabad, in order to limit the examiner variability. To reduce the intra examiner variability, the subjects were randomly called on different days and examiner repeated the examination on them. A group of subjects were re-interviewed on successive days using same questionnaire. Later the results obtained were subjected to Kappa variability test. Intra-examiner reliability was calculated as 0.88 with respect to Kappa co-efficient.

Survey was conducted among 12 and 15 years old school children comprising of 105 twelve-year old and 95 fifteen years old. A written protocol was prepared for the survey. The protocol contained information like objective and the purpose of the study, description and the type of information to be collected, sampling methods and statistical methods to analyze the data.

The sample size was determined based on the results of the pilot study using the formula:

$$Z^2 P (1-P) / d^2$$

Where, P = Prevalence rate which was estimated to be 15% after the pilot study.

Z = Z statistic for a level of confidence (For the level of confidence of 95%, which is conventional, Z value is 2.0).

d = Precision (Least permissible error which was taken at 5.0%).

Using the above formula, the sample size was estimated to be 200. Schools were selected by simple random sampling out of the list available from block education office and children of 12 and 15 years of age present on the day of survey were included in the study.

Those children were excluded whose parents did not give their consent for participating in the study, who was mentally or physically handicapped and children who had medical problems or were undergoing any medication / treatment. The closed ended questionnaire consisted of two parts. The first part contained questions on age, gender, school, nationality, parent's occupation and income, Children's Fear Schedule Survey-Dental Subscale (CFSS-DS) which is most commonly used to measure dental anxiety. This 5-point likert scale which measured dental anxiety from 1 "not afraid at all" to 5 "very afraid" covering 15 items. Scores more than 38 were considered as high dental fear. While the second part comprised of 15 questions on oral health behavior.

Statistical analysis:

The statistical procedure was carried out in two steps.

1. Data compilation and data presentation
2. Statistical analysis

Descriptive and Inferential statistical analysis was carried out in this study. Results on continuous measurements were presented on mean ±SD (Min-Max) and results on categorical measurements were presented in numbers (%). Student's t test was applied keeping p-value < 0.05 at 95% confidence level.

[(Not significance (p value: p > 0.05), Significant (p value: 0.01 < P < 0.05), highly significant (p value: p < 0.01)]. The statistical software SPSS version 18.0 was used for analysis of the data.

Results

A total of 200 children aged 12 and 15 years participated in the study. 71.0% (n =142) were males and 29.0% (n =58) were females (Graph 1).

CFSS-DS has score range of 15–75, in which score of 38 and above is considered as high dental fear.

Children were found to be most afraid of choking (36.5%), drilling of the tooth (34.5%) and injection (31.5%). (Table 1).

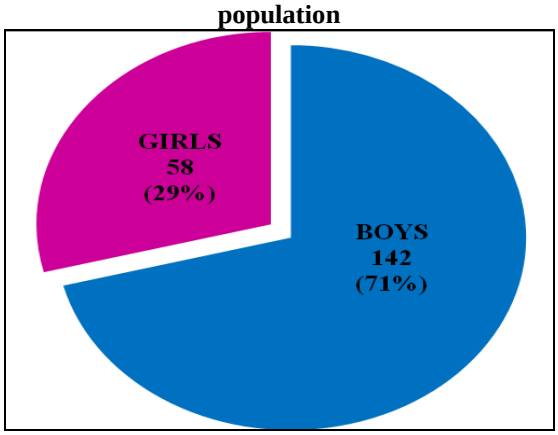
According to CFSS-DS, high dental fear was absent in males while females (12.1%) (n =7) were having high dental fear (Table 2, Graph 2). Dental Fear Score was more in females (28.59+6.75) as compared to males (24.07+6.77) and it was found to be highly statistically significant (p < 0.001) (Table 3).

Dental fear score was found to be more in children who have not received dental health care in the past (31.02+5.54) as compared to, those who have received dental health care in the past (21.04+4.58) and it was found to be highly statistically significant (p < 0.001) (Table 4).

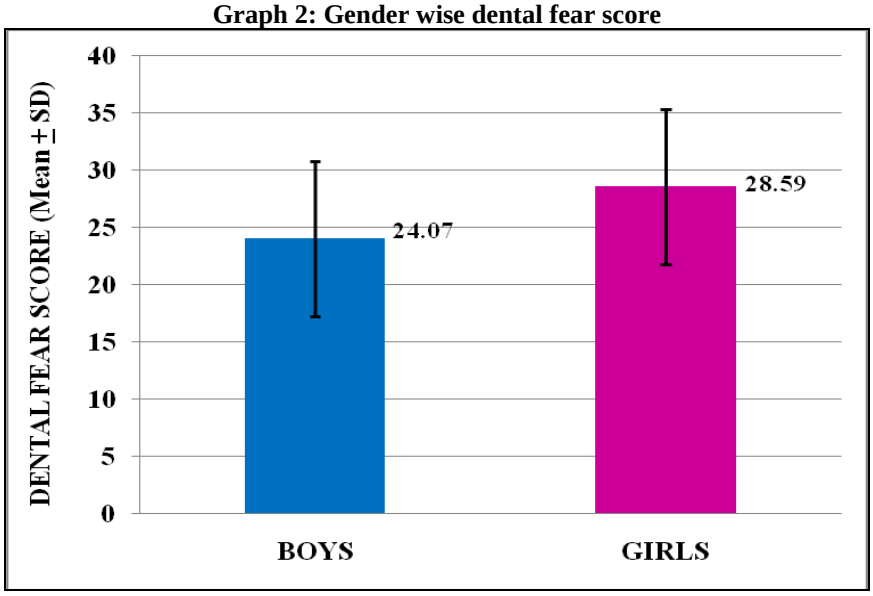
Oral health behaviour score was more in females (12.31+1.15) as compared to males (11.92+1.52), was found statistically non-significant (p = 0.77) (Table 5). There was slight difference in oral health behavior score in those having high dental fear (12.00+0.00) and those not having high dental fear (12.03+1.46) (Table 6, Graph 3).

Oral health behaviour score was found to be more in those who have received dental health care in the past (12.30+1.15) as compared to those who have not received dental health care in the past (11.67+1.68) and it was found to be highly statistically significant (p = 0.002) (Table 7).

Graph 1: Gender wise distribution of study population



Graph 2: Gender wise dental fear score



Graph 3: Oral health behaviour with past dental care received

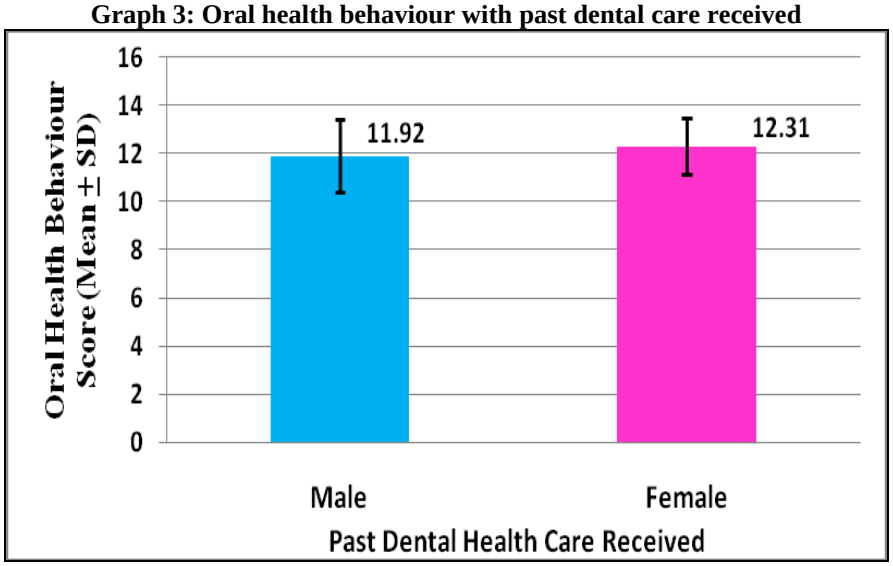


Table 1: Causes of child's fear in dental clinic

Dentist	1.0%
Doctor	3.0%
Injections	22%
Somebody examining your teeth	4.0%
To open your mouth	6.0%
A stranger touches you	10%
Somebody look at you	7%
The drilling of the tooth	14%
The site of drilling	8.0%
The noise of drilling	3%
Somebody put instruments in your mouth	10%
Choking	10%
To go to the hospital	2.0%

Table 2: Presence of high dental fear in males and females

			High Dental Fear		
			Absent	Present	Total
Gender	Males	Count	142	0	142
		% within gender	100.0%	.0%	100.0%
	Females	Count	51	7	58
		% within gender	87.9%	12.1%	100.0%
Total		Count	193	7	200
		% within gender	96.5%	3.5%	100.0%

Table 3: Dental fear score in males and females

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Dental Fear Score	Males	142	24.0704	6.76940	.56808
	Females	58	28.5862	6.74611	.88581

Table 4: Dental fear score in students who have received and not received past dental health care

	Past Dental Health Care Received	N	Mean	Std. Deviation	Std. Error Mean
Dental Fear Score	Yes	113	21.0354	4.58049	.43090
	No	87	31.0230	5.54260	.59423

Table 5: Oral health behaviour score in males and females

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Oral Health Behaviour Score	Males	142	11.9155	1.52401	.12789
	Females	58	12.3103	1.15024	.15103

Table 6: Oral health behaviour score in students with and without high dental fear

	High Dental Fear	N	Mean	Std. Deviation	Std. Error Mean
Oral Health Behaviour Score	Absent	193	12.0311	1.46008	.10510
	Present	7	12.0000	.00000	.00000

Table 7: Oral health behaviour score in students who have received and not received past dental health care

	Past dental health care received	N	Mean	Std. Deviation	Std. Error Mean
Oral Health Behaviour Score	Yes	113	12.3026	1.14949	.107206
	No	87	11.6686	1.68140	.18131

Discussion

A cross sectional study was carried out in I.T.S – Centre for Dental Studies and Research, Ghaziabad on school children of Muradnagar, to determine the relationship between dental fear and oral health behavior.

High dental fear was found to be in females compared to males and this finding was opposite to findings of study done by Suprabha et al[1]. In contrast, gender of the child patient was not related to oral health behaviour in the study done by Kyritsi et al[7].

In contrast to our study, dental fear was found to be more in those who have not received dental health care in the past but oral health behaviour score was found to be more in those who have received dental health care in the past. This is in agreement with latent inhibition theory, in which children tend to become less afraid if they have had more neutral visits (e.g., check up, cleaning of teeth) before any invasive dental treatments (e.g., restorations, extractions). According to Davey GC[8] traumatic experiences are more likely to give rise to dental anxiety if they occurred in the first dental visit than during the subsequent dental visits.

Contrary to local stereotypes, there were no significant differences in oral health behavior score between students having high dental fear and students

not having high dental fear. However, these conclusions must be interpreted cautiously because of the small sample size and it should be noted that there were some patients who were co-operative yet fearful and un-cooperative but non-fearful. Kleinberg et al[9] indicated that child patients with behavior management problems do not always have dental fear, which was also seen in this study. Hence the other factors that affect behavior of a person need to be explored before commencing the treatment.

The limitation of this study was that it was conducted on smaller sample size. As fear of dentistry is preventable, efforts need to be made to identify the sources of the problem.[10] Children who are anxious in many other situations are more likely to be afraid of the dentist. This suggests these children are at higher risk to carry their childhood fear of the dentist into adulthood.[10]

In particular, attention needs to paid to the use of epidemiologic concepts of clinical risk ascertainment using caries activity tests and early intensive preventive efforts (such as occlusal sealants) to reduce the need for injections and restorative dentistry at too early age.

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Pulp volume estimation using CBCT- an in vitro pilot study on extracted monoradicular teeth

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Abstract

Aim: Age estimation is an important aspect of forensic odontology. Calculation of pulp volume using CBCT and its correlation with age could be an effective, non destructive method. The aim of this pilot study was to verify and calibrate the proposed method of calculating pulp and tooth volume using CBCT.

Materials and Method: The study was conducted on six extracted monoradicular teeth which were scanned by Cone Beam CT (CS9300-C 3D.Carestream Health, Inc. Rochester, NY) after endodontic preparation. The tooth (TV2) and pulp volumes (PV 2) were then calculated using imaging software (Xelis Dental software (*INFINITT Inc., Seoul, South Korea).* Then actual tooth (TV1) and pulp volumes (PV1) were calculated based on the Archimedes principle. The pulp and tooth volume ratios R1 and R2 were also calculated. The estimated and actual values were compared and percentage error was calculated.

Results: The percentage error was also calculated to evaluate the accuracy which was found to be 8.84%, 2.6% and 12.7% for TV1 and TV2, PV1 and PV2 and R1 and R2 respectively.

Conclusion: These were in accordance with the results by Yang et al.[7] who obtained a percentage error of ±7.8% while the estimated error was quite less than that reported by Star et al[8] who reported the maximum percentage error to be 21% and 16% for pulp and tooth volumes respectively.

Keywords: Age Estimation, Forensic Odontology, Cone Beam CT, Pulp Volume

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Introduction

Age estimation is important in establishing identity of a person and is a sub-discipline of forensic sciences. Various medico-legal issues warrant accurate age estimation thus making it important in the identification process. Multiple age estimation methods have been reported in the forensic literature using teeth over the years.

Most methods described involve sectioning and extraction of teeth and thus are not possible on living individuals. Radiological examination of teeth, on the other hand, is a simple, non-destructive method used to obtain information and does not require extraction.[1,2] Thus techniques which are radiology dependent allow for age estimation in living individuals. Radiological studies that have been conducted mostly depend on developmental stages of teeth and their correlation with age and thus have a limited applicability only up to the age of twenty five years.[3,4,5,6]

The dental pulp can also be used as an indicator of age because it undergoes regression in size with increasing age due to secondary dentine deposition. This is a continuous process and thus it can be used as a parameter of age estimation even beyond 25 years of age**.** In 1995, Kvaal et al developed a new method for estimating the chronological age of adults based on the relationship between age and the pulp size on peri-apical dental radiographs.[1]

Two dimensional imaging is associated with its inherent errors of distortion and magnification and thus limit the accuracy. Cone-beam computed tomography (CBCT) is an imaging modality which generates three-dimensional (3D) data that is accurate and at lower cost and lower absorbed doses when compared to conventional computed tomography (CT).

Yang et al.[7] in 2006 estimated age through volume matching of teeth imaged by cone beam CT. The aim of this study was to attempt establishing a correlation between the chronological age of a certain individual and the pulp/tooth volume ratio (PTV) of one of the teeth. The images were analyzed using the custom-made software and linear regression analysis was performed. The results of the analysis showed a moderate correlation between the pulp/tooth volume ratio and biological age.[7]

3D images generated by a CBCT unit allow for the calculation of volume of each tooth and corresponding pulp chamber. Thus a study was planned to estimate age using calculation of pulp and tooth volume ratios on mono-radicular teeth and their correlation with age. To validate the research protocol a pilot study was

conducted on extracted teeth which verified the efficacy of the method when compared to the gold standard.

Materials and Method

The study was conducted in the Department of Oral Medicine and Radiology, I.T.S Centre for Dental Studies and Research, Muradnagar, Ghaziabad, Uttar Pradesh, India in collaboration with Dental and Maxillofacial Diagnostics, Ghaziabad, Uttar Pradesh, India between April 2013 and May 2013. Intact and fully developed six mandibular extracted monoradicular teeth i.e. mandibular lateral incisor, mandibular canine and mandibular first premolar were included which were free from any morphological abnormalities. Teeth with restorations, prosthetic rehabilitation, caries, attrition, abrasion, erosion, periapical pathology, root resorption, developmental anomalies were not selected.

The pulp canals of the six selected teeth were prepared endodontically. The cone-beam CT images were taken (CBCT Unit – CS9300-C 3D.Carestream Health, Inc. Rochester, NY) using the high resolution dental mode at 84 kV, 5mA. Pulp and tooth volume was calculated using the voxel counting software (Xelis Dental software (*INFINITT Inc., Seoul, South Korea*). The total scan time was 20seconds. Study images were reconstructed from the volumetric dataset, in planes perpendicular to the selected tooth axes i.e. (True and oblique axial, coronal and sagittal) with a thickness of 0.09 mm and an interval of 0.09mm. Cross-sectional images with a thickness of 0.09 mm and an interval of 1mm were also prepared. Image assessment was performed by specially trained Oral & Maxillofacial radiologist for volume estimation using the CBCT software.

The lines were dragged to reorient the tooth to be analyzed in all three axes and the file was renamed and saved. After reorienting, the data were re-sliced and the file was saved in a separate folder from the source file. Next the selected tooth was segmented using the segmentation tool of the software. A mask was created followed by selection of optimal grayscale threshold which showed the tooth within the bone. The mask was then cropped in all three axes to the closest dimension of the tooth. Then the regions not belonging to the tooth were selected and removed manually slice by slice thus removing parts of the cortical bone and adjacent teeth. This segmentation cannot be established by selecting optimal grayscale threshold because there is a minimal or no gray value difference between these closely apposed tooth anatomical structures. This segmentation process separates the tooth structure from within the bone and a final image is generated. A 3D volume calculation of this image using the "*Merge*" tool gives the tooth volume (TV2).

After this using the image segmentation, different regions of interest were identified within the pulp cavity on selected sequential slices. The "Pick and *Grow*" tool in object tools was then used to segment the pulp cavity from the rest of tooth structure, and the segmented pulp was saved as a new object and rendered in a different color (Green). Finally, the "*Merge*" tool was selected to display the volume of the pulp (PV2).

The object analysis tool in Xelis Dental software enabled calculation of ROI Histogram for volume assessment of the pulp cavity and the tooth. Then the PTV ratios were calculated for each study subject.

Next the teeth were filled with impression material (hydrophilic polyvinyl siloxane impression material), Aquasil Ultra XLV (Ultra Light Body), DENTSPLY using a Dispensing gun (*3M USA*). The volume of the whole tooth was measured by the method based on volume displacement by *Archimedes' principle*, which was generally used in determination of density of various materials. The buoyant force on a submerged object is equal to the weight of the liquid displaced by the object. The volume was calculated by, $V = (m_1g - m_2g) / \rho_1 g = (m_1 - m_2)/\rho_1$, where ρ_1 is the density of the liquid, V the submerged volume of the object, g the constant 9.8 N/kg, m_1 the mass of the object and m_2 is the apparent mass when submerged.[7]

Both m_1 and m_2 of all the teeth were measured in the Department of Biotechnology, I.T.S-CDSR, Muradnagar, and Ghaziabad. Electro-balance (Shimadzu Analytical India Pvt. Ltd) with a glass beaker (50ml, Borosil, India) of absolute ethyl alcohol with the density of 0.78 g/cm3 was used for volume measurements.

Each tooth was measured two times. First the actual mass, M_1 was determined**,** next when it was submerged in the alcohol, M_2 was determined. Then the tooth volume was calculated (TV1). Next the dental substrate was dissolved by immersing samples in successively 30% Hydrochloric Acid (HCl) for 36 h and 2.5% Sodium Hypochlorite (NaOCl) for 10 min. The same methodology was used to determine the volume of remaining silicon core which calculated the pulp volume (PV1).[7]

Finally the pulp/tooth volume ratios were calculated. This allowed comparing the outcome of the software with the gold standard measures of the pulp. The statistical analysis was done using SPSS (Statistical Package for Social Sciences) Version 16.0 Statistical Analysis Software.

Results

Six extracted mandibular monoradicular teeth were analyzed and their actual tooth (TV1) and pulp volume (PV1) was calculated by the method based on volume displacement by Archimedes' principle. This allowed comparing the gold standard measures of the tooth (TV2) and pulp volume (PV2) with the outcome of the software.

Mean of actual tooth and pulp volume was found to be 541.72±169.67 mm^3 and 27.63±3.13 mm^3 respectively (Table 1, Table 2) and mean of the estimated tooth and pulp volume by CBCT was found

to be 493.80±169.68 mm^3 and 28.35±4.49 mm^3 (Table 1, 2) while the mean for PTV Ratios R1 and R2 was found to be 0.0550± 0.0168 and 0.0620±0.017 respectively (Table 3).

The difference in the actual and estimated tooth volume was statistically significant [p=0.002] while the difference in actual and estimated pulp volume was not statistically significant [p=0.486].The difference in PTV Ratios R1 and R2 was statistically significant [p=0.002].

The percentage error was also calculated to evaluate the accuracy which was found to be 8.84%, 2.6% and 12.7% for TV1 and TV2, PV1 and PV2 and R1 and R2 respectively. (Table 4)

Table 1: Table showing mean actual and estimated tooth volumes for all 6 teeth in mm^3

Tooth Volume	Mean	S.D.	P-value
TV1	541.72	169.67	0.002
TV2	493.80	169.68	

Table 2: Table showing mean actual and estimated pulp volumes for all 6 teeth in mm^3

Pulp Volume	Mean	S.D.	P-value
PV1	27.63	3.13	0.486
PV2	28.35	4.49	

Table 3: Mean PTV ratios for all 6 teeth

Ratio	Mean	S.D.	P-value
R1 (PV1/TV1)	0.0550	0.0168	0.002
R2 (PV2/TV2)	0.0620	0.017	

Table 4: Percentage error for all 6 teeth

	Mean	S.D.	% Error
TV1-TV2	47.92	18.68	8.84%
PV1-PV2	0.72	2.35	2.6%
R1-R2	0.007	0.0028	12.7%

Fig. 1a: Endodontically prepared extracted tooth

Fig. 1b: Radiograph of endodontically prepared extracted tooth

Fig. 2: Dispensing gun (3M) with polyvinyl siloxane Cartridge

Fig. 3: Electric balance, Shimadzu, Japan

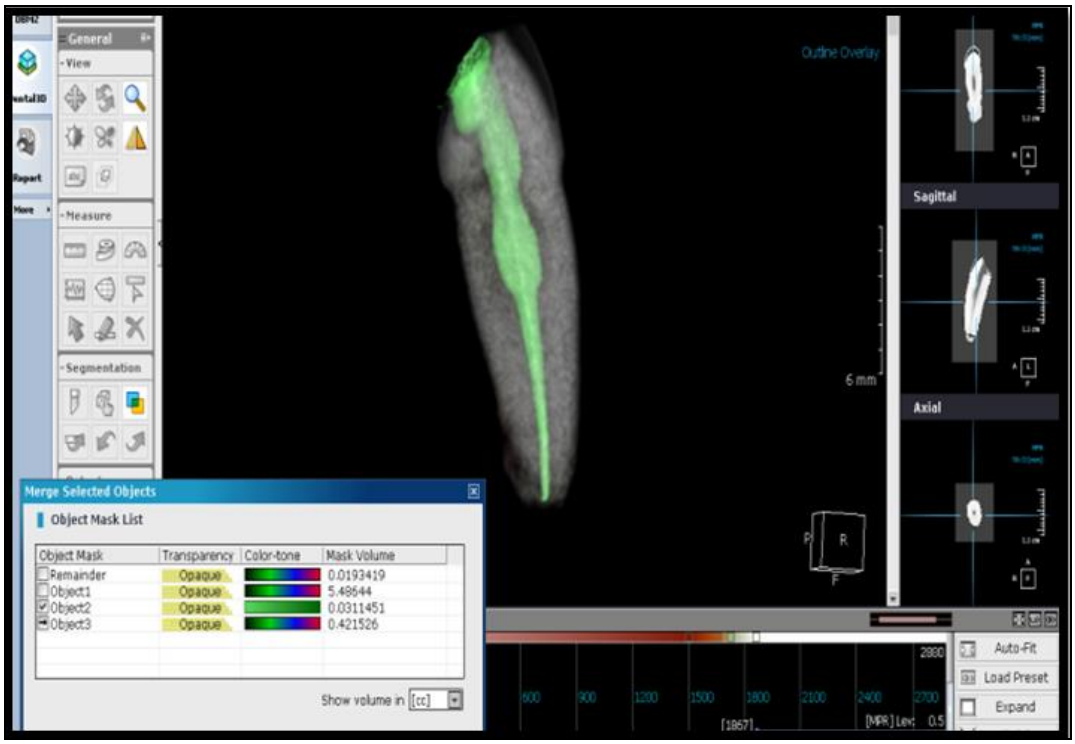

Fig. 4: Segmentation process showing the pulp volume marked with different color

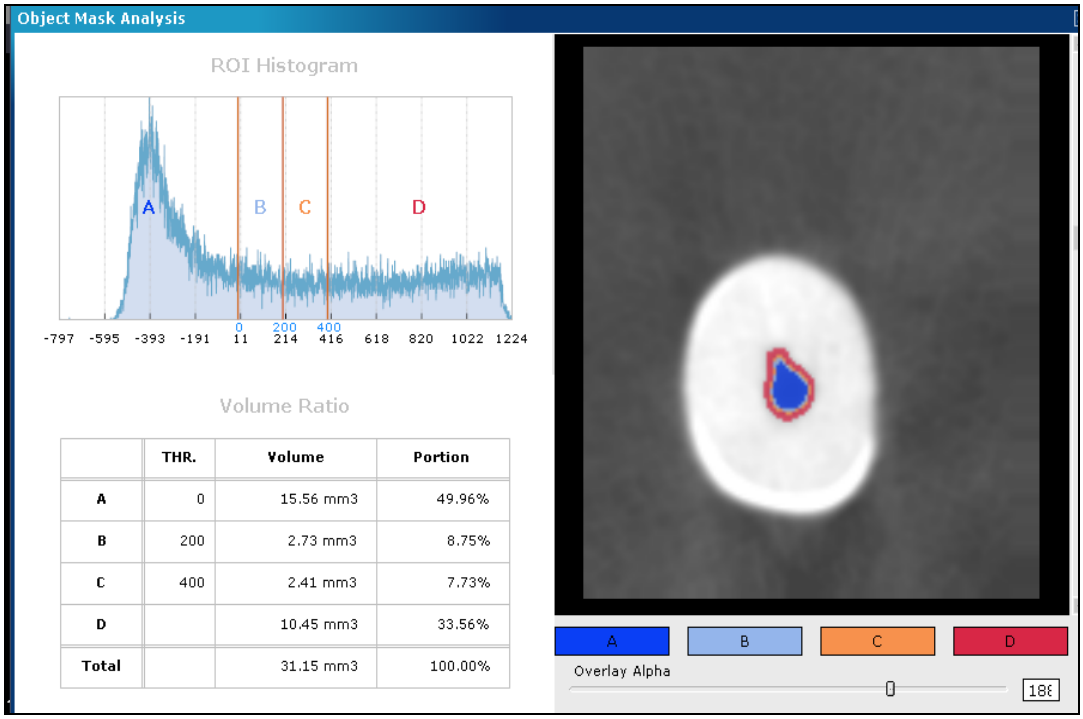

Fig. 5: The object analysis tool in Xelis Dental s/w enabled calculation of ROI Histogram for volume assessment of the pulp cavity

Fig. 6a: Tooth decalcification in 30% HCl

Fig. 6b: Post-decalcification remnant Silicone core

Discussion

The estimated age prediction outcomes allow authorities in their judgment on the chronological age of individuals with a questioned age and provide more accurate post-mortem profiling of unidentified body remains. Age estimation using teeth is viable, because teeth are highly resistant to mechanical, chemical, physical insults and also time. Secondary dentine apposition is a significant morphological dental age predictor.

The formation of secondary dentine is attributed to abrasion, erosion, attrition, caries, changes in pulpal osmotic pressure and aging thus leading to decrease in the pulp volume. Therefore, the volume changes of the pulp chamber in intact teeth are considered as a dental age predictor.

CBCT images of the extracted teeth enable the calculation of tooth and pulp volume non-destructively. Analysis in this study showed an acceptable reproducibility and accuracy with a percentage error of 8.84%, 2.6% and 12.7% for TV1 and TV2, PV1 and PV2 and R1 and R2 respectively.

These were in accordance with the results by Yang et al[7] who obtained a percentage error of ±7.8% while the estimated error was quite less than that reported by Star et al[8] who reported the maximum percentage error to be 21% and 16% for pulp and tooth volumes respectively.

The total procedure including scanning, image reconstruction, pre-processing and measurements took about 1 hour which is much faster than the 5 h per tooth processing time reported in a previous study on Micro CT.[9]

The segmentation process could be challenging because of its dependence on grey scale values and its dependence on inherent resolution of Cone Beam CT. Recent generations of cone-beam CT are available with better contrast resolution and detail which thus will enable improved visualization of the tooth segmentations. The technique needs to be evaluated on living individuals and could be a very objective and non- invasive method of estimating age.

Conclusion

Cone-beam CT scanning provides us a new method to acquire the 3D images of teeth in living individuals by which pulp/tooth volume can be calculated and correlated to age. The presented method shows promising results for age estimation in forensic odontology.

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Periodontal disease and preterm low birth weight: a case control study

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Abstract

Introduction: The influence of subject-based and environmental factors on the balance between the subgingival microbial challenge and the host response in periodontal diseases illustrates the intimate link between oral and systemic health. From this stems the hypothesis that the persistent gram-negative challenge and associated inflammatory sequelae in periodontal disease may have consequences extending beyond the periodontal tissues themselves. This article addresses the design of a case-control study to examine the relationship between preterm low birth weight and maternal periodontal disease.

Materials and Method: A case control study design was chosen including postpartum women between the age group of 18- 35 years of age. Cases were mothers delivering an infant weighing < 2,500g before 37 weeks' gestation and controls as mothers delivering an infant > 2,500g after 37 weeks. A full mouth periodontal examination was performed and corroborated by one examiner. The clinical parameters measured included plaque index, gingival index, pocket probing depth and clinical attachment level. Data was analyzed with Chi-square test, Fisher's exact test, Student t-test and Mann Whitney U test.

Results: There was statistically no significant difference in the mean age between the case group and the control group. There was a strong association between the socioeconomic status, gingival status, plaque levels, pocket probing depth, clinical attachment level and the incidence of preterm low birth weight.

Conclusion: The data from the present study, thus, shows an association between maternal periodontal disease and the risk of pre-term low birth weight infant.

Keywords: Periodontal Disease, Preterm Low Birth Weight, Clinical Attachment Level, Pocket Probing Depth, Socio-economic Status, Gingival Status

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Introduction

Preterm low birth weight is a major medical, social, and economic problem accounting for a large proportion of maternal and especially neonatal mortality, acute morbidity and long term sequelae. It is associated with mortality in the first year of life with developing problems in childhood like acute and chronic infections, cerebral palsy, respiratory conditions, epilepsy, severe learning problems and the risk for adult-onset diseases, such as hypertension and type 2 diabetes.[1] India contributes to 8 million (40%) LBW babies every year.[2]

The etiology of preterm birth is clearly multifactorial, and a host of individual, environmental and genetic factors affect risk.[3] Potential risk factors include parity (number of previous births), short cervical length, short maternal stature, low maternal weight, low socioeconomic status and education, poor maternal nutrition and genito-urinary infections.[4,5] Out of these known risk factors periodontal inflammation is a significant new risk factor that may have as large an impact on the rate of obstetric complications as smoking, alcohol or genito-urinary tract infections.[6]

The role of maternal periodontitis as a potential maternal fetal stressor that has detrimental effects on the pregnancy outcome is a relatively new field of investigation.[7] Early work[8] with pregnant rodent models, including a model with *Porphyromonas gingivalis* and also a model of experimental periodontitis demonstrated that low grade challenges with oral micro-organisms during pregnancy resulted in impaired fetal growth as measured by amniotic fluid prostaglandin E2 (PGE_2), tumor necrosis factor – α (TNF- α) and attendant fetal growth restriction.

The hypothesis linking subclinical infection and preterm birth states that microbes themselves or microbial toxins such as endotoxins (lipopolysaccharide) enter the uterine cavity during pregnancy, which in case of periodontal disease interacts, most likely in the decidua or possibly in its membranes leading to prostaglandin production or directly to uterine muscle contraction.[8]

This interaction is mediated through a cytokine cascade including Interleukin-6 (IL-6), TNF- α which have been shown to be locally elevated as a part of host response to the microbial challenge in periodontal disease. In turn, there is cervical dilation, entry of more microbes into the uterus and continuation of the "vicious cycle" resulting in premature birth.[9] Thus periodontal

disease may influence preterm delivery directly by seeding the genital tract with pathogens or indirectly through endotoxins and release of prostaglandins and cytokines implicated in both periodontal disease and preterm birth thereby representing an additional pathway of infectious/inflammatory exposure to the maternal – fetal unit.[8]

This study was thus undertaken to elucidate the relationship between periodontal disease in women and the risk of preterm low birth weight infant. The objectives of the study were to assess the relationship between clinical attachment level, plaque scores, gingival health, pocket probing depth, socioeconomic status and the incidence of preterm low birth weight infant.

Materials & Method

The present study was designed in the Department of Periodontology and Oral Implantology, I.T.S-CDSR, Muradnagar, Ghaziabad and conducted in the department of Paediatrics, Kalavati Saran (Lady Harding Medical College), New Delhi.

A case control study design was chosen, including 100 postpartum women, between the age group of 18- 35 years of age. The study population was grouped as follows:

Controls (n= 50): Defined as mothers who delivered infants after 37 weeks of gestation and infants weighing more than or equal to 2500 grams at birth.

Cases (n= 50): Defined as mothers who delivered infants before 37 weeks of gestation and infants weighing less than 2500 grams at birth.

Study participants having Body Mass Index (BMI) ranging between 19kg/m^2 and 25kg/m^2 were included as cases. All mothers suffering from severe anaemia, diabetes, urinary tract infections, and environmental factors including use of tobacco, alcohol, were excluded from the study. Women presenting with an obstetric history of severe polyhydramnios, severe oligohydramnios, umblical cord coiling and pre-eclampsia were also excluded from the study. All the data was collected within 48 hours after delivery. Mother's height and weight were determined in order to evaluate the nutritional status.

Socio-economic status of the mother was assessed using Kuppuswamy's Socio-economic Status Scale.[9] This scale takes into account education, occupation and income of the family to classify study groups into high, middle and low socio-economic status.

A full mouth periodontal examination was performed. The oral examination was carried out with the help of artificial light source, mouth mirror and William's graduated periodontal probe.

Clinical parameters measured included:

1. Plaque Index: Tureskey –Gilmore Glickman Modification of the Quigley –Hein Plaque Index[10]
2. Gingival Index (GI) by Loe H and Silness J[11]
3. Pocket Probing Depth (PPD) in mm
4. Clinical Attachment Level (CAL) in mm

Birth weight was obtained within the 1st hour of life by placing the naked infant on a precise scale and calibrated in grams. Gestational age of the infant was determined using Ballard's (Modified) gestational age assessment chart[12] which is based on physical and neurological examination to determine maturity.

The data obtained was tabulated and then subjected to statistical analysis. Continuous data were expressed as mean± SD. Difference between two proportions was expressed by Chi-Square test. Fischer's exact test was carried out to determine the distribution of the study population according to the pocket probing depth. Difference between means for two independent groups was expressed by student t-test.

Results

Study results were presented for each of the following variables; maternal age, socio economic status, gingival condition, periodontal condition, infant birth weight, gestational age and BMI of the mother.

The majority of women in the case group (n=33, 66%) belonged to the upper lower class, as compared to the controls (n=19, 38%) with a statistically very highly significant difference between the groups (Table 1).

Table 1: Distribution of the study population according to the socioeconomic status

SE-Class	Cases (%)	Controls (%)	Total
I	0	0	0
(Upper)	0%	0%	0%
II	0	10	10
(Upper Middle)	0%	20%	10%
III	4	18	22
(Lower Middle)	8%	36%	22%
IV	33	19	52
(Upper Lower)	66%	38%	52%
V	13	3	16
(Lower)	26%	6%	16%
Total	50	50	100
	100%	100%	100%

The age of the mother ranged from 19-32 years in the case group and 18-31 years in the controls, with a mean age of 23.76±2.911 years and 24.84±3.203 years respectively. Statistically no significant difference was observed between the cases and the controls ($p > 0.05$) (Table 2).

Table 2: Comparison of age, BMI, gestational age, weight of the infant between the cases and the controls

Groups	Mean±S.D	Minimum	Maximum	p value
Age				0.081
Cases	23.76±2.911	19	32	
Controls	24.84±3.203	18	31	
BMI				.97
Cases	22.02±1.612	19.56	25	
Controls	22.00±1.882	17.35	24.57	
Gestational age				0.000
Cases	29.92±2.019	27	35	
Controls	39.20±1.325	38	42	
Weight of infant				0.000
Cases	1.66±0.525	0.734	2.400	
Control	2.80±0.187	2.600	3.300	

When the BMI was compared, it ranged from 19.56 kg/m^2 to 25 kg/m^2 in the cases with a mean BMI of 22.02±1.612 kg/m^2. In the controls, the BMI ranged from 17.35kg/m^2 to 24.57 kg/m^2 with a mean BMI of 22.00±1.582 kg/m^2. Statistically no significant difference was obtained between the two groups (p>0.05) (Table 2).

In the cases group, mean plaque scores were 1.78±0.49, whereas, the mean plaque scores were 0.97±0.47 in the control group. Statistically a very highly significant difference was observed between the groups (p≤ 0.0001) (Table 3).

Table 3: Comparison of PlI (Q), GI, PPD, CAL between the cases and the controls

Variables	Mean±S.D	T value	p- value
PlI(Q)			<0.0001
Cases	1.78±0.49	8.4357	
Controls	0.97±0.47		
GI			<0.0001
Cases	1.62±0.45	10.1447	
Controls	0.775±0.38		
PPD			<0.0001
Cases	2.21±0.62	6.9467	
Controls	1.52±0.33		
CAL			<0.0001
Cases	2.28±0.74	9.1499	
Controls	1.014±0.64		

The mean gingival score in the cases was 1.62±0.45 and was 0.775±0.38 for the controls. Statistically a very high significant difference was observed between the two groups (p≤ 0.0001) (Table 3).

The PPD in the cases ranged from 1.43 mm to 4.09 mm and the mean depth was 2.21±0.62 mm. In the controls, the PPD ranged from 1.18 mm to 2.78 mm with a mean depth of 1.52±0.33 mm. Statistically a highly significant difference was observed between the two groups (p≤ 0.0001) (Table 3).

The CAL in the cases ranged from 1.43 mm to 4.56 mm with a mean value of 2.28±0.74 mm. In the controls, the values ranged from 0.12 mm to 3.00 mm with a mean level of 1.014±0.64 mm. Statistically, a very highly significant difference were observed between the two groups (p≤0.0001). (Table 3).

Discussion

Preterm low birth weight is a major medical, social, and economic problem accounting for a large proportion of maternal and especially neonatal mortality, acute morbidity, and long term sequelae.

A landmark study by Offenbacher et al.[12] was the first to demonstrate an association between maternal periodontal infection and adverse pregnancy outcome in humans, suggesting that maternal periodontal disease could lead to a seven fold increased risk of preterm low birth weight infant.

In the present study selection bias was avoided by excluding all the traditional risk factors and confounding variables were controlled, as the study sample was obtained from a well-defined population. Women aged 18-35 years were selected because maternal age less than 18 years and greater than 35 years has been found to be a risk factor for preterm low birth weight.

The majority of women were between 20-29 years of age, with statistically no significant difference between the groups. This is in agreement with the results obtained by Radnai et al.[13] and Davenport et al.[14]

With respect to the socio-economic status, majority of women in the case group, (66%) belonged to the upper lower class as compared to the controls (38%) with a statistically very highly significant difference between the groups (p<0.001). This correlates well with the results of Dasanayake AP[15] which lends further credibility to the validity of the study. According to Radnai et al[16] the difference was insignificant, which is in contrast to the present study.

When the mean gingival scores were compared there was a statistically very highly significant difference between the two groups (p<0.001). These results correlate well with the results obtained by Marakoglu et al[17] and Rajapaske et al.[18]

The mean plaque scores were higher in the cases (1.78±0.49) as compared to the controls (0.97±0.47). The results of the present study are in agreement with the observations of Rajapaske et al.[18] These findings are, however, in contrast to the results observed by Radnai et al[16] where no significant difference was obtained between the cases and the controls. A possible reason for the more healthy periodontal status of the Hungarian subjects included in their study, could be due to the ethnic homogeneity of the sample, contrary to the present study, where the subjects included, belonged to the lower socio-economic strata, who have more negative attitude towards dental care, worse dental health and are less likely to receive preventive dental care.

The mean PPD was comparatively greater in the case group (2.21±0.62 mm) as compared to the controls (1.52± 0.33 mm) with a statistically very highly significant difference between the two groups (p<0.001). This correlation is further strengthened by the

observations of Jeffcoat et al[19] and Marakoglu et al.[17] However, the conclusion drawn from the present study are in contrast to studies conducted by Radnai et al[16] and Davenport et al.[20]

The mean CAL was comparatively higher in the cases (2.28±0.74 mm) as compared to the controls (1.014±0.64 mm) with a statistically very highly significant difference between the two groups ($p<0.001$). These observations are in conformity with the results obtained by Santos-Pereira et al[21] and Jeffcoat et al.[19] On the contrary, Davenport et al[20] observed no statistically significant difference between the cases and the controls. Again, this may be due to a different definition used to describe the extent of CAL, in comparison to the present study.

Local inflammation may be the price paid for preventing the spread of dental plaque bacteria to other parts of the body. If the host's local defenses are compromised as a consequence of the microbial challenge or host-based factors, then continued or renewed inflammation will lead to continued destruction. Therefore, it follows that an improved understanding of the influence of systemic, environmental, and host genetic factors on the balance between the microbial challenge and the host response represents a significant goal in periodontal research, with opportunities for the development of novel diagnostic, preventive, and treatment strategies.

Conclusion

With respect to the age of the subject population, there was statistically no significant difference in the mean age between the cases and the controls. There was a strong association between the socioeconomic status, gingival status, plaque levels, pocket probing depth, clinical attachment level and the incidence of preterm low birth weight. The data from the present study thus shows an association between maternal periodontal disease and the risk of pre-term low birth weight infant.

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Awareness towards management and prevention of dental injuries among sports instructors in Delhi, India

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Abstract

Background/Aim: The purpose of this study was to assess the level of awareness towards management and prevention of dental injuries among sports instructors in Delhi, India, by a self-administered questionnaire.

Materials and Method: A total of 100 questionnaires were distributed to sports instructors from different sports academies of Delhi, India. The questionnaire surveyed the basic details of the sports instructors, their knowledge in management of dental trauma and awareness regarding use of mouth guards to prevent dental trauma.Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) version 16.0.

Results: 96 out of 100 teachers responded to the questionnaires, who had a mean experience of 6.9 years, out of which 23% gave training for basketball, 20.8% for cricket, 13% for tennis and rest 43.2% for other contact sports. 28% stated that they would preserve a fractured fragment or avulsed tooth, while the remaining 72% won't. The medium which they preferred was ice (35%), handkerchief (22%), any liquid (20%), in child's mouth (9%), cotton (8%) and in child's hand (2%). Amongst ones who preferred other liquid as transportation medium, 57% preferred tap water, 28% fresh milk, 8% spirit while 3% normal saline. Though, 67% of these teachers were aware of the use of mouth guards, 51% of these stated that they wouldn't advice its use.

Conclusion: Hence, the present study indicates that there is lack of awareness among the sports instructors regarding the management and prevention of dental injuries in Delhi, India.

Keywords: Dental Trauma, Sports Instructors, Awareness, Children, Avulsion.

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Introduction

Dental traumatic injuries are the fourth most common injuries among 7-30 years of age group.[1] The prevalence of dental injuries is 60%, out of which over 48% involve maxillary teeth.[2] Oral injuries can be as minor as an enamel infraction or it can be very extensive leading to maxillofacial fractures involving dental and alveolar structures.[2] Loss of a child's permanent anterior tooth can be devastating for both the parents and the child. Although the main psychological impact is due to the unaesthetic smile of the patient, dental injuries can also interfere with the various other functions like mastication and phonetics.[3]

The immediate management of a traumatized tooth is critical for its long term survival and the onus of this step lies on the person who is attending to the child at that moment of the injury. This situation will usually be faced by the parents or the school teachers generally. In case of children who are getting professional training for certain contact sports, the most likely person to be attending would be the sports instructor.[4]

As Delhi is a hub for training in various sport activities in India, professional sports teacher working with the children on playground should know the importance of emergency management and prevention of dental injuries.

Hence, this present study was planned to assess the level of knowledge of sports instructors in various sports academies in Delhi, India, about the emergency management of dental trauma by means of self-administered questionnaire.

Materials and Method

The present study was conducted in sports academies of Delhi, India. A total of 100 self-administered questionnaires were distributed to the sport instructors of a variety of games, out of which we received 96 fully filled questionnaires back.

Inclusion criteria

- Sports teachers from various sports academies and schools in Delhi, India, giving training of different contact sports.
- Sports teachers who accepted to be a part of the study.

Exclusion criteria

- Teachers for sports like swimming, bowling (with limited or no contact).

The questionnaire was constructed in both Hindi and English, and contained 20 multiple choice, closed ended questions, aimed to evaluate the general information regarding their training experience, knowledge and attitude in management of traumatic

injuries and awareness about the prevention of dental injuries by use of mouth guards. The questionnaire was checked for the content validity by two professors of the Department of Pediatric and Preventive Dentistry and was checked for construct validity by test and retest method.

The questionnaire was divided in three parts. The first part dealt with the basic details of the sports instructor for e.g.: their experience in sports training. The second part contained questions to evaluate the knowledge about the management of traumatic injuries including tooth fracture and avulsion and the third part dealt with the awareness of these teachers regarding the prevention of dental trauma using mouth guards.

Statistical analysis was done using SPSS version 16.0. The level of significance was set at $p<0.05$.

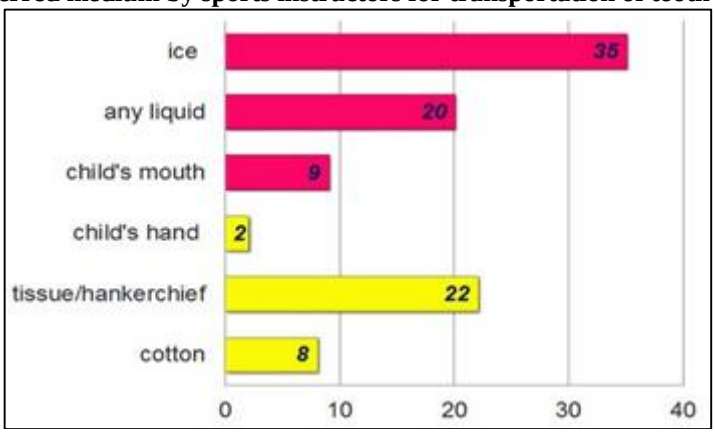
Results

96 out of 100 teachers responded to the questionnaires. They had a mean experience of 6.9 years, out of which 23% gave training for basketball, 20.8% for cricket, 13% for tennis and rest 43.2% for other contact sports like taekwondo, skating, athletics and football (Table 1). 92% of the trainers believed that immediate attendance to dental traumatic injuries would be beneficial which depicted their attitude towards the injuries. In the second part of the questionnaire, the instructors were questioned about their knowledge regarding management of avulsed, luxated and fractured tooth. The results showed that only 28% would preserve an avulsed tooth, while the remaining 72% won't. The medium which they preferred was ice (35%), handkerchief (22%), any liquid (20%), in child's mouth (9%), cotton (8%) and child's hand (2%) (Graph1). Out of those who preferred a liquid as transportation medium, 57% preferred tap water, 28% fresh milk, 8% spirit while 3% preferred normal saline (Graph 2).

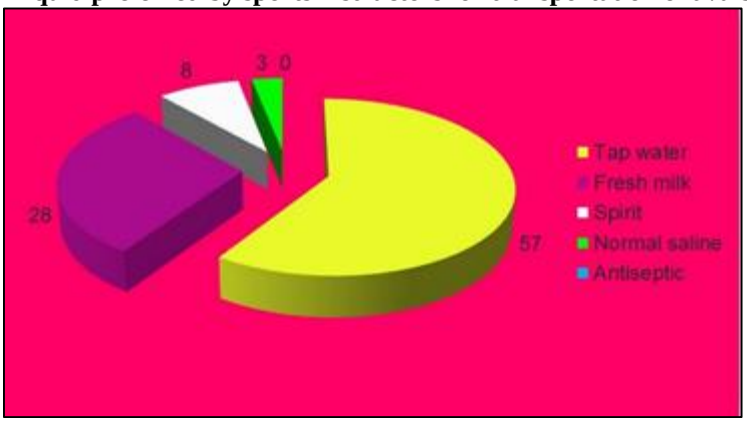
Table1: Fields of the sports instructors

Sport	Percentage
Basketball	23%
Cricket	20.8%
Tennis	13%
Others(skating, football, taekwondo, athletics)	43.2%

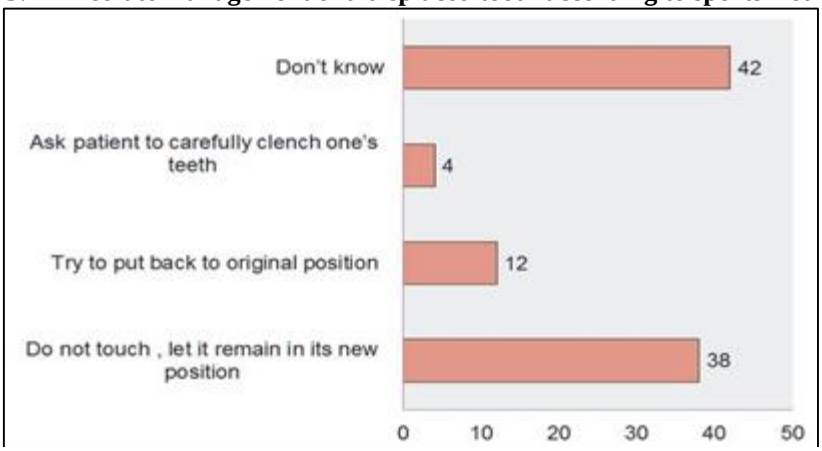
Graph 1: Preferred medium by sports instructors for transportation of tooth after avulsion



Graph 2: Liquid preferred by sports instructors for transportation of avulsed tooth



Graph 3: Immediate management of a displaced tooth according to sports instructors



On asking about the immediate management of fractured tooth, 33% didn't know what to do while 25% would ignore it and only 10% would try and find the fragment. While in case of displaced tooth, 42% didn't know what to do, 38% would ignore the displaced tooth, 12% would try to put it back in its location and 4% would ask patients to be careful while clenching.(Graph 3)

The third part of the questionnaire showed that 67% of these teachers were aware of the use of mouth guards to prevent sports injuries, while, 51% stated that they wouldn't advise its use. 49% stated that they would advise the use of mouth guards without any specific reasons.

Discussion

The study assessed the level of knowledge of sports instructors in sports academies of Delhi, India, about the emergency management of dental trauma by means of self-administered questionnaire. The response rate of the sports instructors who trained children in various contact sports was high (96%), compared to other survey based studies done by R. Hashim[5] in 2011 at Emirate of Ajman, United Arabs Emirates, (84.4%) and 86.3% in Jordanian study by Suhad-H Al Jundi[6] (2005). While the experience of 87.6% of the teachers included in R. Hashim's study was more than 3 years compared to mean experience of the sports trainers in this study being 6.9 years. 92% of the sports teachers believed it to be beneficial to immediately attend to a child with dental trauma which was a favorable number. A study done by Sea-Limet al.[7] 2001 at Singapore, showed that only 65% of pre-school teachers knew the importance of urgent care which substantiates their perspective in management of dental trauma. Only 28% of the sports trainers agreed to save an avulsed tooth. These results were similar to the earlier survey based studies by McIntyre in 2008 at Orange County, North Carolina[8], where only 7% of elementary school staff said that they would save an avulsed tooth. 27.7% of the primary school teachers in a study by Blakytyn[9] (2001) at United Kingdom, didn't know that an avulsed tooth can be saved. This reflects the lack of awareness of the sports instructors regarding the benefits of immediate reimplantation of an avulsed tooth. The preferred medium for storage and transportation of an avulsed tooth by the majority of teachers was tap water 57%. In an Iranian study by Mesgarzadah et al.[10] in 2009, only 18.7% of elementary school teachers knew the proper storage medium. These results were similar to the study of Mohandas U[2], 2009, at Bangalore, who stated that 58.3% of physical education teachers had no knowledge about the storage medium for an avulsed tooth and according to Chan et al[11] 2001 at Hong Kong, only 15% of the school teachers answered correctly about the storage medium for an avulsed tooth. The results of these studies depict the urgent need for educational training in the management of traumatic dental injuries. In our study, more than half of the instructors stated that they either didn't know the immediate management of fractured tooth or they would ignore it showing their lack of awareness of the treatment options available for fractured tooth fragment. In a study by Feldenset al.[12] 2010 at Brazil, 22.5% of school teachers had completely inadequate knowledge about management of an avulsed or fractured tooth. More than 80% of the sports instructors did not know that a displaced tooth could be repositioned in its original position which is evident about their obliviousness regarding the presence of the permanent tooth bud and possible damage that a displaced tooth can cause to it, if not repositioned. 67% of the sports trainers were aware of the use of mouth guards but only 45% advised its use during the various contact sports and they even agreed with the fact that mouth guard wear was not 100% implemented. The results of all the studies show a severe lack of knowledge regarding dental trauma management among all sections of society. Thus, a community level awareness program needs to be implemented wherein the parents, teachers and even the children themselves can be taught about the protocol for the emergency management of dental traumatic injuries.

Conclusion

Following conclusions were drawn from our study:

- Majority of the sports teachers were unaware of the immediate reimplantation required for an avulsed tooth.
- Although many teachers agreed to preserve the avulsed tooth in a liquid medium but the choice of the medium was very variable with majority of them preferring tap water.
- Very little knowledge regarding the preservation of fractured tooth fragment was evident.

Conflict of interests

The authors declare no conflict of interest.

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Disposable mobile sleeves – a protective barrier in dental clinics

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Abstract

Aim: To evaluate the presence of microorganisms on mobiles phones in dental clinics, as a possible nidus for infection and to suggest the use of disposable sleeves to reduce the level of microorganisms in the dental clinics.

Materials and Method: An observational study was conducted, on two groups, study group (group I) and control group (group II), having 25 mobile phones. Before entering the dental clinics, the mobiles phones were cleaned with an alcohol based disinfectant under aseptic conditions. Then, the mobile phones in group I were covered with an autoclaved disposable sleeve having a chemical indicator and group II were left uncovered. After five hours, swabs were obtained from the surfaces of mobile phones of both group I and group II. The swabs were cultured and incubated on blood agar for twenty four hours and evaluated for their microbial load.

Results: The sample taken from the sleeve showed growth of microorganisms whereas, there was no growth on mobile surface of group I. On the contrary, the mobile surface of group II showed significant microbial load.

Conclusion: Mobile phones can act as a fomite in dental setup and the use of disposable sleeves can effectively curtail any cross contamination of microorganisms, thereby, serving as a protective barrier. Therefore, these sleeves act as yet another protective barrier in dental clinics.

Keywords: Mobile Surface, Disposable Sleeves, Microbial Load

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Introduction

The mobile phones are used routinely all day long both inside and outside the hospital, playing a plausible role in spreading infections. They act as a prime breeding ground for all sorts of microorganisms. It is discovered that an average mobile phone is dirtier than either a toilet seat or the bottom of the shoe.[1] A study reported that 40% of the mobile phones of 266 medical staff members and students were culture positive.[1] The mobile phones used inside the hospitals especially in clinically sensitive areas are controversial, as their usage can improve the quality of healthcare but they transmit various infections.

Healthcare Associated Infections (HAI) are increasing day by day causing significant rate of morbidity and mortality.[2] The hands of healthcare workers (HCW), thermometers, stethoscopes, any inanimate object in a hospital can be contaminated with different pathogens and infections can spread through them.[2] The mobile phones are used in hospital halls, dental clinics, laboratories, intensive care units and operating rooms by the HCW.[2] The strongly contaminated human body areas establish a close contact with the mobile phones during every phone call. The mobile phones act as a perfect habitat for microbes to breed, especially in high temperature and humid conditions. Therefore, HCW's mobile phones may serve as reservoirs of microorganisms.[2] These could be easily transmitted from the mobile phones to the HCW's hands facilitating the spread of bacterial isolates, from one patient to another.[2] When we enter a dental clinic everything is well protected and sterilized. This includes the dental chair, the dentist's stool, dental lights and the instruments. All these equipment's are protected by sterilized sleeves which are changed for every patient. Even the dentist is draped in protective clothing. The only thing which is not protected is the dentist's mobile phone. This study was conducted to determine the potential of mobile phones to harbour microorganisms in dental clinics and to evaluate its role in spread of infection.

Materials and Method

A sample of fifty mobiles phones was evaluated, divided in two groups of twenty five each. Group I acted as a study group and group II as control. Before entering the dental clinics, the mobiles phones were cleaned with an alcohol based disinfectant under aseptic conditions.[3] Then, the mobile phones in group I were covered with an autoclaved disposable sleeve having a chemical indicator and those in group II were left uncovered. After five working hours, swabs were obtained from the sleeve surface of group I and from the mobile surfaces of both the groups. The swabs were cultured and incubated on blood agar at 37°C, for twenty four hours and evaluated for any colony growth[4]

(Fig. 1). Later, Gram's staining was done on the cultured micro-organisms.

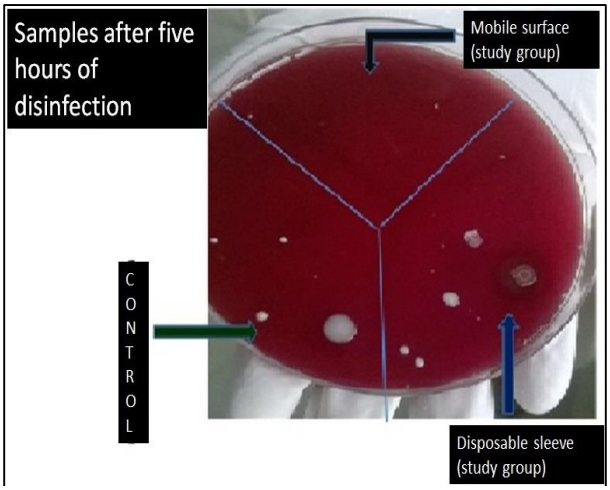
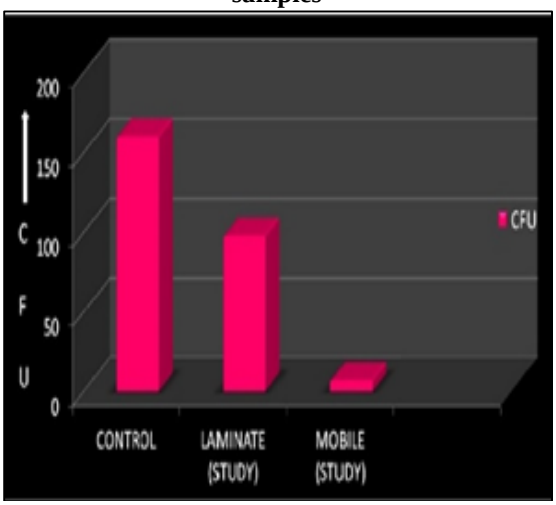


Fig. 1: Microbial load on blood agar plate after five hours of disinfection

Result

Samples obtained from the sleeve surfaces of group I and the mobile surfaces of group II, after five hours, of disinfecting and usage, showed a great deal of microbial load. On the contrary, samples obtained from the mobile surfaces of group I showed minimalistic microbial growth (Graph 1). Covering the mobile phones with the sleeves showed a decrease of 95.6% in the microbial load. The various types of colonies found included coenocytic fungi, gram negative rods, gram positive cocci, staphylococcus and streptococcus (Fig. 2).

Graph 1: Comparison of microbial load in different samples



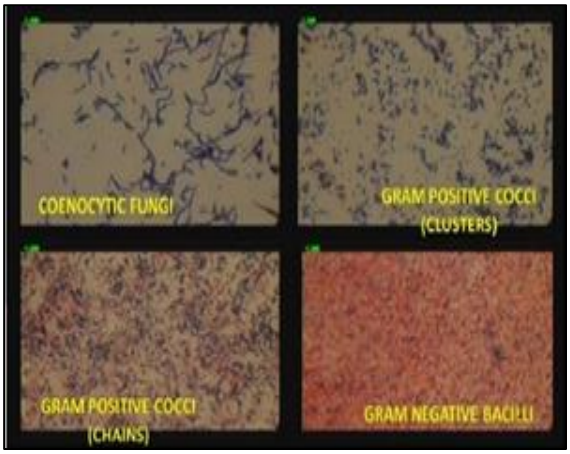


Fig. 2: Different microorganisms seen on Gram's staining

Discussion

Currently, there are no rules and regulations restricting staff to carry mobiles into the sterile environment of the clinics.[1] Many infectious agents can survive for extended periods once they are deposited and the airborne microorganisms eventually settle on the surfaces in the environment. Given the volume of aerosols and spatter produced during dental treatment, the contamination of mobiles is of particular concern, as they become potential reservoirs for infections.[5] Various threatening diseases which can be caused commonly include skin and nail infections, boils, food poisoning, pharyngitis, scarlet fever, toxic shock syndrome, meningitis, infections of urinary tract and GIT. The i-pad sleeves are already available in the market which is classified as cover, barrier and a protective device (non-latex). When used with an I-pad that has been appropriately cleaned, this satisfies the requirements for its use in the operating room. The practical solution of the problem cannot be restriction of the mobile phones, which is an extensively used accessory during working hours. Therefore, we recommend a simple measure of using disposable sleeves by the clinicians to reduce the spread of hospital acquired infections. Even after following a whole spectrum of sterilization protocol, mobile phones prove as a pertinent area without asepsis in the working environment, which needs corrective measures to complete the lattice of a sterile environment. According to the biomedical waste management protocol, the used sleeves should be disposed in the red bin which is for the infected non-biodegradable waste.

Conclusion

The use of mobile phones as a mode of cross contamination is widely established but no remedial action has ever been suggested. Therefore, a simple, economical and easily procurable mobile sleeve can make a pertinent difference in the clinics. Although, it was a novel idea, the sample size was limited to fifty.

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Evaluation of clinical efficacy of 0.2% chlorhexidine irrigation, 1.5% chlorhexidine gel and 2.5mg biodegradable chlorhexidine chip as an adjunct to scaling and root planing in the management of Chronic Periodontitis

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Abstract

Introduction: Various chemotherapeutic agents can be administered subgingivally to enhance the efficacy of non-surgical therapy mechanical treatment. Chlorhexidine (CHX) is an effective antimicrobial agent and has been used as a topical antiseptic for over 30 years. The aim of the study was to evaluate and compare the clinical efficacy of various forms of local delivery of Chlorhexidine (CHX) i.e. 0.2% CHX irrigation, 1.5% CHX gel and 2.5mg biodegradable CHX chip as an adjunct to scaling and root planning in the management of Chronic Periodontitis.

Materials and Method: Forty sites from patients with Chronic Periodontitis and probing depth 5 to 7 mm were randomly divided into 4 groups. Group I (10 Sites): scaling and root planing (SRP) + subgingival irrigation with 0.2% Chlorhexidine; Group II (10 Sites): SRP + subgingival application of 1.5% Chlorhexidine gel (Chlo-Site); Group III (10 Sites): SRP + intrapocket administration of Chlorhexidine chip (Periocol-CG); Group IV (10 Sites): scaling and root planing only (control group). Improvement in periodontal health was assessed by the gingival index of Loe and Silness and plaque was assessed using the Turesky et al. modification of Quigley Hein Index at baseline, 1 month and 3 months. Pocket probing depth and clinical attachment level were also measured using customized acrylic stents.

Results: Significant clinical improvement was seen in all the groups from baseline to 3 months. Subgingival irrigation with 0.2% CHX xdid not provide any additional benefit over SRP alone in the improvement of clinical indices. Adjunctive use of 1.5% xanthan based CHX gel and CHX chip along with conventional nonsurgical therapy provided clinically favorable results in terms of reduction of pocket probing depth and clinical attachment level than SRP alone.

Conclusion: Based on the findings, it was concluded that 1.5% CHX gel and CHX chip provide significant results as compared to SRP alone. Subgingival irrigation with 0.2% CHX provides similar clinical benefits as mechanical debridement alone.

Keywords: 1.5% Chlorhexidine Gel; Chlorhexidine Chip; Subgingival Irrigation; Chronic Periodontitis

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Introduction

Chronic Periodontitis is a disease attributable to multiple infectious agents and interconnected with cellular and humoral host immune responses. Progress in the understanding of pathogenesis has paved way for new approaches in the prevention, diagnosis and treatment of Chronic Periodontitis.

The aim of effective treatment of periodontal disease is to arrest the inflammatory disease process by removal of the subgingival biofilm and establish a local environment and microflora compatible with periodontal health. Non-surgical therapy includes both mechanical and chemotherapeutic approaches to minimize or eliminate the microbial biofilm. Chemotherapeutic approaches include both local and systemic administration of various antiseptics and antibiotic agents.

However, targeted delivery of therapeutic agents are fast gaining popularity as it reaches the base of the periodontal pocket and is maintained for an adequate time for the antimicrobial effect to occur. Local administration of antimicrobial drugs directly into the periodontal pocket has been accepted as a means of reducing systemic complications and targeting localized areas of periodontal destruction.[1] Several local drug delivery systems using antiseptics and antimicrobial have been developed and proven effective as an adjunct to scaling and root planing. These include application of the drug in the pocket via irrigating devices, gels, fibers or a chip form.

Among various chemical plaque control agents, chlorhexidine has proven to be the most effective, safe and clinically effective in reducing plaque and gingivitis and is accepted as the gold standard for the management of periodontal diseases.[2]

Chlorhexidine can be effectively used to lessen the biofilm burden when introduced in to the periodontal pockets, hence, resulting in improvement of the clinical parameters. It is well retained in the oral cavity, by reversible electrostatic binding to glycoproteins in the dental pellicle and by adsorption to teeth.[3] First sustained release dosage of chlorhexidine diacetate for topical use was developed by Friedman and Golomb in 1982[4]. In fact, Walsh et al, concluded that irrigation

with Chlorhexidine was more effective in reducing plaque vitality than rinsing with Chlorhexidine.[5] Recently, a new sustained release drug delivery Chlorhexidine gel (1.5%) and a controlled release 2.5mg Chlorhexidine chip have been developed which achieve high intrapocket concentration and significant reduction in the bacterial counts.

Chlo-site® (GHIMAS, Italy), is a xanthan based syringable gel system. The gel is a combination of two CHX formulations: 0.5% Chlorhexidine digluconate and 1.0% Chlorhexidine dihydrochloride incorporated in a saccharidic polymer, xanthan. The CHX xanthan based gel undergoes an imbibition process and is physically removed in 10-30 days. On the first day, Chlorhexidine digluconate is released and it achieves a concentration >100 µg/ml, which is maintained for an average of 6-9 days. Chlorhexidine dihydrochloride is released subsequently and maintains the bacteriostatic and bactericidal concentrations for at least 2 days, thus, preventing recolonization.[6]

PerioCol™-CG (Eucare pharmaceuticals (P) Ltd.) is a small, orange- brown rectangular chip. It is rounded at one end for easy insertion into periodontal pockets. Each chip contains approximately 2.5 mg of chlorhexidine gluconate in a biodegradable matrix of Type 1 collagen which is derived from fish sources. It releases chlorhexidine approximately 40-45% within 24h and afterwards in a linear fashion for 7-8 days. The release profile may be explained by initial burst effect due to diffusion of the drug from the chip followed by release of the drug due to enzymatic degradation.[7]

Thus, the present study was undertaken to compare the clinical effectiveness of three different modes of local delivery of chlorhexidine via pocket irrigation, chlorhexidine gel (CHLO-SITE) and chlorhexidine chip (PERIOCOL-CG) as an adjunct to scaling and root planing in the management of moderately deep periodontal pockets.

Materials and Method

The study was conducted in the department of Periodontology and Oral Implantology, ITS Dental College, Ghaziabad. 40 patients diagnosed with Chronic Periodontitis in the age range of 30 to 50 years were selected from the outpatient department.

Inclusion criteria

- Subjects with Chronic Periodontitis with at least one site having 5-7mm of probing depth
- Subjects in age group of 30 to 50 years were selected

Exclusion criteria

- Subjects who had received any periodontal therapy in the last 6 months
- Subjects wearing removable or fixed partial dentures and undergoing orthodontic therapy
- Teeth with caries, restorations or endoperio lesions were not included in the study
- Subjects who had taken antibiotics, immunosuppressant or oral contraceptives in the last 6 months
- Subjects sensitive or allergic to Chlorhexidine
- Tobacco users
- Pregnant or lactating females
- Subjects unable to provide informed consent

Based on the selection criteria, 40 sites with probing depth 5 to 7 mm were selected for the study. All patients received standard periodontal therapy i.e. scaling and root planing in a single sitting using an ultrasonic scaler and Gracey curettes.

The selected 40 sites were further randomly divided into 4 groups and received the following treatment:
GROUP I (10 sites)
Scaling and root planing + subgingival irrigation with 0.2% Chlorhexidine
GROUP II (10 sites)
Scaling and root planing + subgingival application of 1.5% Chlorhexidine gel (CHLO-SITE)
GROUP III (10 sites)
Scaling and root planing + intrapocket administration of Chlorhexidine chip (PERIOCOL-CG)
GROUP IV (10 sites)
Scaling and root planing only (control group)

Clinical parameters were assessed using UNC 15 probe and a mouth mirror.
These included:

- Gingival index (Loe and Silness, 1963) [8]
- Plaque index (Turesky Gilmore Glickman modification of the Quigley Hein Plaque index, 1970)[9]

For recording periodontal parameters, customized acrylic stents were used to provide fixed reference point for measurements. These stents were fabricated on the patient's casts made from alginate impression of the upper and lower arches.
The following measurements were made:

- Relative attachment level (measured from a fixed point on the stent to the base of the pocket)
- Probing depth (measured from the gingival margin to the base of the pocket)

All the clinical measurements were made at baseline, 1 month and 3 months after the initial treatment.

Statistical analysis: Results were expressed as mean±standard deviation and SPSS (statistical package for social sciences) version 16.0 was used for statistical analysis. ANOVA (Analysis of Variance) test was used for calculating difference between more than two mean values. Post-Hoc Bonferroni test was used for multiple comparisons after the application of the ANOVA test

for comparison within the groups. The p-value was taken significant when less than 0.05 ($p<0.05$).

Results

The present study was conducted to evaluate and compare the clinical efficacy of various forms of local drug delivery of CHX irrigation, CHX gel and CHX chip as an adjunct to SRP and SRP alone in the management of patients with Chronic Periodontitis. The study included 40 sites from 40 patients that included 22 males and 18 females in the age group of 30 to 50 years and clinically diagnosed with Chronic Periodontitis.

The evaluation was done by comparing the Gingival Index, Plaque Index, pocket probing depth and relative attachment level in four groups at baseline, 1 month and 3 months after the procedure.

Comparison of clinical findings in four groups at various time intervals has been shown in Table 1. At baseline, all clinical parameters did not show any significant intergroup difference. When intergroup comparisons were made, it was found that there was a statistically significant improvement in all clinical parameters from baseline to 3 months. On applying Post Hoc Bonferroni multiple comparison test, significant reduction of probing depth was seen in Group II and III as compared to control group at 1and 3 month time interval. ($p<0.05$)

Table 2 evaluates the comparison of change in clinical parameters in four groups at various time intervals. A reduction in plaque accumulation was seen in all groups from baseline to 3 months. However, this difference between the groups was not found to be statistically significant. When the reduction in gingival index was compared between groups, it was found that CHX chip was more effective in reducing gingival inflammation than control group from baseline to 3 months. ($p<0.05$).

Use of CHX gel and chip as adjuncts to SRP were also found to be statistically better in reduction of pocket probing depth and improvement in relative clinical attachment level from baseline to 3 months. However, Post Hoc Bonferroni multiple comparison tests showed that the difference between control and CHX irrigation groups was statistically insignificant from baseline to 3 months. Also, no significant difference in mean reduction of probing depth and relative attachment level was found in Group II and III from baseline to 3 months indicating comparable results.

Table 1: Comparison of clinical parameters in four groups at baseline, 1 month and 3 months. (p <0.05 significant)

Group	Clinical parameters	Mean + SD			P value
		Baseline	1 Month	3 Month	
Group I CHX Irrigation	PI	2.40 ±0.52	1.50±0.53	1.60±0.52	0.000
	GI	1.90±0.32	1.50±0.53	1.60±0.52	0.000
	PD	6.20±0.63	5.40±0.52	5.70±0.48	0.000
	RAL	10.20±1.40	9.0±1.16	9.50±0.97	0.000
Group II Chlosite	PI	2.40±0.52	1.40±0.52	1.40±0.52	0.000
	GI	1.80±0.42	1.30±0.48	1.30±0.48	0.000
	PD	6.00±1.05	4.60±0.84	4.80±0.79	0.000
	RAL	10.1±1.20	8.7±1.06	8.7±0.68	0.000
Group III Periocol CG	PI	2.50±0.53	1.3±0.48	1.3±0.48	0.000
	GI	1.90±0.32	1.40±0.52	1.20±0.42	0.000
	PD	6.30±0.95	5.00±0.82	4.60±0.70	0.000
	RAL	10.30±1.06	9.10±0.74	8.40±1.08	0.000
Group IV Control	PI	2.30±0.82	1.50±0.53	1.83±0.42	0.000
	GI	1.90±0.32	1.70±0.48	1.80±0.42	0.000
	PD	6.20±0.42	5.90±0.57	5.80±0.42	0.000
	RAL	9.50±0.71	9.30±0.82	9.20±0.79	0.000

Table 2: Comparison of change in clinical parameters in four groups groups at baseline, 1 month and 3 months. (* -p <0.05 significant)

Clinical Parameters		Group I CHX Irrigation	Group II CHLOSITE	Group III PERIOCOL CG	Group IV Control	P value
GI	Baseline – 1 month	0.40±0.52	0.50±0.53	0.50±0.53	0.20±0.42	0.5
	Baseline – 3 months	0.3±0.48	0.5±0.53	0.7±0.48	0.1±0.32	0.03*
	1 month – 3months	-0.1±0.57	0.0±0.47	0.2±0.42	-0.1±0.32	0.4
PI	Baseline – 1 month	0.9±0.88	1.0±0.82	1.2±0.83	0.8±0.92	0.7
	Baseline – 3 months	0.8±0.79	1.0±0.47	1.2±0.79	0.5±1.08	0.2

	1 month – 3months	-0.1±0.74	0.0±0.67	0.0±0.67	-0.3±0.82	0.7
PD	Baseline – 1 month	0.8±0.42	1.40±0.52	1.3±0.68	0.3±0.48	0.00*
	Baseline – 3 months	0.5±0.53	1.20±0.63	1.7±0.68	0.4±0.52	0.00*
	1 month – 3months	-0.3±0.68	-0.2±0.63	0.4±0.52	0.1±0.32	0.03*
RAL	Baseline – 1 month	1.20±0.63	1.40±0.52	1.2±0.63	0.20±0.42	0.00*
	Baseline – 3 months	0.7±0.82	1.4±0.84	1.9±0.57	0.3±0.48	0.00*
	1 month – 3months	-0.5±0.71	0.00±0.67	0.70±0.68	0.10±0.32	0.001*

Discussion

Success of periodontal therapy is aimed at eliminating pathogenic microorganisms found in dental plaque associated with the tooth surface and other niches in the oral cavity. However, very few patients are able to maintain periodontal health over a lifetime without regular dental care, which consists primarily of oral hygiene instructions and non-surgical therapy.[10] Since, most patients are not skilled in adequate plaque control, clinicians include local and systemic chemotherapeutic agents in their treatment regimen.

The present study was conducted to evaluate the clinical efficacy of administration of CHX in various forms i.e. irrigation, gel and chip form directly into periodontal pockets as adjuncts to SRP in the management of Chronic Periodontitis.

Clinical parameters were recorded at baseline, 1 month and 3 months. The 3 month interval was chosen because the effects of locally delivered Chlorhexidine are maintained for eleven weeks after administration and also 3 months corresponds to the typical recall interval for patients after periodontal treatment.[11,12,13]

In the present study, supragingival plaque decreased significantly from baseline in all the groups as a result of full mouth supragingival and subgingival scaling. The plaque scores were maintained at a low level throughout the study period, which indicate good oral hygiene maintenance by all the patients and successful motivation in supportive periodontal care.

Though the clinical parameters improved in all groups, we did not find any significant difference in the mean reduction between control and irrigation group. Subgingival irrigation with CHX resulted in less optimal results probably because of inability to reach biologically adequate concentration for sufficient time in periodontal pocket.[14] Therefore, research studies have focused on slow-releasing devices with higher substantivity to overcome these limitations of CHX irrigation.[15]

On clinical examination, Group II and III demonstrated a higher reduction in probing pocket depth (PPD) when compared to Group I and IV. In control group, the probing pocket depth reduced because of the beneficial effects of scaling and root planning and effective plaque control. In Group II and III, the probing pocket depths further reduced because of the placement of Chlosite and PerioCol TM-CG. This indicates that there was an enhanced benefit of chlorhexidine along with scaling and root planing alone.

On comparing the mean gain in clinical attachment level between the groups, the gain was higher in Group III. In Group IV, the improvement in clinical attachment level (CAL) could be due to higher baseline probing depth in the present study. According to Kaldahl, there was greater gain in clinical attachment level after scaling and root planing with PPD of >4 mm.[16] In Group III, the sites were treated by SRP followed by treatment of periodontal pockets with PerioCol TM-CG. With the additional placement of chlorhexidine chip, there was prolonged exposure of chlorhexidine in pocket environment for 6-9 days which gave long-lasting effects on microbiota. This would have brought about additional gain in the clinical attachment level in this group. These findings were similar to studies by Soskolne and Jeffcoat who also demonstrated gain in the clinical attachment level in test sites which were treated with the chlorhexidine chip.[17,18]

Enhanced improvement in clinical periodontal parameters should be attributed to CHX which is known to inhibit microbial proteases from potent periodontal pathogens, responsible for destruction of periodontal tissues during progression of periodontal diseases.[19] Puri et al, reported higher reduction in Porphyromonas gingivalis (Pg), Aggregatibacter actinomycetemcomitans (Aa), Prevotella intermedia (Pi) and Fusobacterium nucleatum (Fn) at sites treated with CHX chip.[20]

Also, prostaglandin E2 which is an immunoactive host produced agent and responsible for tissue damage is reduced by CHX thus accounting for improvement in periodontal health.[21] Grover et al also reported significant clinical attachment gain, reduction in bleeding index scores, probing pocket depth reduction and bone gain in sites treated biodegradable CHX chip.[22]

Similar results were reported by Paolantonio et al[23] and Gupta et al[24] who reported a significantly higher reduction in bleeding on probing, probing depth and clinical attachment level in sites treated with xanthan based CHX gel along with SRP than with SRP alone. Paolantonio et al[23] also reported reduction in total bacterial counts and GCF alkaline phosphatase activity at sites treated by CHX gel. Xanthan based CHX gel also reduced percentages of sites positive for the eight putative periodontopathic compared to SRP alone. Good effects of xanthan-based CHX gel is due to its

bio-adhesive capability by xanthan and slow release of CHX, which might help maintain acceptable oral hygiene in these patients. [14]

Thus, the results of the present study indicated that local subgingival application of CHX in the form of irrigation, gel and chip all produced significant clinical improvement in periodontal health. However, CHX gel and placement of CHX chip as an adjunct to SRP produced a statistically significant reduction in the probing depth and a gain in CAL at 1 month and 3 months from baseline when compared to SRP alone or the use of CHX irrigation. Further long term studies with larger sample size and multiple applications of these agents can be conducted to validate the results of the study.

Conclusion

Based on the findings of the study, subgingival irrigation with CHX did not provide clinically significant benefits beyond that achieved with conventional SRP after a 3 month period. Adjunctive use of xanthan based CHX gel and CHX chip along with conventional nonsurgical therapy provide more favorable results in terms of reduction of pocket probing depth and clinical attachment level than SRP alone and thus can be recommended as a safe and effective chemotherapeutic agents in the management of patients with Chronic Periodontitis.

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Knowledge, attitude and practice of dental products by the out patients of dental college and hospital - questionnaire survey

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Abstract

Introduction: Awareness, attitude and pattern regarding oral health among general public has grown, but the practice of self-medication is posing a threat to life. Therefore, the aim of the study was to evaluate self-medication practice and medicine knowledge among the out patients visiting dental college and hospital.

Materials and Method: The study was anonymous, questionnaire-based survey conducted among 400 subjects, aged above 18 years visiting the out-patient department of a Dental College and Hospital. The questionnaire consisted of demographic details, questions regarding the type of medication, the source of knowledge of the medicines, illness for which the medication was used, reason for self-medication and reason for not adhering to the prescriptions. The collected data was analyzed using the SPSS Version 21.

Results: Knowledge of usage of dental products was 74.4%, 31.6% ticked television as the source of information, 88.4% of the respondents felt that the prescription is required for the dispensing of the drug at the pharmacy. 52.2% of the respondents followed the instructions given by the dentist.

Conclusion: A majority of the respondents had a fair knowledge about the dental products prior to their visit to the dental college. The major source of information was from the dentists, television and from friends. The larger population did know that the prescription was important for procuring the medication and also to follow the instruction for the proper drug dosage, time of consumption and for the duration of the course.

Keywords: Dental Products, Knowledge, Self-medication, Awareness, Attitude

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Introduction

The changing oral health patterns, oral health awareness, dental knowledge and positive attitude of the general public has grown. In contrast, increasing levels of dental caries have been observed in several developing countries where preventive programmes have not been implemented[1,2]. Under usage of prescription, medicines constitutes a large problem for the global health care system.[3-9] This could be attributed to under-diagnosis, under-treatment and to the fact that patients do not take medications that they have been prescribed, a phenomenon referred to as medication non-adherence.[4-16] Medication non-adherence is related to greater morbidity and mortality in chronic diseases[16-18] and has been estimated to increase health care costs.[19,21] The public health consequences of medication non-adherence have led providers and health planners, to aspire to measure its frequency, assess its root cause, develop and implement interventions to address it. Prior research has demonstrated that many patients stop taking medications soon after filling the first prescription.[21] These studies generally rely on claims data and begin tracking adherence when the patient first fills a prescription, in effect measuring "persistence" on a medication.[16] The rate at which patients fill new prescriptions has been defined as "primary adherence"[22,23] and is an important phenomenon, since timely initiation of medications is critical for treating both acute and chronic conditions.

Therefore, the aim and objective of the study was to evaluate self-medication practice and medicine knowledge among the out patients visiting dental college and hospital.

Materials and Method

This study was an anonymous, questionnaire-based survey. A self-developed, pre-validated close-ended questionnaire was used which was translated in both Kannada and English language, consisting of 11 questions.

The study population comprised of patients visiting outpatient department of a dental college and hospital, Mysore. The study enrolled patients who were 18yrs and above. Prior to the data collection, the questions were pre-tested (pilot study) in order to ensure the level of validity and degree of repeatability (Cronbach's alpha=0.76). 400 patients (subjects) agreed to participate in the study. 97 were excluded in accordance with the exclusion criteria like incomplete information (incompletely filled questionnaire) and 52 withdrew

from the study. Convenience sampling method was used, Ma Corr Inc. Sample size calculator was used for estimating the sample size at 95% confidence interval.

A briefing was given about the nature of the study, and the procedure of completing the questionnaire was explained. Consenting participants anonymously completed the questionnaire.

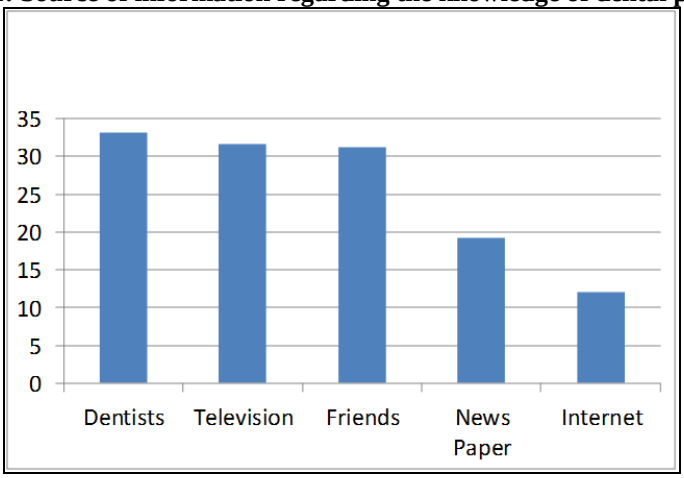
For the purpose of the study, certain operational terms were defined. Self-medication was defined as the use of over-the-counter or non prescription drugs, whether modern or traditional, for self-treatment, without prior consultation with a doctor. A doctor was defined as any person who is medically qualified to prescribe medications. It included practitioners of modern scientific medicine as well as practitioners of other health care systems. Medication was defined as any substance used for the treatment or prevention of disease. The questionnaire consisted of demographic details, questions regarding the type of medication, the source of knowledge of the medicine, illness for which the medication was used, reason for self-medication, reason for nonadherence to the prescriptions.

Knowledge regarding any adverse drug effects associated with self-medication was noted. The results were based upon the data obtained from 251 patients. The prevalence of self medication was reported as percentages. The survey was descriptive and data was summarized as counts and percentages, some of the questions had multiple options to choose from. The tabulated data was analyzed using the Statistical Package for the Social Sciences (SPSS) Version 21 and results were expressed as number and percentage of respondents for each question.

Results

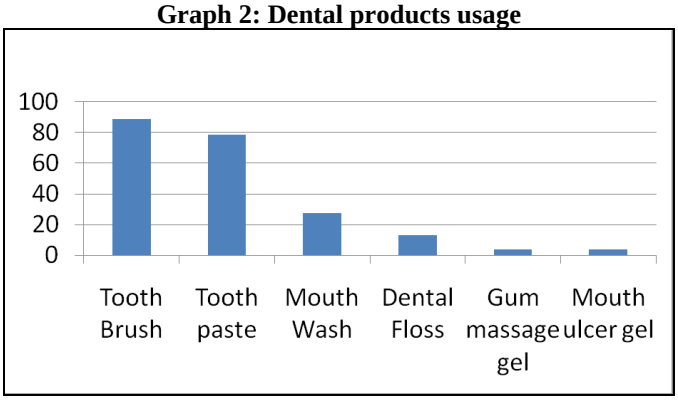
Taking into consideration the 251 filled questionnaires, the response to the question asked regarding the knowledge of usage of dental products prior to visiting the dental hospital, 74.4% was yes and 25.6% was no. The respondents who answered yes were asked about the source of information. Among them, 31.6% stated television, 19.2% newspaper, 12% internet, 31.2% friends, and 33.2% dentists as the source of information (Graph 1). Information through TV, friends and through doctor takes almost equal percentage in acquiring knowledge considering Marascuillo procedure.

Graph 1: Source of information regarding the knowledge of dental products



78.8% responded as using tooth paste, 27.6% were familiar with the usage of mouth wash, 13.2% were familiar with the usage of dental floss, 11.2% were familiar with the usage of interdental brushes, 3.6% were familiar with the usage of gum massage gels or the gum paints, 3.6% were familiar with the usage of mouth ulcer gels (Graph 2) and 2.8% of them were using the other dental products. 88.4% of the respondents agreed that the prescription is required for the dispensing of the drug at the pharmacy. Among them, 48% felt the prescription was important to know the correct dosage of the drug, 14.8% to know the correct time of consumption of the drug, 35.2% to know both of the above.78.8% of the respondents believed that it is not acceptable to buy the drugs without the prescriptions like Over the Counter (OTC). 37.2% of the respondents believed that only by consuming the prescribed medication, the dental problems would be solved. Whereas, 62.8% of them contradicted to the above. Regarding a question related to adherence to the instructions to be followed post prescription, 52.2% of the respondents followed the instructions given by the dentist, 26.5% followed the instructions provided on the label, 11.6% of them followed the instructions provided by the pharmacist and 3.2% of them did not adhere to any of the instructions.

Graph 2: Dental products usage



Discussion

A majority of the respondents, 74.4% were found to have awareness about the dental products prior to visiting the dental college and similar results were obtained in a study conducted by Tunde Joshua Ogunrinde et al[24] and 31.6% stated television as a major source of information regarding the awareness which was similar to a study by Arigbede AO, Ogunrinde TJ.[25]

78.8% of the respondents answered usage of tooth paste, 27.6% were familiar with the usage of mouth wash, 13.2% were familiar with the usage of dental floss well, in a study conducted by Ostberg AL, Halling et al [26] and in another study, it was found that the usage of dental floss is less when compared to other dental products, this could be attributed to lack of knowledge on the use of dental floss as oral hygiene aids or the difficulty in the use of the material as seen in a study done by Muttappillymyalil J, Devakaran B.[27]

88.4% of the respondents agreed that the prescription is required for the dispensing of the drug at the pharmacy and 78.8% of the respondents believed that it is not acceptable to buy the drugs without the prescriptions as seen in a previous study by Amanda B. Bower et al.[28]

In the present study 48% felt the prescription was important to know the correct dosage of the drug, 14.8% to know the correct time of consumption of the drug, 35.2% to know both of the above. 78.8% of the respondents believed that it is not acceptable to buy the drugs without the prescriptions in other words usage of the Over the counter drugs (OTC) and a similar result was observed in another study done by Giriraju A[29], which described that 60% of the subjects self medicated themselves with analgesics and only about 7.4% with antibiotics and remaining with the topical applications. Rawlani SM[30], tried to find out the reasons for self-medication, 96 patients (61.04%) mentioned that dental treatment required more time and was costly. 54 patients (28.42%) mentioned that they had fear for dental treatment and dental instruments, while others 40 patients (10.54%) mentioned various reasons such as dentist are not available, dental clinic is far away from home or they can take care of themselves. Despite wide availability, patient information leaflets were rarely used by the patients. The leaflets were usually only read if the medicine was new or if a side-effect was experienced. Negative views of the leaflets included poor design and long lists of side-effects.

Accurate information and advice from health care professionals could serve to reassure patients and to ensure they are well informed about the medicines they take, as stated by Hughes L[31]. However, when thinking about OTC and prescription drug instructions in general, subjects tend to take the prescription drug instructions more seriously. While further studies are obviously needed.

Based on the studies carried out on self medications it was found that it is very common practice, especially in economically deprived communities. Self-medication also has some advantages and disadvantages.[32, 33] Here, we discuss about the risks involved and at different stages.

Potential risks

Individual level

- Incorrect self-diagnosis
- Failure to seek appropriate medical advice promptly
- Incorrect choice of therapy
- Failure to recognize special pharmacological risks
- Rare but severe adverse effects
- Failure to recognize or self-diagnose contraindications, interactions, warnings and precautions
- Failure to recognize that the same active substance is already being taken under a different name
- Failure to report current self-medication to the prescribing physician (double medication/harmful interaction)
- Failure to recognize or report adverse drug reactions
- Incorrect route of administration
- Inadequate or excessive dosage
- Excessively prolonged use
- Risk of dependence and abuse
- Food and drug interaction

Prevention of Potential Risks Associated with Self-medication

Role of health profession

Health professionals are the ones who have potential role in preventing risks of self-medication. Because he is the one who works on three main therapeutic aspects of professionalism in his daily practice: Information, therapeutic advice and education.[34]

Information: Whenever health professionals are prescribing drugs, he should give proper instructions and explain for what it is prescribed so that it will be helpful for the patient to understand and make his own decisions. Given information should be at patient's comprehension level so that it will be helpful for them to understand its management.

Therapeutic advice: Lack of therapeutic compliance is a serious problem in both acute and chronic treatments and reflects a poorly understood or incomplete description of the treatment aims. If patients are not well informed they are unlikely to use medication correctly. However, if the directions for use and the limitations of a given drug are explained-for example, dose, frequency of dose, treatment course, how to take it, etc., then patients have a set of guidelines which will help them to use the drug correctly, both now and in the future. Inappropriate and erratic self-medication, along with lack of compliance, will only be reduced if patients are informed and understand clearly why certain advice has been given.

Education: Inappropriate self-medication is the result of the medical model from which people have learnt. Proper health education should be given to the patients. By regularly adopting an educational attitude we can have an effect on large sectors of the population, on people who, in turn, may directly influence their friends and family. This aspect is of particular importance with respect to the self-medication of children by their parents or care takers.

Self-medication is an alarming concept. It would be safe, if the people who are using it, have sufficient knowledge about its dose, time of intake, side effect on over dose, but due to lack of information it can cause serious effects such as antibiotic resistance, skin problem, hypersensitivity and allergy. Hence, developing country like India, where we have poor economic status, education status as well as poor health care facilities, people have less knowledge regarding risks associated with their self-medication. Hence it is recommended that holistic approach should be taken to prevent this problem, which includes proper awareness and education regarding the self-medication and strictness regarding pharmaceutical advertising. Dispensing modes need to be improved through proper education, strict regulatory and managerial strategies to make health care easily accessible and cost-effective.

Health professionals have to spend some extra time in educating patients regarding the same. Improved knowledge and understanding about self-medication may result in rationale use and thus limit emerging microbial resistance issues.[35]

Conclusion

A majority of the respondents had a fair knowledge about the dental products prior to their visit to the dental college. The major source of information was from the dentists, television and from friends. The larger population knew that the prescription was important for procuring the medication and also to follow the instruction for the proper drug dosage, time of consumption and for the duration of the course.

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Assessment of Langerhans cells using modified ATPase histochemistry technique: a pilot study

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Abstract

Introduction: Langerhans cells are dendritic bone marrow derived cells situated suprabasally in most stratified squamous epithelia and behave as very potent antigen presenting cells. Routine Hematoxylin and Eosin staining cannot localize them in the epithelium, thus immunofluorescence or immunohistochemical techniques are employed.

Aim and Objectives: To develop a technique for staining Langerhans cells in tissues which is equally specific and sensitive while being relatively inexpensive in comparison to the contemporary techniques.

Materials and Method: The study was carried out in the oral pathology laboratory with post graduate teaching requirements. It mainly included a cryostat other than the routine set up equipment. The study included twenty histopathologically confirmed cases of Oral Lichen Planus (OLP). Four serial sections of each tissue were stained with Hematoxylin & Eosin (H&E) stain, ATP-lead substrate, control (absence of Adenosine triphosphate salt) and Masson's Fontana stain and observed under the microscope for presence of Langerhans cells. A modified method for staining, to observe Langerhans cells, given by Juhlin L and Shelly WB was used.

Results: All twenty cases showed positive staining using the modified technique. The cells which were typified as Langerhans cells, were those with round/ovoid brown stained cells showing the presence of minimum of 2-3 dendritic processes from the cell surface. ATPase activity was found more localized in the cell membrane and dendrites.

Conclusion: The modified histochemistry technique for identifying Langerhans cells was found to be highly sensitive and specific, as well as, very cost effective.

Keywords: ATPase; Histochemistry; Langerhans cells; Special stains.

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Introduction

Langerhans cells are dendritic bone marrow derived cells situated suprabasally in most stratified squamous epithelia that behave as very potent antigen presenting cells that activate mainly the helper T lymphocytes.[1]

Several techniques, like immunohistochemistry and immunofluorescence, have been employed to identify the various surface markers present on Langerhans cells.[2-6] Based on the histochemical observation that they posses on their surface, high levels of enzyme(s) like nucleotide triphosphatase, a number of studies have been performed utilizing this specific enzyme marker. As the usual substrate for this enzyme is adenosine triphosphate (ATP), it is commonly identified as ATPase.[7] The technique used in this study utilizes this enzyme for the identification of Langerhans cells.

Materials and Method

The biopsy specimens were obtained from patients after an informed consent and institution ethical committee approval. Twenty punch biopsies were obtained from patients with confirmed Oral Lichen Planus (OLP), after taking a written informed consent. All biopsies were obtained from the right buccal mucosa region.

The soft tissue specimens washed in phosphate buffered saline and transferred to Michel's transport media were sent to the laboratory. No specimens were retained for more than two weeks before processing.

The basic method for staining was same as that given by Juhlin L and Shelly WB, 1977. This method has been used by several workers to identify Langerhans cell in normal mucosa[8-13] and diseased conditions.[14] The steps had to be modified because of two reasons:

1. The reagent mentioned is not available in pure form in India, thus their strength and their time of action has been modified keeping in mind the shelf life of the chemical.
2. Climatic conditions vary here as compared to that in the west, thus, the incubation time and temperature had to be modified.

It was ensured that all the modifications resulted in highly specific and sensitive staining of the Langerhans

cells. Some controversy exists regarding the specificity of the cell surface ATPase marker for identification of Langerhans cells, as well as its expression by melanocytes. Therefore, in the present study, serial sections of the mucosal specimens were stained using Masson's Fontana stain, to serve as controls. This helped to differentiate melanocytes and melanin incontinence from the basally placed Langerhans cells, thus avoiding the over counting of cells.

Solutions used in the study

1. **Phosphate Buffer Solution (PBS)**

(i)	Potassium dihydrogen phosphate solution	6.8 gm/l
(ii)	Disodium hydrogen phosphate solution	7.1 gm/l

Working solution

1.	Potassium dihydrogen phosphate	100 ml
2.	Disodium hydrogen phosphate	300 ml
3.	Distilled water	1600 ml
4.	Sodium chloride	17.4 gm

Adjust pH to 7.2

2. **Transport Media – Michel's media**

Solution A

1.	1M Citrate buffer	2.5 ml
2.	0.1M Magnesium sulphate	0.06 gm
3.	0.1M Ethylmelemide	0.06 gm
4.	Distilled water	97.5 ml

Working solution:

1.	Solution A	100 ml
2.	Ammonium sulphate	55gm

Adjust the pH to 7.2

3. **Fixative solution – 4% Paraformaldehyde in 0.1M Cacodylate Buffer Stock solution**

Solution A

1.	Dissolve 8 gm paraformaldehyde in 100 ml distilled water by heating to 60ºC with continuous stirring. This should be done in a fume cabinet and the beaker should be covered to avoid evaporation.
2.	Add 1M sodium hydroxide dropwise with stirring until the solution clears; 5-8 drops should be sufficient.
3.	Cool under running cold water.

Solution B

1.	Mix 50 ml of 0.2M sodium cacodylate and 2.7 ml of 0.2 M hydrochloric acid. Check the pH and adjust to 7.4, if necessary.
2.	Add 1.0 ml of 0.5M calcium chloride dropwise with agitation (optional).
3.	Add 1.5 g sucrose.

Final solution: The fixative is prepared by mixing solution A with solution B in the ratio of 1:1.

Note: Although this fixative does not deteriorate quickly, it is preferable to use it when fresh.

4. **Stains – Adenosine tri phosphatase - Lead Method** [Juhlin L and Shelly WB, 1977]

ATP-lead substrate

1.	Adenosine 5' triphosphate disodium salt	50 mg
2.	Glucose	5 gm
3.	Distilled water	50 ml
4.	Trismal buffer	40 ml (see below)
5.	Magnesium sulphate	10 ml 0.1M (i.e. 1.2%)

Trismal Buffer

1.	Tris buffer salt	1gm
2.	Maleic acid	6 gm
3.	Sodium hydroxide	4.0 gm
4.	Distilled water	400 ml

Final ATP-lead substrate solution

1. 2.7 ml stock ATP solution
2. 0.3 ml 2% lead nitrate in distilled water

Note: Final solution to be always prepared fresh for each case.

5. **Developer – 1% Ammonium sulphide solution**

1.	Ammonium sulphide solution	0.5 ml
2.	Distilled water	4.5ml

Note: Developer should be prepared fresh for every use as ammonium sulphide degrades very fast.

6. **Counterstain – Methyl Green-Pyronin [Jordon and Bakers Method]**

1.	0.5% Aqueous Pyronin Y	37 ml
2.	0.5% Aqueous methyl green	13 ml
3.	Acetate buffer (pH 4.8)	50 ml

7. **Mountant**

Glycerol + PBS

A mixture of glycerol and PBS was taken in ratio of 1:1.

8. **Distilled water for washes.**

9. **Routine Hematoxylin & Eosin Stain**

10. **Masson's Fontana Special stain**

i.	Silver solution: To 25ml of 10% aqueous silver nitrate add strong ammonia drop by drop until the precipitate which forms has almost disappeared, then add 25ml of distilled water. This solution should be left for 24 hours, stored in a dark bottle and filtered before use. It is better to renew this solution after 14 days, but it may be used for a month.
ii.	3% Sodium thiosulphate solution
iii.	Neutral Red

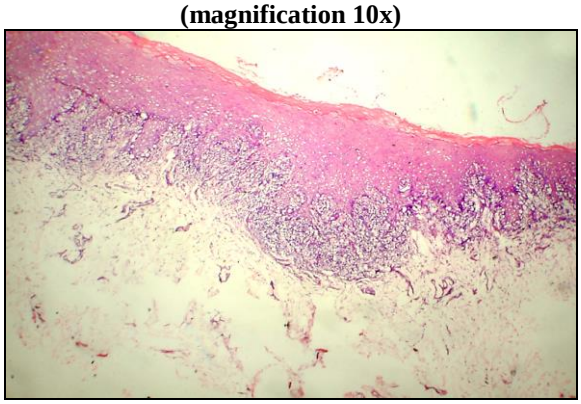
Methodology

1. The biopsy specimens collected in the Michel's media were washed in Phosphate buffered saline for 30 minutes.
2. The specimen before sectioning were properly oriented in Optimum Cutting Temperature (OCT) compound, and frozen upon a pre-cooled chuck at –25°C in the cryostat.
3. 8µm thickness frozen sections were cut on a LEITZ cryostat at –25°C and 4 serial sections were picked up onto a set of four Poly-L-lysine coated slides (A,B,C,D) respectively.

Slide A – Routine hematoxylin-eosin stain

1. Sections were air dried.
2. Then they were brought to water and stained with the routine Hematoxylin and Eosin stain.
3. Mounted the sections in DPX / Canada balsam.
4. Photomicrographs taken (Photomicrograph 1)

Photomicrograph 1: Hematoxylin and Eosin stained section showing classical features of lichen planus (magnification 10x)

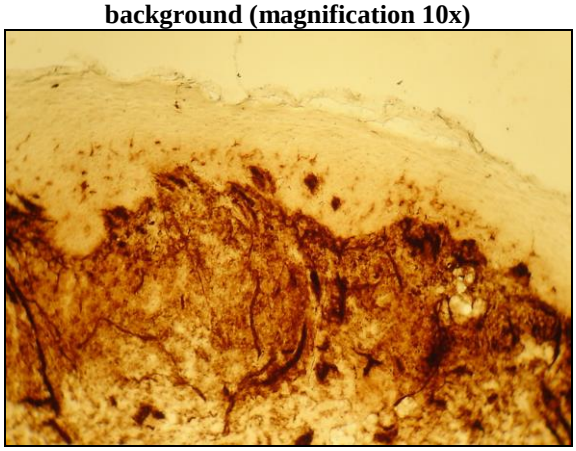


Slide B – ATP-Lead stain

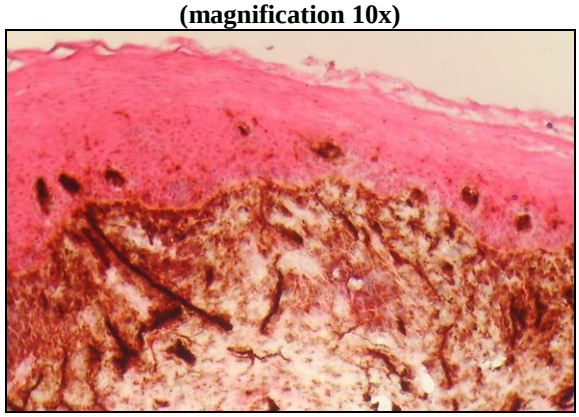
1. Sections were air dried for 15 minutes.
2. Sections were fixed for 20 minutes at 4ºC in 4% paraformaldehyde-cacodylate buffer.
3. Rinsed in distilled water for 1 minute.
4. Sections were then incubated in ATP-Lead substrate for 1 hour in a humid chamber at 37ºC.
5. Wash the sections thoroughly in cold distilled water for 2 minutes.
6. Sections were then treated with 1% ammonium sulphide solution for 5 minutes.
7. Wash thoroughly in distilled water for 2 minutes.
8. Counterstained with methyl green pyronin for 2-5 minutes.
9. Counterstain was washed with chilled distilled water.
10. Sections were then air dried.
11. Mounted in Glycerol + PBS and observed.
12. Counting of Langerhans cells was done
13. Photomicrographs taken.

Note: ATPase stained sections cannot be kept for long as the black deposits of lead sulphide formed as the end product within the cells degrades rapidly losing its color. Langerhans cells were observed as brown stained ovoid cells with dendritic extensions against a golden yellow background (Photomicrograph 2). Keratinocytes were stained pink after the counter stain (Photomicrograph 3).

Photomicrograph 2: ATP-Lead stained section showing dark brown stained dendritic Langerhans cell's towards the basal layer in a golden yellow background (magnification 10x)



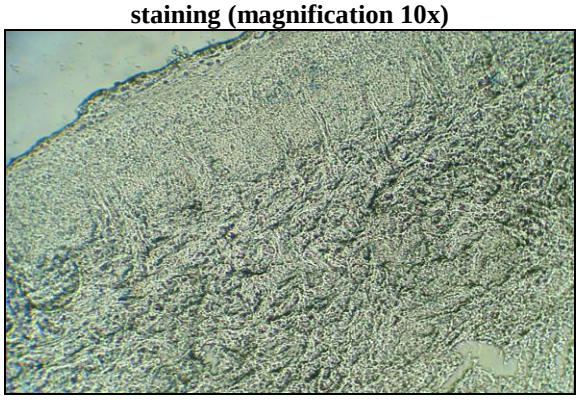
Photomicrograph 3: ATP-Lead stained section with Pyronine counterstain showing brown dendritic Langerhans cells in a pink background (magnification 10x)



Slide C – Control slide

1. The sections were treated in the same way as for slide B, except that the ATP-lead substrate used for the incubation was without the Adenosine triphosphate salt. This slide was used as a negative control to compare with the test slides.
2. Photomicrographs taken (Photomicrograph 4).

Photomicrograph 4: Control section (without Adenosine triphosphate salt) showing absence of staining (magnification 10x)



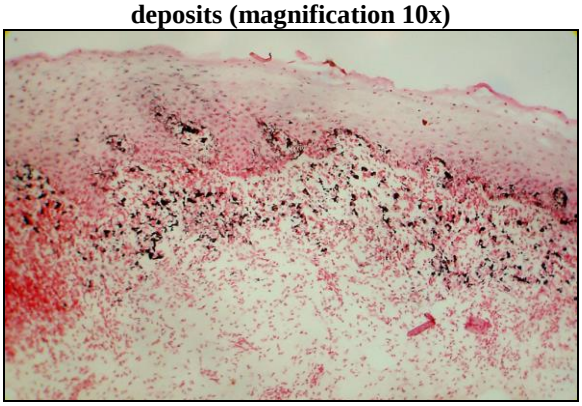
Note: Sections remain unstained.

Slide D – Masson's – Fontana stain

1. Bring the frozen sections to water.
2. Transfer to silver solution in a covered container and leave it in the dark for 18- 48 hours at room temperature.
3. Rinse in several changes of distilled water.
4. Fix in 3% sodium thiosulphate for 2 minutes.
5. Wash in running tap water for 2 minutes.
6. Counter stain with neutral red for 3 minutes.
7. Wash in tap water for half a minute.
8. Dehydrate, clear and mount in DPX / Canada balsam.
9. Photomicrographs taken (Photomicrograph 5).

Thus, over counting of the Langerhans cells was avoided.

Photomicrograph 5: Masson's Fontanna stained section (to differentiate between melanocytes and Langerhans cells) showing melanocytes and melanin incontinence as brown – black dendritic cells and deposits (magnification 10x)



Results

In all 20 study cases, the Langerhans cells stained positively with the modified ATPase staining technique. Langerhans cells were identified as dendritic brownish cells seen clearly lying dispersed among the keratinocytes. These cells can be clearly differentiated from melanocytes and melanin incontinence by comparing with the sections stained with Masson's Fontanna stain. The counting of the Langerhans cells was done based on the following criteria: round/ovoid brown stained cells showing the presence of a minimum of 2 -3 dendritic processes from the cell surface, having an average size of 5.5–7 microns, the cytoplasm of these cells was relatively less intensely stained, ATPase activity was found more localized in the cell membrane and dendrites, which appeared brownish to brownish black in color and anastomoses between the dendrites of adjacent Langerhans cells were not seen.

The slides stained with Masson's Fontanna stain were viewed in a similar manner as the ATPase stained slides to avoid melanocytes and melanin deposits from being counted as basally placed Langerhans cells, thus, preventing over counting.

Discussion

The aim of preparing this staining methodology was to find a sensitive, specific and cost effective staining technique which could be used routinely in place of immunohistochemistry. In the present study, the activity of the specific enzyme marker, adenosine triphosphatase (ATPase) on the surface of Langerhans cell has been demonstrated using enzyme histochemistry. The presence of ATPase enzyme is suggestive of transmembrane transfer mechanism that indicate the intercellular interactions between Langerhans cell, altered keratinocytes and lymphocytes.[7,15] Another role of this enzyme proposed, was that at sites of inflammation, nucleotides such as ATPs, released by dying cell, function as signaling molecules through P2 receptors present on the Langerhans cells. The formation of ATP gradients at the site of inflammation might transiently delay the migration of these local dendritic cells, thereby, prolonging the time of antigen encounter.[16]

Some controversy exists regarding the specificity of the cell surface ATPase marker for identification of Langerhans cells, as well as its expression by melanocytes. Therefore, in the present study, serial sections of the mucosal specimens were stained using Masson's Fontana, to serve as controls. This helped to differentiate melanocytes and melanin incontinence from the Langerhans cells, thus avoiding the over counting of cells.

The storing of all the reagents are at room temperature, except that of prepared Michel's media and of Cacodylate Crystals which are at 8 degree centigrade (refrigerator below ice chamber).The shelf life of all the reagents is long, the only exception being

that of ammonium sulphate solution (precaution is to tightly close the lid of regent bottle after use and use one bottle within 30 days once the reagent is opened.

Conclusion

Enzyme histochemistry provides a useful adjunct to immunofluorescence and immunohistochemical methods for the identification of Langerhans cells. The modified histochemistry technique to detect ATPase positive Langerhans cells used in the present study was found to be highly sensitive and specific as well as cost effective which can be easily carried out in routine oral pathology laboratory.

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Prediction of gender by odontometric data using logistic regression analysis

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Abstract

Introduction: Determination of gender by anthropologists can be done by various methods e.g. skull bones, pelvic bones and other skeletal determinants. Assessment of odontometric data is a promising tool for gender prediction, which is usually preserved due to its robust nature.

Aim and Objectives: The objective of the study was to predict the gender of an individual, using the odontometric data with powerful statistical tools like Logistic Regression Analysis (LRA) and Discriminant Analysis (DA).

Materials & Method: 100 subjects were selected (50 male and 50 female) within the age group of 18-28 years. An alginate impression was made and models were prepared. The odontometric data was collected in the form of various mesiodistal and buccolingual measurements with Vernier calipers which was subjected to statistical analysis, using the two tests LRA and DA. Thereafter, results were compared for accurate gender prediction.

Results: The statistical analysis of the measurements obtained was done by using two tests logistic regression analysis and discriminant analysis. After analysis and comparisons of the two methods for gender prediction, it was observed that LRA provides more accurate prediction than DA in determining the gender. Also, when data from both the arches was analyzed, it was more accurate in predicting the gender as in comparison to the analysis from either of the arch.

Conclusion: The study has revealed that LRA may be better than DA for odontometric sex prediction. Overall, the results depict that the complete dentition, when used as a unit and through the application of flexible multivariate statistics such as LRA, has potential for its use as a prominent and sole indicator of sex prediction.

Keywords: Forensic Odontology; Logistic Regression Analysis; Discriminant Analysis; Gender Prediction; Odontometric Data.

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Introduction

To establish the identity of a person, one of the most essential factor is gender determination. Gender determination is a procedure adopted by anthropologists, archaeologists and forensic scientists[1]. The determination of sex from the femur has been the subject of many studies which have been conducted both on well-preserved bones and poorly preserved skeletal remains. Measurements at the midpoint of the shaft, the femoral head diameter, and the femoral distal breadth are taken, for the determination of sex from the femur and multivariate and univariate analyses are performed.[2,3,4]

During a forensic investigation, dentition is routinely used and the application ranges from postmortem comparative identification to estimation of age among children, juvenile and adults[3]. The teeth form a unique part of human body as they are the most durable and resilient part of the skeleton. The science dealing with establishing the identity of a person by teeth is known as Forensic odontology or Forensic dentistry.[1]

Measurement of dimensions of the permanent dentition are extremely helpful adjunct in assessment of an individual's gender and their value is enhanced as teeth are highly resistant to postmortem destruction.[5] Assessment of gender using orodental dimensions is primarily based upon the comparison of tooth dimensions in males and females or upon the comparison of frequencies of non-metric dental traits, like Carabelli's trait of upper molars, deflecting wrinkle of lower first molars, distal accessory ridge of the upper and lower canines or shovelling of the upper central incisors (Teschler-Nicola and Prossinger, 1998).[6] Therefore, odontometrics provide quite sufficient information on the gender of the individual.[7]

The term "regression" had its origin with the 19th century statistician Francis Galton. He used it to describe his observation that the sons of short fathers tended to be taller and sons of tall fathers shorter, so that the height of sons "regressed" to the mean height of all men. Galton's friend Karl Pearson developed the mathematical basis for what has come to be termed regression analysis, a statistical technique used to describe and quantify the relationship between two or more variables. In linear regression, the term "simple" refers to the fact that only two variables are to be

related. The technique is therefore said to be bivariate. The term "linear" indicates that the relationship can be described by a straight line. The relationship between variables is one of change, that is, as one variable increases or decreases in magnitude, the other also changes in magnitude.[8]Albanese et al.[9,10] used logistic regression analysis (LRA) to assess gender from the hipbone and femur and obtained accuracy rates of up to 98.5%. Steyn and İşcan[11] recently suggested that it would be interesting to see whether results of LRA and DA are at par with respect to their accuracy.[5]

Application of discriminant function analysis (DA) resulted in about 95% accuracy in odontometric sex identification[12,13], further enhancing the dentition's role. However, these results are exceptions, for other studies have found that dental measurements predict the gender with a precision ranging between 77% and 87%.[5]

LRA is considered to be better than the discriminant function models since the former is more flexible in its assumptions and it can handle both discrete and continuous variables, which need not be normally distributed, linearly related or of equal variance within each group. Furthermore, even when DA satisfies the assumptions required of it, logistic regression, comparatively, still performs well. That is, the assumptions which DA must fulfill, need not be met by LRA, in order to optimize its prediction accuracy.[14] Therefore, one would expect a 'natural' improvement in gender assessment using LRA. While LRA has been a useful adjunct in other areas of forensic odontological investigations such as race prediction and age estimation[15], its utility in sex prediction using teeth is unexplored. The present study has, therefore, ventured to evaluate the usefulness of LRA in odontometric sex prediction by comparing the outcome with that of DA.[5]

Materials & Method

The study sample comprised of dentitions from 100 individuals (50 females and 50 males), all young adults between 18 and 28 years of age. All subjects were either enrolled as students or employed as faculty in our institution and originated from this region. Following informed verbal consent, impressions of the teeth were made using alginate material and the casts poured in dental stone (Fig. 1, 2).

Fig. 1: Materials used for impression making

Fig. 2: Final impression of both the arches

Mesiodistal (MD) and buccolingual (BL) dimensions of all teeth, except third molars, were measured on the casts using a Vernier caliper device calibrated to 0.01 mm. The third molars were excluded for an obvious reason of having a wide range of anatomical variations. The MD dimension was defined as the greatest distance between contact points on the approximate surfaces of the tooth crown and was measured with the caliper beaks placed occlusally along the long axis of the tooth.[16] In cases where teeth were rotated or misaligned, measurements were taken between points on the approximate surfaces of the crown where it was considered that contact with adjacent teeth would normally occur. The BL measurement was defined as the greatest distance between the labial/buccal surface and the lingual surface of the tooth crown measured with the caliper held at right angles to the MD dimension.[17]

Following measurement and data entry into an MS Excel spreadsheet, three discriminant and logistic regression analyses (one for teeth of both jaws, one each for the maxillary and mandibular teeth) was performed using a statistical software program named SPSS version 11.5 as suggested by the department of statistical analysis of the institute. The three analyses were undertaken with a view to compare prediction accuracy of teeth in both jaws taken together with teeth

from a single jaw, as may be encountered in forensic contexts.[5]

Results

In both DA and LRA, coefficients and constants were derived and the variables multiplied with the respective coefficient and added to the constant. In DA, it results in a discriminate score, which is compared to the cut-off or sectioning point (the average of group centroids). A score which was less or more than the sectioning point would categorize the case as female or male, respectively. The default cut-off in logistic regression is 0.5, so a case with a probability >0.5 would be categorized as male, while P<0.5 would be considered a female.[18] The closer the value is to 1, the greater the probability that the case is male, while a value closer to 0 indicates a greater probability of the case being female.[5]

The accuracy of sex prediction of DA and LRA are depicted in Table 1. Entering all 56 tooth variables (i.e., 28 MD and 28 BL dimensions) yielded 84% and 89% success rates for DA and LRA, respectively. Accuracy levels from LRA fell when consideration is limited to only the maxillary or only mandibular teeth (Table 1).

Table 1: Cross-validated classification results of the discriminant analysis (DA) and logistic regression analyses (LRA)

	Male		Female		All	
	n	%	n	%	n	%
Discriminant Analysis						
Both Jaws	43 / 50	86.0	41 / 50	82.0	84 / 100	84.0
Maxillary Teeth	40 / 50	80.0	37 / 50	74.0	77 / 100	77.0
Mandibular Teeth	20 / 50	40.0	32 / 50	64.0	52 / 100	52.0
Logistic Regression Analysis						
Both Jaws	47 / 50	94.0	42 / 50	84.0	89 / 100	89.0
Maxillary Teeth	42 / 50	84.0	40 / 50	70.0	82 / 100	82.0
Mandibular Teeth	30 / 50	60.0	43 / 50	86.0	73 / 100	73.0

Table 2 shows the **Goodness of fit statistic**, the −2Log likelihood and **Nagelkerke R Square statistic**. Lower the −2LL statistic, better the fit of the model to the data, whereas, in Nagelkerke R Square statistics, higher the value better is the fit of model to the data. Thus, both the statistical analysis concludes that when data from both the jaws are analyzed using LRA it gives a more accurate prediction of the gender (Graph 1). Table 3 shows the **Test of significance statistic** which also concludes that when odontometric data from both the jaws are taken into account it is more accurate in the sex prediction of the model.

Table 2: Goodness of fit Statistic (LRA)

	-2 Log likelihood	Nagelkerke R Square
Both Jaws	62.862	0.708
Maxillary Teeth	89.228	0.520
Mandibular Teeth	138.172	0.006

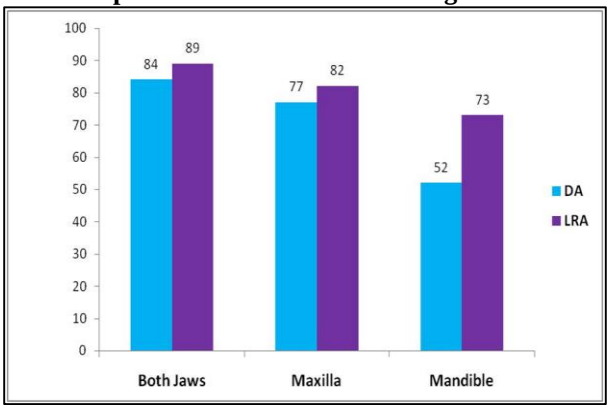
Note: Lower the – 2 Log likelihood, better is the fit of the model to the data and vice-versa.

Table 3: Test of significance (DA)

	Wilk's Lambda	P-value	Significance
Both Jaws	0.515	0.001	Significant
Maxilla	0.633	0.001	Significant
Mandible	0.995	0.802	Not Significant

Note: Lower the Wilk's lambda, better is the prediction from the data and vice-versa

Graph 1: The graph showing the columnar representation of the percentage accuracy of the two tests methods i.e. Cross-validated classification results of the discriminant (DA) and logistic regression analyses (LRA) as well as the comparisons of both and each single arch



Discussion

The accurate gender assessment of skeletal remains has important ramifications in forensic and bioarchaeological investigation. It has been suggested that, for optimal sex prediction, as many criteria as available should be utilized.[19,20] Sex determination, one of the basic features of identification, is a much more demanding task. Unfortunately, it is also much less reliable if performed on poorly preserved material. Therefore, due to this reason, it is best to combine several methods in order to raise the level of confidence and the percentage of success in determining sex.[7]

As a means of determining the gender, odontometric features have been the subject of research for a long time (Iscan and Kedici, 2003; Pettenati-Soubayroux*et al*., 2002).Ditch and Rose (1972)[12] were the first to prove that teeth diameters can be successfully used in determining sex in poorly preserved and fragmentary skeletal remains in archaeology. Crowns of permanent teeth are formed at an early stage and their dimensions remain unchanged during further growth and development, except in cases when specific changes and disorders in terms of functionality, pathology and nutrition can have affect the normal dimensions of a tooth (Teschler-Nicola and Prossinger, 1998).[6] Due to this odontometric features of teeth can be used in determining sex after the tooth has erupted even in children whose osseous features of the sex are not yet defined (Teschler-Nicola and Prossinger, 1998).[6,7]

Albanese believed that LRA is a powerful, albeit underused, statistical approach for predicting a binary dependent variable such as sex. In addition to the advantages of logistic regression stated in the introduction, a major benefit over DA is that the probability of sex allocation is calculated.[5] Logistic regression is the statistical technique used when we wish to estimate the probability of a dichotomous outcome such as the presence or absence of a disease or of death. The probability of the outcome is the dependent variable and the various factors that influence it are the independent variables, sometimes termed risk factors. One may think of the probability of the outcome as a proportion or a percentage. However, the results of logistic regression are presented in terms of the odds, rather than the probability, of the outcome.[8]

A practical issue that is seldom addressed in most odontometric sex assessment studies is that of the influence of age on tooth dimensions.[5] Tooth abrasion, most commonly due to hard food consumption, is one of the dental characteristics of ancient peoples. Although there is an obvious sexual dimorphism in human crown dimensions, the level of dimorphism is lower than that of the non-metric dental traits like Carabelli's trait of upper molars, deflecting wrinkle of lower first molars, distal accessory ridge of the upper and lower canines or shovelling of the upper central incisors. Many non-metric dental traits are highly positive correlated with tooth size because they are both genetically determined (Scott and Turner, 1997). This can be helpful during sex determination of skeletal remains, because some of dental traits can disappear due to tooth abrasion, but the mesiodistal and buccolingual crown dimensions can still be unchanged. On the other hand, at times crown dimensions can be useless for sex determination due to pathological conditions like caries, while presence of some dental treatment can yet be helpful for sex identification.[7]

It would, therefore, be interesting to test the use of LRA in odontometric sex differences in samples that include subjects from diverse age groups. This would give an indication of sex differences in a 'normal' population, in contrast to sex differences depicted in 'ideal' populations such as the one used here and previously.[11,13]

Another factor which can influence the determination of gender is absence or loss of teeth due to any physiological or pathological causes. For such cases, appropriate grouping of teeth present, which are morphologically and dimensionally similar, could be an adjunct in conclusion. For example, a group consisting of maxillary lateral incisor and both mandibular central and lateral incisors could be considered one group which is more or less morphologically and dimensionally similar. Similarly both maxillary and mandibular premolars can be included in a group because of morphological and dimensional resemblance. Thus any loss of tooth from this group can give a rough idea of the dimension of the missing tooth when compared to the average dimensional range of the group.

Conclusion

The advantages in determining sex on the basis of odontometric features are simplicity, speed and low cost, while the greatest disadvantage is the possible inaccuracy in cases where the normal dimensions of teeth is altered.[7] The present study has revealed that LRA may be better than DA for odontometric sex prediction. In fact, a perfect fit of the logistic regression model to the odontometric data was derived using the entire dentition, although there was a tendency for allocation accuracy to reduce when maxillary/ mandibular teeth were assessed separately and when teeth are missing. Overall, the results show that the dentition, when used as a unit and through the application of flexible multivariate statistics such as LRA, has potential for its use as the sole indicator of sex prediction.[5]

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Comparative evaluation of tensile bond strength of addition silicone impression material to different tray materials using different adhesive systems

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Abstract

Introduction: Accurate impressions are of utmost importance for a well fitting prosthesis. Use of custom tray and application of tray adhesives have been shown to provide best accuracy. But, there is a dearth of studies on cohesive and adhesive bond strength of tray adhesive to the light polymerizing and autopolymerising custom tray materials.

Aim & Objectives: Comparative evaluation of the tensile bond strength of addition silicone impression material to different tray materials using different adhesive systems.

Materials & Method: Addition silicone impression material was used along with universal paint on tray adhesive. 20 samples of auto polymerizing tray material were made. In 10 samples adhesive was not applied (AM GROUP 1) and in the remaining 10 samples adhesive was applied (AMC GROUP 2). Similarly, 20 samples of light polymerizing tray material were made. In 10 samples adhesive was not applied (LM GROUP 3) and in remaining 10 samples adhesive was applied (LMC GROUP 4). The samples were placed in Universal Testing Machine to evaluate the tensile strength. The values obtained were tabulated & pair t test statistical analysis was performed to obtain the results.

Results: The mean tensile bond strength was highest in Group 4 Light cure acrylic resin mechanical + chemical [LMC] (0.2694 MPa), followed by Group 2 Auto polymerizing acrylic resin mechanical + chemical [AMC] (0.179 MPa), Group 3 Light cure acrylic resin mechanical [LM] (0.1302 MPa), & lowest in Group 1 Auto polymerizing acrylic resin mechanical [AM] (0.101 MPa) respectively.

Conclusion: Application of tray adhesive increased the tensile bond strength between the tray and addition silicone impression material. Light polymerizing tray material with perforations and adhesive application showed highest tensile bond strength. The use of tray adhesive is highly recommended for making accurate impressions.

Keywords: Tensile Bond Strength, Adhesive Systems, Tray Materials.

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Introduction

Making an accurate impression is one of the most important objective in Prosthodontics. Various factors such as the selection of tray, type of impression material and the technique, mode of retention of impression material in the tray etc. influence the accuracy of an impression.[1]

Several impression materials are available for different clinical situations. In fixed restorations, a precise marginal fit is an important factor for longevity of the prosthesis as well as for the health of surrounding tissues.[1]

Elastomers refer to a group of rubbery polymers which are either chemically or physically cross linked. They can deform under stress within limits and recover from deformation when the applied stress is released. The rheological property of elastomeric impression materials plays a major role in high accuracy of impression.[2,3] Addition silicon impression material is considered to produce more accurate and consistent results than the other types of elastomers.[3] These materials are popular due to their excellent physical properties, handling characteristics, and dimensional stability.[3, 4]

The impression techniques used for elastomeric impression are double mix two step impression, double mix single step impression and monophase impression. As per few studies and clinical experiences the two stage putty and wash impression technique is recommended for better accuracy as this allows an enhanced representation of the gingival sulcus and compensates for polymerization shrinkage of putty to a great extent.[1]

Impression can be made either in stock trays or in custom trays. Custom trays are believed to produce more accurate impression as compared to stock trays because they provide a uniform and desired amount of material thickness.[5,6] The materials commonly used for making custom trays are self-cure and light cure acrylic resins. The rigidity of the tray is important to gain full advantage of the physical properties of the impression material.

One of the pre requisites for making an undistorted impression is that the impression material should adhere firmly to the tray either mechanically or chemically or

by both and should not come out of the tray while being removed from the mouth.[7]

Mechanical methods for retention of material in the tray include perforations and use of rim lock trays. Proper retention of impression will be affected by size and number of perforation and their location and distribution in the tray. Chemical methods include application of adhesives. The adhesive can be a conventional, universal adhesive or a manufacturer supplied adhesive. If the material pulls away from the tray during removal from the mouth, the completed impression may fail to return to its original shape and dimension, resulting in a distorted die, wax pattern and casting.[7]Therefore, a combination of mechanical and chemical methods have been suggested.

During removal of impression material from the mouth, the bond between the impression material and the tray is highly stressed in both tension (base of trays) & shear (side of trays). Therefore, the tray adhesive must have sufficient cohesive and adhesive strength to resist these stresses.[7,8]This depends on the properties of the adhesive agents and the resin tray material.

Several methods are used for application of tray adhesive and include liquid paint-on method, spray on method and self-stick adhesive system. The conventional or liquid paint-on adhesive method is most commonly used. Each class of elastomeric impression materials has its own specific adhesive for application on impression trays. Failure to adequately apply adhesive material to the tray and not following the manufacturer's directions could compromise the retention of impression material.[9,10,11,12]

In routine practice it has been observed that most of the practitioners do not use tray adhesives and rely on mechanical retention alone, which may compromise the accuracy of impression.[7]

Review of literature reveals that there is a dearth of studies on cohesive and adhesive bond strength of tray adhesive to the light polymerizing and auto-polymerizing custom tray material. Therefore, this study was undertaken to evaluate the tensile bond strength of impression material to different tray materials using different adhesive systems.

It was hypothesized that none of the factors being considered have a bearing on the outcome of this study.

Aim & Objectives

This was an in vitro study which aimed to evaluate the tensile bond strength of impression material to different tray materials with different adhesive systems.

The objectives were:-

1. To compare the tensile bond strength of polyvinyl siloxane impression material with two different tray materials i.e. auto polymerizing resin and light polymerizing resin tray material.
2. To compare the type of bond failure of light polymerizing tray material and auto polymerizing tray material.

Materials and Method

The study was carried in the following manner:

1. Preparation of master die
2. Preparation of test samples
   a. Auto polymerizing acrylic resin tray material.
   b. Light polymerizing acrylic resin tray material.
3. Testing of the samples.

For standardization, a stainless steel assembly was fabricated which had two parts. There was an upper assembly of 3.5X3.5cm and depth of 4mm (Fig. 1) and a lower assembly of 2.5X2.5 cm (Fig. 2). The lower assembly had the vertical wall of 2mm, so that when the sample (custom tray material) which was prepared in this mould, it had 2mm depth to accommodate the impression material. The assembly was so machined, that, when the two parts were assembled together, it provided space to be filled by the tray material and produce a tray of 2 mm thickness and 2 mm border height. Two such trays were required to make one sample that produced 4mm thickness of impression material.

Fig. 1: Mould assembly: upper component

Fig. 2: Mould assembly: lower component

The custom tray resin (DPI, India) was mixed according to the manufacturer's recommendation. After the material reached dough stage, it was packed into the mould and pressed with a lubricated glass slab so that the material flowed inside the mould completely and excess flowed out. A stainless steel hook with threads was pressed in the centre approximately 1mm inside the

acrylic resin. Hooks facilitated holding of the sample in universal testing machine for evaluation of bond strength. After polymerization, holes were drilled in all the trays for mechanical retention.20 trays were painted with tray adhesive (Aquasil, Dentsply) and allowed to dry for 10min before making impression. For making impression, two trays were filled with the impression materialand were held undisturbed to allow complete polymerisation of the material which produced one test sample. 10 such samples were prepared for both Group 1 and Group 2.

The visible light cure denture base resin (WP dental, Germany) was packed inside the mould and a hook attached as for auto polymerizing acrylic resin. The assembly was placed inside the VLC polymerization unit and polymerized for 12 min. 40 such trays were placed and stored at room temperature for 24 hours. After polymerization, holes were drilled in all trays for mechanical retention. 20 trays were painted with tray adhesive (Aquasil, Dentsply) (Fig. 3) and allowed to dry for 10 min before making impression. For making an impression, two trays were filled with the impression material and were held undisturbed to allow complete polymerisation of the material which produced one test sample. 10 such samples were prepared for both Group 3 and Group 4 (Table 1).

Fig. 3: Adhesive application on the resin tray material before adding the impression material

Table 1: Study groups

All the test samples were grouped as below:
1. Auto polymerizing acrylic resin mechanical [AM]
2. Auto polymerizing acrylic resin mechanical + chemical [AMC]
3. Light cure acrylic resin mechanical [LM]
4. Light cure acrylic resin mechanical + chemical [LMC]

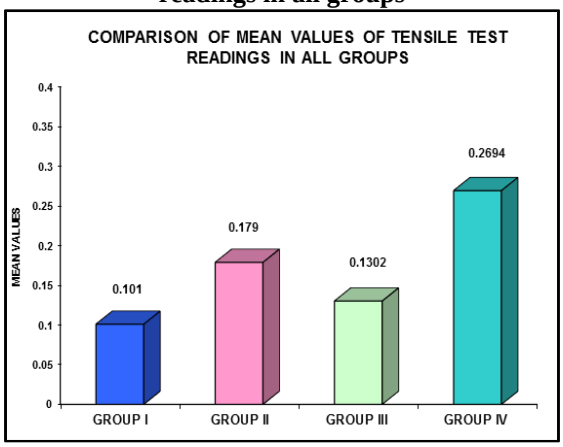
All specimens (10 of each group) were placed in Universal Testing Machine (Instron) for evaluating tensile bond strength of each group. The test was carried out in tensile mode at a cross head speed of 5mm/min, using a 980N load cell set at full scale load until separation failure occurred(Fig. 4). The maximum force at which separation failure occurred was divided by the area of adhesion and recorded as adhesive strength. The mode of adhesive failures were classified as occurring at either the adhesive/impression material interface, the impression adhesive/tray material interface, or as a mixed failure occurring at both interfaces.

Fig. 4: Testing of samples for bond strength by Universal Testing Machine

Results

The values of the tensile bond strength (Mpa) and mean± SD of all the samples of all the four groups was tabulated (Graph 1). It was observed that the samples with mechanical plus chemical retention showed higher tensile bond strength as compared to mechanical alone. Group 4 showed the maximum bond strength followed by Group 2 and Group 3, whereas, Group 1 had the least bond strength.

Graph 1: Comparison of mean values of tensile test readings in all groups



A comparison of bond strength among the four groups was carried out by means of unpaired-t test (Tables 2-7). The tensile bond strength of auto polymerizing acrylic resin combination retentive system showed significant difference in comparison with the light polymerizing mechanical retentive system.

Table 2: Comparison of mean values of tensile test readings between Group 1 and Group 2

Group I (n=10)	Group II (n=10)	Unpaired 't' test value	'p' value	Result
Mean ± SD	Mean ± SD			
0.101 ± 0.0028	0.179 ± 0.0017	82.22	p<0.01	Highly significant

Table 3: Comparison of mean values of tensile test readings between Group 1 and Group 3

Group I (n=10)	Group III (n=10)	Unpaired 't' test value	'p' value	Result
Mean ± SD	Mean ± SD			
0.101 ± 0.0028	0.1302 ± 0.0018	29.20	p<0.01	Highly significant

Table 4: Comparison of mean values of tensile test readings between Group 1 and Group 4

Group I (n=10)	Group IV (n=10)	Unpaired 't' test value	'p' value	Result
Mean ± SD	Mean ± SD			
0.101 ± 0.0028	0.2694 ± 0.0020	168.14	p<0.01	Highly significant

Table 5: Comparison of mean values of tensile test readings between Group 2 and Group 3

Group II (n=10)	Group III (n=10)	Unpaired 't' test value	'p' value	Result
Mean ± SD	Mean ± SD			
0.179 ± 0.0017	0.1302 ± 0.0018	69.01	p<0.01	Highly significant

Table 6: Comparison of mean values of tensile test readings between Group 2 and Group 4

Group II (n=10)	Group IV (n=10)	Unpaired 't' test value	'p' value	Result
Mean ± SD	Mean ± SD			
0.179 ± 0.0017	0.2694 ± 0.0020	116.72	p<0.01	Highly significant

Table 7: Comparison of mean values of tensile test readings between Group 3 and Group 4

Group III (n=10)	Group IV (n=10)	Unpaired 't' test value	'p' value	Result
Mean ± SD	Mean ± SD			
0.1302 ± 0.0018	0.2694 ± 0.0020	167.34	p<0.01	Highly significant

Discussion

Impressions are indispensable to the practice of dentistry. Accuracy and dimensional stability of the impression are of utmost importance in prosthodontics especially in the field of fixed prosthodontics where the restoration has to be placed on unyielding hard tooth structure. Amongst latest elastomeric impression materials, addition silicone is believed to produce most accurate and dimensionally stable impressions.[11]

In accordance with the study undertaken, the highest tensile bond strength [0.2694MPa] was recorded for the VLC (visible light cure acrylic resin) material (Group 4), that had mechanical perforations and chemical adhesive application. The tensile bond strength achieved with VLC mechanical retention system (Group 3) was considerably less [0.1302 MPa] as compared with the combination group of VLC (Group 4) and auto polymerizing acrylic resin (Group 2). The reason for these results could be attributed to the holes which favor the shear strength than the tensile bond strength so that the combination group of VLC has better tensile strength than the mechanical group alone. The results were also in accordance with the studies referred.[13,14,15,16,17]

The tensile bond strength of auto polymerizing combination group was second best to the VLC combination group [0.17MPa]. The auto polymerizing resin with mechanical retention alone showed the least tensile bond strength [0.1MPa] amongst all the groups. In comparison with the combination retention system and the mechanical system, the light polymerizing acrylic resin had better tensile strength than the auto polymerizing acrylic resin group as the light curing tray shows less polymerization, better dimensional stability and the solvent of the adhesive created more micro porosities in the light cure resin than the auto polymerizing resin.[1] It was postulated that there is a better adherence of polyvinyl siloxane impression material to visible light cure acrylic resin as compared to auto polymerizing acrylic resin tray material.

The results obtained in this study were compared with the other studies by Pujya et al[18], Payne et al [19], Dixon et al[20], which however suggested the bond strength of 0.55-0.97MPa. The difference could possibly be the result of different brands of polyvinyl siloxane impression material in the solvent of impression adhesive.[1] Vinyl polysiloxane compared with studies by Peregrina[19], Grant B[13], Sulongwzs[16], Chee[4]showed similar results (0.20- 0.21).

The tensile bond strength of auto polymerizing acrylic resin combination retentive system showed significant difference in comparison with the light polymerizing mechanical retentive system. The tensile bond strength of light polymerizing combination system showed the maximum strength, followed by auto polymerizing combination system. Light polymerizing mechanical showed third best bond strength, whereas, auto polymerizing acrylic resin, purely mechanical, showed least bond strength.

Conclusion

Light polymerizing acrylic resin trays with a combination of perforations and application of tray adhesive demonstrated the highest tensile bond strength. Auto polymerizing resin trays with perforation alone were least retentive of the impression material.

Application of tray adhesive significantly improves the tensile bond strength of both the tray materials. VLC trays were approximately 30 -50% more retentive than the auto polymerizing acrylic resin. The maximum bond failure with auto polymerizing acrylic resin was of adhesive type occurring at the junction between the tray material and the adhesive. The maximum bond failure with light polymerizing acrylic resin was of cohesive type occurring within the adhesive itself. A perforated custom VLC tray with application of appropriate adhesive is therefore recommended for routine use.

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Surface analysis of titanium maxillofacial plates and screws retrieved from patients

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Abstract

Introduction: Miniplate fixation and screws is the method of choice for many surgeons to obtain rigid fixation and promote osteosynthesis within the maxillofacial region. The most common commercially used plates and screws are made up of pure titanium. The popularity of biocompatible devices containing titanium is due to its high resistance to corrosion in physiologic body fluids.

Generally titanium fixation plates are not removed after osteosynthesis because they have high biocompatibility. This study was done to analyze the surface characteristics and changes in retrieved titanium plates and screws by scanning electron microscope (SEM) and stereomicroscope.

Materials and Method: A total of 20 plates were retrieved from 12 patients visiting the department of oral and maxillofacial surgery at our institution over a period of 18months. These samples were studied by stereomicroscopy and scanning electron microscopy. Each plate and one of its screws were examined for evidence of manufacturing defects, surgical damage and corrosion. Particular attention was focused on countersink area of plate and taper of the screw head as these regions were particularly prone to micro movements and subsequent corrosion.

Results: Surface contamination was detected both on retrieved and control plates. Manufacturing defects comprising of rough metal edges and protuberances were identified on the unused controls and surgical damage was evident on retrieved specimens. Two of the retrieved plates and screw showed the presence of corrosion and metal release which had been in the tissues for 14 to 20 months. Rest of the retrieved plates and screws, which had been in the tissues, between 6 months to 48 months showed no signs of corrosion or surface deterioration.

Conclusion: The present study showed that 2 plates and its associated screws had signs of corrosion and metal release; but further long-term follow-up studies are desirable to assess the clinical and toxicological effects of the retention of titanium plates, especially in relation to release of particles to the surrounding tissues. The source of metal release has to be further confirmed by EDX analysis. There was no evidence from this study to support the routine removal of titanium maxillofacial miniplates.

Keywords: Titanium Plates, Corrosion, Metal Release, Retrieved Plates

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Introduction

Miniplate fixation is an accepted and reliable method of fixation for patients with maxillofacial trauma. Titanium is more frequently used for metallic miniplates manufacturing since its well tolerated by living tissue causing minimal local reactions in vivo. Titanium has been used because of its high wear and tear resistance, chemically inert nature i.e. corrosion resistant and absence of metal release. It is available in all sizes and shapes and is easily adaptable. Once implanted these plates are often left in place because of its biocompatible and corrosion resistant nature. These features are the result of the fact that titanium forms a dense, pore free and self-regenerating oxide film on the surface also called passive layer of titanium dioxide. Inspite of their excellent clinical performance doubts have been emerged about their long term behavior in the tissue and about potential local and systemic side effects. A concern about leaving metal plates and screws is the tissues with the possibility of corrosion stays.

The severity of corrosion and the quantity of corrosion products released may depend, not only on the corrosion susceptibility of titanium plates; but it also depends on the tissue response to the titanium plates as well as surgical procedures used during plate fixation. There is very little information available on the release of elements from titanium plates used for immobilization of fractures of maxillofacial skeleton.

There is an agreement that symptomatic plates should be removed, but there is no consensus among the maxillofacial surgeon on the need of routine removal for asymptomatic plates. Some of the authors recommend removal while others recommend retention, unless clinically indicated.

There have been previous plate retrieval studies performed on both patients and animals but few of these studies were flawed because comparison was not made between retrieved and control plates[1,2,3].

The aim of this study is to study the corrosion of titanium metal plates used for immobilization of fractures of maxillofacial region with special emphasis on the release of metal from the plates, to compare the surface characteristics of retrieved titanium miniplates with the unused (control) plates and to study the structural changes of titanium plates and screws.

Materials and Method

A total of 20 plates were retrieved from 12 patients visiting the department of oral and maxillofacial surgery at our institution over a period of 18 months.
The inclusion criteria in the present study were:

1. Patient aged between 15 to 60 years
2. Patient should be medically fit for the surgery
3. Patient willing to give a written consent
4. Cases where the radiographic evidence shows complete healing of the fractured segment or where the signs of infection were present making plate removal mandatory.
5. Cases which can be operated under local anesthesia

The exclusion criteria in the present study were:

1. Patient with systemic co-morbidity
2. Mentally and physically challenged patients
3. Patient requiring general anesthesia for surgery
4. Patient unable to or not willing to give a written consent
5. Radiographs showing evidence of nonunion or malunion

Later the retrieved titanium plates and screws and the control samples of unused plates and screws comprising of 10 titanium plates and screws were taken from the same plating system encountered in the retrieved specimen. All these samples were studied by stereomicroscopy and scanning electron microscope (SEM).

Each plate and one of its screws were examined for evidence of manufacturing defect, surgical damage and corrosion. An initial lower power stereomicroscopy and subsequently high power scanning electron microscopy were performed around the end of screw hole of each plate, on the head and fitting taper of each screw and on any area exhibiting unusual surface characteristics. Particular attention was focused on the counter sink area of the plate and taper of the screw head. These were the regions particularly prone to micro-movements and subsequent corrosion.

Results

SEM Results: All the plates and screws studied under SEM were manufactured from commercially pure titanium consisting of greater than 97% of titanium by weight. Two surface finishes were identified on the specimens. One was plain titanium dioxide and another one was the anodized surface or finish. The plain titanium plate on SEM showed surface characteristics by multiple, randomly arranged polymorphous defects and fine surface scratches. Few scratches were found on plain titanium plates and were covered by electrolytically thickened layer of titanium dioxide. Surface defects were seen on both retrieved and controlled plates.

Retrieved Specimens: Nine plates showed or had an anodized surface finish and the rest of the plates showed plain non anodized surface. Signs of surgical damage were identified on all retrieved plates and screws. Surgical damage was evident as shallow score marks on the plates; and on the screws damage was seen on head of the screws. Two of the plates and screws showed metal release (Aluminum), which has to be further confirmed by Energy Dispersive X-Ray Spectroscopy (EDX) analysis (Fig. 1). Two of the retrieved plates showed pitting corrosion seen as depressions and stress corrosion seen as surface cracks in the area of tensile stress (Fig. 2). One of the plate showed hole like defect which might be due to corrosion. Surface defects and finishing defects were seen. Intrinsic surface irregularities and small number of score marks were visible on surface.

Fig. 1: SEM images showing stress corrosion of titanium plate

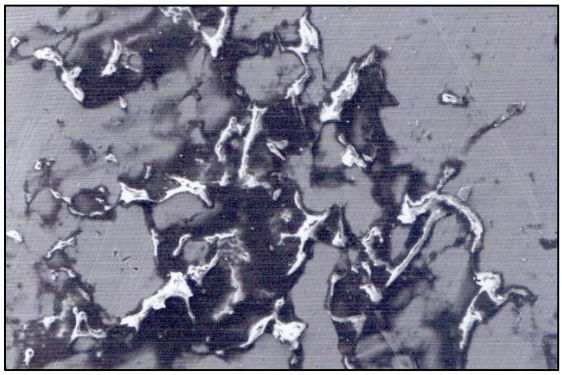

Fig. 2: SEM images showing metal release

Control specimens: Study of control plates and screws revealed mainly manufacturing defects which consisted of round edges. Metal protuberances which were

located on plates and screws mainly on head of screws and around rim of screw holes. Dark irregularities with a smooth surface were found on control plates. Group of polymorphous defects were seen interspersed, randomly over the surface, on controlled titanium plates. Depression or defects seen on control pates are shallower than used plates. Linear cracks were seen adjacent to depression on both surfaces of control plates. These cracks measured l -30 um long and I -5 um thick and were randomly distributed parallel to each other. Shallow scratch marks were also apparent on control plates and were oriented randomly (Fig. 3).

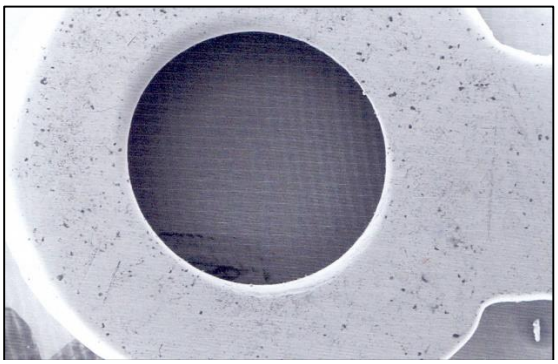

Fig. 3: Control (unused) plate

Stereomicroscopic Results

Results could be classified as mechanical damage, corrosive degradation or combination of two (Fig. 4).

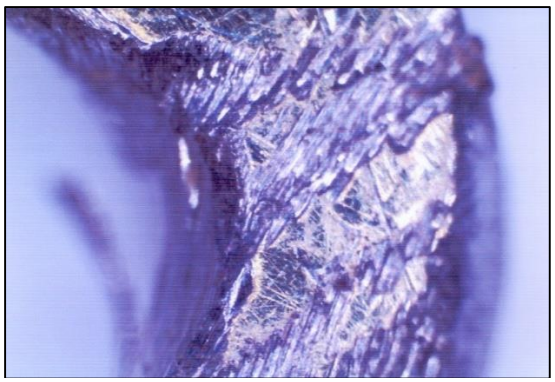

Fig. 4: Stereo microscopic images showing corrosion and metal release of titanium plates

Plates

- Mechanical defects on the surface of majority of plates were observed.
- Handling defects were found on all the plates, however the distribution and severity varied.
- Tool marks on the free surface of the plates had a character of sharp-edged scratches but were not involved by detectable corrosion.
- Mechanical defects in the countersink regions had a similar appearance to those appearing on free surface.
- Typical drilling injuries in the countersink area were common on all the plates.
- In contrast, corrosive degradation was observed in two cases observed in association with ~~the~~ mechanical defects in the countersink region (Corrosion never extended onto the free surface outside the countersink area).
- No relation was found between the frequency of corroded devices and plate removal earlier than 6 months or more than 6 months postoperatively.

Screws

- All screws exhibited handling defects visible as minor scratches on screw heads and along screw threads. In combination with the mechanical defects, minor splints were infrequently observed under screw head (Fig. 5).
- There was no obvious difference regarding the severity of mechanical screw defects.
- Corrosion defect were found on screw head and at the transitional zone of screw head / screw thread.

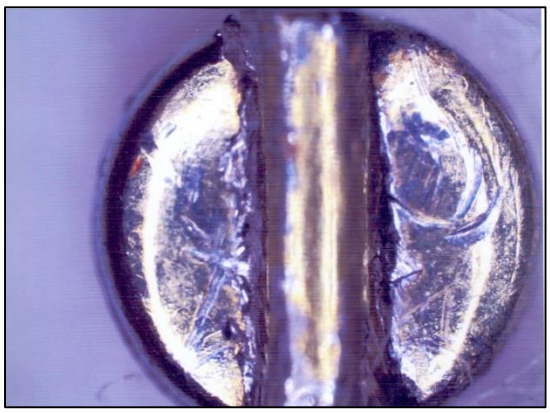

Fig. 5: Stereo microscopic images showing corrosion and metal release of titanium screw head

In this study comprising of 12 patients, 11 (91.6%) were males and 1 (8.4%) was female. The extremes of ages ranged from 15-55 years, with the mean age group of 28.83±10.78 years (Table 1). The maximum number of plates were removed from left parasymphysis [12 plates (60%)] followed by right parasymphysis [4 plates (20%)], then frontozygomatic area [3 plates (15%)] and 1 plate (5%) was removed from right infraorbital region (Table 2). The duration for which the plate was kept in-situ ranged from 6 months to maximum of 37 months with average duration of 15.08±10.5 months (Table 3). Results showed manufacturing defects in 100% cases of both the study and control group, whereas, corrosion and metal release were seen in only 10% cases of the study group (Table 4).

Table 1: Age and Sex wise distribution of cases

Age	Male		Female		Total	
	No	Percentage (%)	No	Percentage (%)	No	Percentage (%)
15-24	4	33.3	0	0	4	33.2
25-34	5	41.5	1	8.4	6	50.0
35-44	1	8.4	0	0	1	8.4
45-54	0	0	0	0	0	0.0
>=55	1	8.4	0	0	1	8.4
Total	11	91.6	1	8.4	12	100.0

Table 2: Location wise removal of plates

Location	Number of cases	Percentage (%)
Left Parasymphysis	12	60
Right parasymphysis	4	20
Frontozygomatic area	3	15
Right infraorbital area	14	5
Total	20	100

Table 3: Duration of plates in-situ

Location	Number of cases	Percentage (%)
6 months to 12 months	7	58.3
12 months to 24 months	4	33.3
25 months to 36 months	0	0.0
>= 37months	1	8.4
Total	12	100

Table 4: Comparison of study group and control group

Analysis	Study group		Control group	
	No.	Percentage (%)	No.	Percentage (%)
Manufacturing	20	100	10	100
Corrosion	2	10	0	0
Metal release	2	10	0	0

Discussion

During last decade, rigid internal fixation with titanium miniplates and screws had gained widespread acceptances in the management of maxillofacial fractures. Titanium and its alloys possess outstanding biocompatibility in human body by virtue of formation of oxide film in minimum time and their corrosion resistance to blood and other body fluids.

Metal miniplates are used to immobilize fractures of facial skeleton but the question arises, whether, nonfunctional miniplates be removed routinely after bone healing or not. The decision to leave miniplates insitu may be influenced by many factors such as the known biocompatibility of the implant, poor access and patient's choice. The financial and resource implications of a second procedure to remove miniplates may also be a constraint, screws may be damaged and may fracture during removal, thus, complicating miniplates retrieval. Therefore, some clinicians thus feel justifiable to leave implants insitu if there have been no clinical symptoms from the fracture site during healing. However, an international study group has recommended that all nonfunctional implants should be evaluated for removal[4].

A major concern about the permanent retention of metal miniplates and screws after osteosynthesis is the effect on the implant surface of general corrosion and fretting corrosion between miniplates and screws. Experimental studies on animals have shown that the surface of implant material may retain their original surface characteristics after a period of implantation. Linder and Lundskog[5] used SEM to study the surface of stainless steel and pure titanium cylindrical implants retrieved from 7 to 10.5 months after implantation into bone defects created in the tibia of rabbits and found that there was no evidence of corrosion. Moberg et al[6] examined miniplates made of cobalt chromium alloy, nickel chromium and titanium retrieved from mandible of monkey upto 6 months after surgery. Using light microscope the authors found no visible corrosion sites or corrosion products on surface of implants. Retrieval studies provide useful information about surface characteristics of miniplates that have been removed from patients after osteosynthesis. There are many retrieval studies that are done on animal but a very few retrieval studies[7] of titanium plates on human beings. However, some of the studies done on animals were flawed because comparison was not made between the retrieved plates and unused control specimens. The importance of this element in any retrieval study has been emphasized by a study on unused titanium plates, showing numerous defects and irregular fragment on the surface.

A controlled retrieval study in animals in which titanium miniplates were used to fix mandibular osteotomies found that there were no significant changes in surface characteristic of miniplates retrieved upto 24 weeks after insertion in comparison with unused controls. Our present study was designed to determine whether these findings were same in humans. The retrieved plates and screws were studied under SEM and Stereo microscope to identify the surface contamination of control and retrieved plates.

The surface characteristics of experimental titanium plates and screws removed from patients were compared with unused control plates and screws. Particulars attention was paid to potential sources of metal release into tissues such as corrosion, wear, manufacturing defects and surgical defects.

The plates most frequently used in oral surgery are made of cobalt-chromium, titanium and nickel-chromium alloys. It has been shown that release of metals occurs in vivo from all types of alloys used in Implantology. The release of Ti from implant in bone has earlier been reported to be low. However, Fergusonet al[8] found a relatively large release of Ti

from a Ti alloy. The results of our present study showed metal release from titanium plates and screws used for fracture immobilization procedure. Metal may be released as a result of manufacturing defect, corrosion, surface contamination or mechanical damage which may occur during insertion, removal or due to wear while in-situ.

The long term management of miniplates osteosynthesis remains controversial with some authors recommending routine removal of plates at 3 months (Peterson et al, 1986), while others recommended retention of plates until their removal is clinically indicated[9-11].

The likelihood of infection or pain have been cited as a reason for the routine removal of plates. Other causes of plate removal were palpability, wound dehiscence, sensory disturbances and discomfort. The decision as such to remove maxillofacial miniplates depends upon the presence of signs and symptoms and on consent from the patients.

In this study, out of 20 plates retrieved from 12 patients, only one patient showed signs of infection and pain, which was the cause for the removal of the plates, in other cases plates and screws were removed on a routine basis without any associated signs and symptoms of infection. The reason for low infection rate is due to the reason that patients were managed with strict antibiotic protocol and adherence of the patient to rigorous postoperative dietary instructions leading to reduced mobility at the fracture sites. This does not concur with other authors[1,12,13] who found infection to be the main cause of plate removal.

In one of the study done by Alpert and Seligson[14], they reported that temperature conduction, associated with bone plates, is a significant cause of morbidity and plate removal. In this present study, none of the plates were removed due to temperature sensitivity, which is in line with the other studies[1,15,12,13] in which there were no examples of plate removal due to thermal sensitivity.

In this study 9 of the titanium plates showed anodized surface and rest of the plates showed non anodized surface. Under SEM, the plain plates had a matt grey appearance and anodized surface had a dull gold or colored finish. Anodized surface produce a smoother, scalloped surface whereas, defects and scratches found on non-anodized surface are covered by an electrolytically thickened layer of titanium dioxide. This concurs with the result of the study done by R.J Langford et al[16] in which anodized plates had a smoother more uniform surface with no detectable rough edges or metallic protuberances.

In the present study, all titanium plates were retrieved after complete union of fractured fragments. Two of the plates were retrieved within 7 months of insertion. These findings coincided with the study done by T.Kawai et al and Heppenstall who have found most of the fractures had united 4 months or more after surgery and suggests that favorable time for removal of fixation material is after 5 months of fracture fixation.

In the study, most of the titanium plates (9 plates) were removed from the mandible in the parasymphysis region and rest of the plates were removed from frontozygomatic area. This is not surprising because most of the titanium plates used in trauma cases are placed in parasymphysis region. These findings concur with Mosbashet al[12] where most plates were removed from parasymphysis region.

Mosbal et al in his study showed 75% of the plates placed in trauma patients were removed within 6 months of insertion. But in this study, only two of the plates placed in parasymphysis region were removed within 7 months of insertion, rest most of the plates were removed within one year of insertion, which concurs with the study done by Bhatt et al[1], in which they have demonstrated a removal rate of 72% within first year of placement.

There are studies done on surface analysis of titanium miniplates and stainless steel plates. These plates were analyzed under SEM and EDX analysis. SEM analysis revealed corrosion and metal release only in relation to stainless steel plates, but, these findings were not found in retrieved titanium plates. In this study only titanium maxillofacial plates and screws were studied under SEM, the results of which differ from previous studies as two of titanium plates and associated screws were associated with corrosion and metal release.

In this study, corrosive degradation was observed in association with the mechanical defects in the countersink region of titanium plates and screws as this region is particularly prone to micro movements and subsequent corrosion. The results of this study differs with other studies done by Langford et al[2] and IR Mathew et al[7], in which, there were no signs of corrosive degradation in countersink area of titanium plates and screws.

The results of this study showed surface defects which were present on both control specimen and retrieved specimen and they showed no differences. These surface defects were most likely the results of manufacturing process which involves rolling milling and polishing. These results concur with the study done by I.R. Mathew et al[7] the results of which shows surface detects and handing defects. The surface irregularities of the control specimens appeared to have occurred during implant manufacture. The surface cracks and depression probably arose during production of the sheets from which miniplates are cut. The countersinks for the screw hole had in smooth finish and a consistent bevel angle, indicating that a precision milling apparatus was used to machine the screw holes and the line scratches on the surfaces of all miniplates probably occurred during the final polish. The surface deposits may have been caused by aluminium oxide or

silicon carbide abrasives used to polish the miniplates during manufacture.

In this study, signs of surgical damage were evident but there was no indication that this leads to corrosion. Previous in-vivo retrieval studies done by Mathew IR et al[17] and Torgersen et al[4,18] have shown no evidence of titanium corrosion. But these results differ from the studies done by Acero J et al[19], who have claimed to have identified areas of corrosion and metal loss from titanium plates in both experimental and clinical situations. But these studies were flawed due to lack of suitable controls. In this present study, surface analysis of both retrieved and control groups were done under SEM and stereomicroscope.

In this present study, surface deposits of aluminum were identified on retrieved specimens on SEM analysis, which has to be further confirmed by EDX-analysis. This contamination was found embedded in the surface irregularities and may have occurred during manufacturing .Other possible sources of aluminum contamination are from atmospheric dust or from autoclaving the plates prior to clinical use. These findings concurs with previous studies done by 1.R Mathew et al[7] who have identified aluminum and silica on the surfaces of titanium plates and in the soft tissues adjacent to titanium miniplates. The cellular toxicity caused by aluminum has been associated with Alzheimer's disease, Parkinsonism and osteomalacia.

In our study two of the retrieved plate showed pitting corrosion which was seen as depression and stress corrosion seen as surface cracks in the areas of tensile stress. One of plate showed hole like defect which might he due to corrosion or the defects might be representative of the manufacturing process or due to surgical manipulation. This finding concurs with the results of study done by Acero et al[19], in which, hole like defects were identified in 35% of the plates supposed to be due to corrosion.

In this present investigation there were signs of titanium corrosion and metal release. Surgical manipulation and manufacturing defects are probably more important sources of particulate metal release when maxillofacial osteosynthesis plates are used. The source of surface contamination with aluminum should he determined and appropriate action taken to minimize the problems. Anodizing does appear to reduce the presence of surface contamination with aluminum.

Further, long term follow-up studies are desirable to assess the clinical and toxicological effects of retention of titanium plates especially in relation to release of particles into surrounding tissues.

Conclusion

To conclude for retrieval studies to be informative a control group of plates and screws must be examined before insertion and comparison must be made between retrieved and unused samples. In this present study out of 20 retrieved titanium plates and screws only 2 plates showed signs of corrosion and metal release into the tissues. Surgical manipulation and manufacturing defects are probably more important sources of particulate metal release into the tissues, when maxillofacial osteosynthesis plates are used. Therefore, from this study, there is no evidence to support the view that titanium miniplates should be removed on routine basis.

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Autofluorescence spectroscopy of blood plasma in characterization of oral malignancy - a pilot study

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Abstract

Introduction: Oral malignancy has a very high incident rate in India as a result of habitual tobacco chewing and its products. Microscopic examination of the tissue specimen following a biopsy, which is an invasive procedure, forms the gold standard for diagnosing these lesions. Autofluorescence spectroscopy (AF) of blood plasma promises to be a sensitive and non-invasive method for screening and monitoring such cases.

Aim and Objectives: To evaluate and compare the spectral emission range of cases from oral squamous cell carcinoma, leukoplakia and control subjects in the visible spectral region.

Materials and Method: Blood samples from 5 cases each of oral squamous cell carcinoma, leukoplakia and normal individual were taken and subjected to excitation wavelengths at 405 and 420 nm using autofluorescence spectrometer and emission wavelength were noted.

Results: Fluorescent emission spectra of blood plasma of oral malignant lesions exhibited characteristic spectral difference with a shift towards the red spectrum with reference to normal subjects indicating alteration in the internal fluorophore concentration owing to malignant changes.

Conclusion: Autofluorescence spectroscopic analysis of blood plasma promises to be a valuable non invasive tool in the diagnosis of oral malignancy from clinically appearing normal tissue.

Keywords: Autofluorescence, Oral Cancer, Spectroscopy, Noninvasive.

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Introduction

Oral carcinogenesis follows a multistep progression model where carcinomas of oral cavity are characterized by high degree of aggression and have a great propensity to metastasize. Most cases of oral cancer are preceded by oral potentially malignant disorders, but they may develop de novo also. Common potentially malignant disorders include oral leukoplakia, oral lichen planus and oral submucous fibrosis. Up to 36% of such lesions may progress to carcinoma making early diagnosis a necessity.[1] Diagnosis of oral malignant lesions involve histological examination of the tissue procured following a biopsy. Biopsy is an invasive procedure, in which, the results of histopathological examination may be subjective, with variation according to the biopsy site and associated inadvertent diagnostic delay. Therefore, there is, a growing need to develop sensitive and less invasive methods for screening of malignant lesions of the oral cavity.[2]

Recently, the use of alternative methods such as fluorescence spectroscopy has been extended to the medical field to characterize various metabolic and pathological changes at cellular and tissue level, as, it is a highly sensitive method for monitoring minor changes in the structure and micro environment of fluorophores. Biomolecules, within the tissue have the ability to give fluorescence emission within the UV-visible region when excited at suitable wavelengths. Cellular and tissue alterations in pathological conditions result in alterations in the fluorescence emission spectrum. Photosensitizing substances such as tryptophan, Nicotinamide adenine dinucleotide (NADH), flavin adenine dinucleotide (FAD) preferentially accumulate in premalignant and malignant lesions.[2] The fluorescent emission spectrum is also influenced by the histological organization of the tissue, in particular for multilayered tissue.[3] The technique of autofluorescence has previously shown promising results in other tissues such as breast[4], cervix[5] and colon[6]. The present pilot study was designed to study and compare fluorescence characteristics in blood plasma of healthy controls, leukoplakia and oral squamous cell carcinoma subjects.

Materials and Method

5 cases each of clinically healthy controls, leukoplakia and oral squamous cell carcinoma were included in the study. The procedure of autofluorescence spectroscopy was explained to the

individuals and informed written consent was obtained from all the subjects. Blood samples were collected from the controls, leukoplakia and oral squamous cell carcinoma patients. Ethylene diamine tetra acetate (EDTA) coated test tubes were used to store the samples to prevent blood coagulation. The samples were then centrifuged and plasma was removed without disturbing the buffy coat and erythrocyte sediments. The plasma thus separated was stored at -20° C until the assay was performed. For fluorescence measurements, analytical grade acetone was added to plasma. The mixture was centrifuged and the clear supernatant was taken in a quartz cuvette of 1 cm path length for further analysis.

Fluorescence emission spectra of blood plasma-acetone extract were recorded using fluorescence spectrometer. The samples were excited at two different wavelengths, 405 nm and 420 nm and autofluorescence emission spectra were recorded in the region 430-700nm and 450-700nm respectively. The wavelength of 460-500nm attributed to co-enzyme linked nicotinamide adenine dinucleotide phosphate (NADPH) and spectral shoulder at 512-524 nm attributed to FAD.

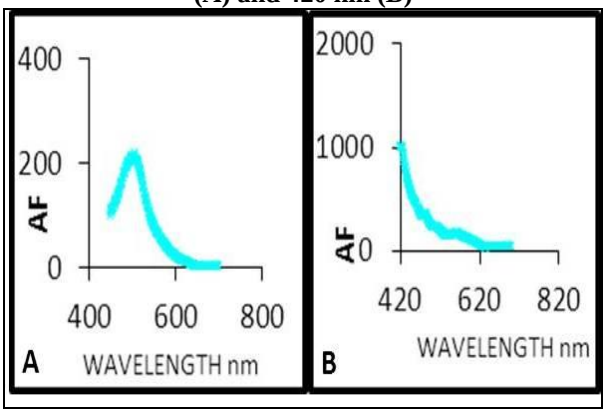
Results

The fluorescence emission spectra of blood plasma of control, leukoplakia and oral squamous cell carcinoma is shown in Table 1 at excitation wavelengths of 405 and 420 nm. In our study, oral squamous cell carcinoma showed a characteristic spectral difference when compared to control and leukoplakia cases. Leukoplakia showed spectral emission in the same range as normal cases (Graph. 1 and 2). At 405 nm excitation wavelength, the oral squamous cell carcinoma showed a primary emission peak at 486.5 nm with a shoulder at 495.5-513 nm, whereas, at 420 nm excitation wavelength, it showed a primary spectral emission peak at 484 nm with a shoulder at around 489.5-500 nm and another peak at around 600-620 nm (Graph. 3).

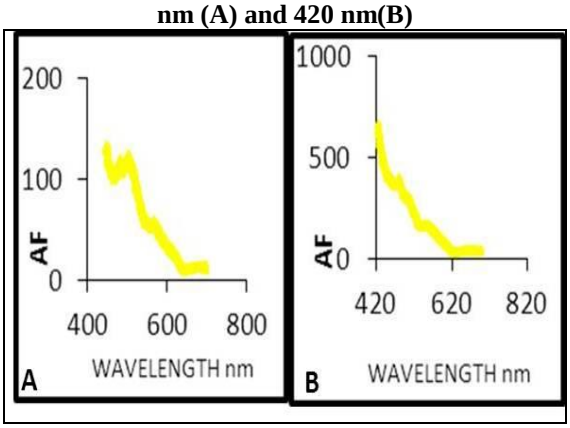
Table 1: Table showing emission peak and spectral shoulder at 405 nm and 420 nm

Group	Emission peak	
	405 nm	**420 nm**
Control	484.5 nm	499.5 nm
Leukoplakia	485 nm	405.5 nm
OSCC	486.5 nm	484 nm
Spectral shoulder	495.5-513	489.5-500nm

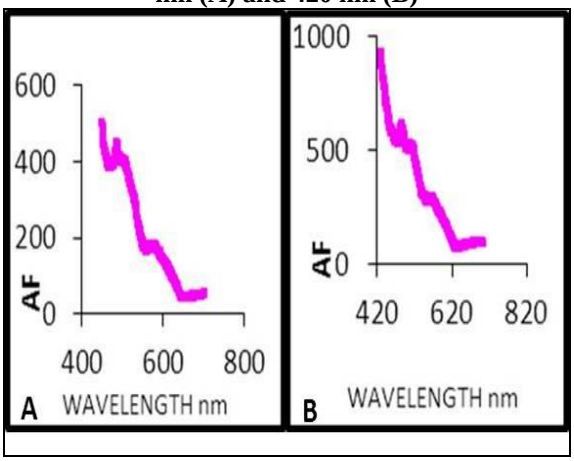
Graph 1: Spectral Graph showing autofluorescence characteristics of blood plasma in controls at 405nm (A) and 420 nm (B)



Graph 2: Spectral Graph showing autofluorescence characteristics of blood plasma in leukoplakia at 405 nm (A) and 420 nm(B)



Graph 3: Spectral Graph showing autofluorescence characteristics of blood plasma in oral cancer at 405 nm (A) and 420 nm (B)



Discussion

Most cases of oral cancer are first diagnosed when they become symptomatic. By this stage, approximately two-third of patient would have already developed advanced disease with regional metastasis and have a

consequently diminished prognosis. The subsequent treatment would require surgery and adjunct radiotherapy, with its high rate of morbidity and mortality. If diagnosed and treated at an early stage, both survival rate and quality of life can be improved.[2,7]

The common procedure for detecting malignant oral lesions consists of visual inspection followed by biopsy of any observed suspicious lesion. Recently, there has been increased interest in diagnostics involving optical system using spectroscopy to establish definitive diagnosis. Spectroscopy, was originally the study of interaction between variation and matter as a function of wavelength. Spectrometry is spectroscopic technique used to assess the concentration or amount of a given molecule.[2,3]

Optical spectroscopy explores the optical phenomena resulting from interaction of light with biological tissue. It may be particularly useful for the analysis of differences between normal and cancerous tissue because of major scattering, absorption and fluorescence change which are known to occur during development of cancer. Three optical techniques that are currently utilized in the detection of oral malignancies include autofluorescence, elastic scattering and Raman spectroscopy.[2] Fluorescence spectroscopy is based on autofluorescence or a laser-induced phenomenon and occurs due to the presence of fluorophores like NADPH, collagen, elastin, and cofactors. VELscope is a portable device based on narrow-emission tissue fluorescence which provides light in the range of 400- 460 nm. Under the intense blue light, normal mucosa emits pale green autofluorescence while the suspicious tissue appears dark.[5] Elastic scattering spectroscopy (ESS), generates a wavelength-dependent spectrum that reflects both scattering and absorptive properties of the tissue. ESS, is sensitive for nuclear size, chromatin content, nuclear-cytoplasmic ratio, and cellular crowding, which are all criteria for establishing malignancy. Raman spectroscopy, utilizes a form of elastic scattering which is generated by a shift in the frequency of the incident excitation light. It is most accurate technique but signals are weak. Trimodal spectroscopy, is a combination of all the above-mentioned techniques to increase the accuracy of the technique.[2,8]

The technique used in our study is autofluorescence spectroscopy which uses the principle of fluorescence spectroscopy which was first described by Alfano et al. (1984).[6] It involves using a beam of light, which excites the electrons in molecules of certain compounds and cause them to emit light of lower energy (fluorescence). This can be detected by sensitive spectrometers. All tissues fluoresce due to the presence of internal fluorescence chromophores (fluorophores) within them. Characteristic spectra reflect biochemical changes occurring within the tissue. The resultant spectra not only detect the light that is fluoresced but also are sensitive to the structure that absorbs light. The commonly detected fluorophores are NADH, collagen, elastin and co factors such as flavins (FAD, FMN).[3,8] The primary emission peak in the range of green fluorescence (480-500 nm) could be attributed to NADPH and those in the higher range towards the red spectrum could be attributed to increased concentration of porphyrins in oral cancer cases.[2]

Blood plasma was used in our study to ascertain the role of internal fluorophores as promising biomarker in oral malignancy. Madhuri S et al. (2003)[3] conducted a study and suggested that the autofluorescence spectroscopy is a useful tool to discriminate oral malignant patients with a sensitivity of greater than 90% from normal healthy subjects. It was observed that the blood plasma of patients with different stages of oral malignancy exhibit significant spectral differences when compared with normal subjects. Gillenwater et al. (1998)[10], utilized autofluorescence technique in neoplastic and non-neoplastic oral mucosa and observed that fluorescence intensities are less for abnormal than normal sites with a shift towards the red region (635 nm) from blue region of the spectrum (455-490 nm).

In another study, Onizawa et al. (1999)[11] showed that fluorescence photography at 360 nm excitation, with emission above 480 nm, could be used to separate benign and malignant oral tissue with 91.1% sensitivity and 84.3% specificity. Van Staveren HJ et al. (2000)[12] used autofluorescence spectra analysis to distinguish oral leukoplakia from normal mucosa using artificial neural network and revealed a sensitivity and specificity of 86% and 100% respectively. It also helped considerably in classifying homogeneous and non-homogeneous tissue well, with weak or no correlation, between spectral patterns in the grade of dysplasia, hyperplasia and hyperkeratosis.

Conclusion

The results of the present pilot study have provided a promising platform to carry out a more detailed investigation on a larger population consisting of normal, potentially malignant and malignant disorders for the characterization of various pathological conditions of the body. These new developments in diagnostic technology may greatly improve the ability to screen people for oral malignant lesions. However, intensive research and clinical trial investigations are needed to test the sensitivity, specificity, negative and positive predictive ability of these technologies before they can be widely implemented.

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Relative efficacy of Tell-Show-Do and live modeling techniques on suburban Indian children during dental treatment based on heart rate values: a clinical study

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Abstract

Aim: This study aims at evaluating the relative efficacy of the Tell-Show-Do and Live Modeling techniques on suburban Indian children during dental treatment based on the heart rate values.

Materials & Method: Children aged between 5 to 11 years were randomly divided into three groups as: *GROUP A:* Children who were presented with the Tell-Show-Do technique to undergo dental treatment. *GROUP B:* Children who were presented with Live Modeling technique, with mother as a live model. *GROUP C:* Children who were presented with Live Modeling technique, with father as the live model. A digital fingertip pulse oximeter was attached to the index finger of child's left hand, in order to record heart rate values at a 30-second interval over a total of 11 data points.

Results: Forty five of the forty six participants completed the entire protocol and participated in the study in three equal groups. Average heart rate over the entire treatment session was significantly lower among children in group B than among those in group A and group C at $p<0.01$.

Conclusion: Live Modeling is a tangible technique in clinical pediatric dentistry as is supported by findings in other relevant fields also. Additionally, application of technique would require necessary skills, organized approach and innovation.

Keywords: Behavior Management Techniques, Pulse Oximetry, Heart Rate.

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Introduction

Visit to a dental operatory can noticeably mete out primal feelings of anxiety or fear in an apprehensive child. Prevalence of child dental anxiety has been estimated to range anywhere from 3% to 20%[1]. Such kind of foreseeable emotional response may lead to compromised quality of care rendered and it is no longer, a bolt from the blue, that, the dental clinic is a place many children would like to circumvent.[2,3] A pediatric dentist attending the aforesaid strata of patients, visiting for the first time, has distinctively clear options varying from pharmacological to non-pharmacological techniques of behavior management. In the past few consensus meetings, the American Association of Pediatric Dentistry (AAPD) panel has agreed upon the fact, that although there is an abundant data on pharmacological approaches, yet paucity exists in literature on communicative and non-pharmacological techniques of behavior guidance, necessitating for more need based research in latter's domain.[4] Among various non-pharmacological techniques, Tell-Show-Do or Explain-Show-Do[5], remains the most widely practiced by pediatric dentists.[6] Another technique, rather a lesser known one, Live Modeling, gained enthusiastic interest amongst advocates of non-pharmacological behavior modification during the late twentieth century when Bandura defined it, as, learning resulting from the observation of a model.[7] Despite the fact that Live Modeling received an encouraging reception from dentistry, it did not evolve much to its caliber as it has been in fields of applied behavior analysis (including specific fears, social withdrawals and language deficits)[8], Pediatrics[9] and sports[10]. Therefore, to supplement the existing data on non-pharmacological techniques of behavior guidance globally and paralleling with the AAPD's school of thought, we undertook this clinical study to compare the effects of Tell-Show-Do and Live Modeling techniques on suburban Indian children, based on their heart rate measurements.

Materials and Method

Complying with the ethical standards of the responsible committee on human experimentation of the institute, the study was conducted at the department of Pediatric and Preventive Dentistry of Himachal Dental College and Hospital, Sundernagar, Himachal Pradesh, a tertiary oral health care institution, drawing footfall from more than five districts of Himachal Pradesh, India.

Inclusion criteria: Children reporting for the first time accompanied by both the parents to the department of

Pediatric and Preventive Dentistry were included in the study. Other criteria included a non-contributory medical history of the child and parents, with optimum physical, as well as, mental faculties to serve as a model.

Children posing with language, learning and behavioral barriers were excluded from the study. Also, the subjects were free at their will to surrender at any stage of progression of the study.

The nature and purpose of the study were explained to parents in detail. A written informed consent was then obtained. Following this, the parents were asked to fill a self-administered questionnaire which included demographic data, educational level of parents, previous objective and subjective experiences of the child in a medical setting, if any.

Subjects, Setting and Design of Study: The study sample comprised of children aged between 5 to 11 years who were randomly divided into three groups in the following criteria:

GROUP A: It consisted of children who were presented with the Tell-Show-Do approach and subsequently undergoing dental treatment.

GROUP B: It consisted of children who were presented with Live Modeling approach, with mother as a live model and subsequently undergoing dental treatment.

GROUP C: It consisted of children who were presented with Live Modeling approach, with father as a live model and subsequently undergoing dental treatment.

Data collection: The procedure for data collection was a modified version of the one outlined by Faraht-McHayleh et al.[11] A digital fingertip pulse oximeter was attached to the index finger of child's left hand to record heart rate values over the entire treatment period. The child's hand was gently stabilized by a dental assistant to avoid ambiguous reading, owing to even the slightest movement of the hand. The child was verbally reinforced to avoid any voluntary movement, until necessary. For group A, the dentist, demonstrated the child with the Tell-Show-Do technique. He was consistently encouraged to raise questions about what was the equipment around him and how it worked. Once the technique was instituted, the child underwent the dental procedure with simultaneous recording of heart rate. For group B, dental examination of the mother was performed and the child actively watched the procedure. The child then underwent the dental procedure with simultaneous recording of the heart rate. For group C, dental examination of the father was performed and the child actively watched the procedure. The child then underwent the dental procedure with simultaneous recording of the heart rate. The same dentist performed the identical treatment which included screening (oral soft-tissue examination) and oral prophylaxis on all the subjects of the study. Concurrently, the data appearing on the pulse oximeter screen was duplicated into the child's case sheet at 30-second intervals over a total of 11 data entry points, by the same dental assistant.

Time span of each trial: The total duration of each trial lasted for 13.00 minutes, which was subdivided into the following schedule:

a. 1.30 minutes: for familiarizing the child with the staff and the dentist.
b. 2.30 minutes: for attaching and stabilizing the pulse oximeter.
c. 4.00 minutes: for psychological preparation of the child employing tell-show-do/Live Modeling technique.
d. 5.00 minutes: for completion of dental treatment (including screening followed by oral prophylaxis).

Data analysis: Data was analyzed using SPSS for windows release 17.0 (SPSS, Chicago, IL, USA). The three groups were compared by Analysis of Variance (ANOVA). Tukey's HSD (Honestly Significant Difference) test was used for multiple pair wise comparisons between the groups.

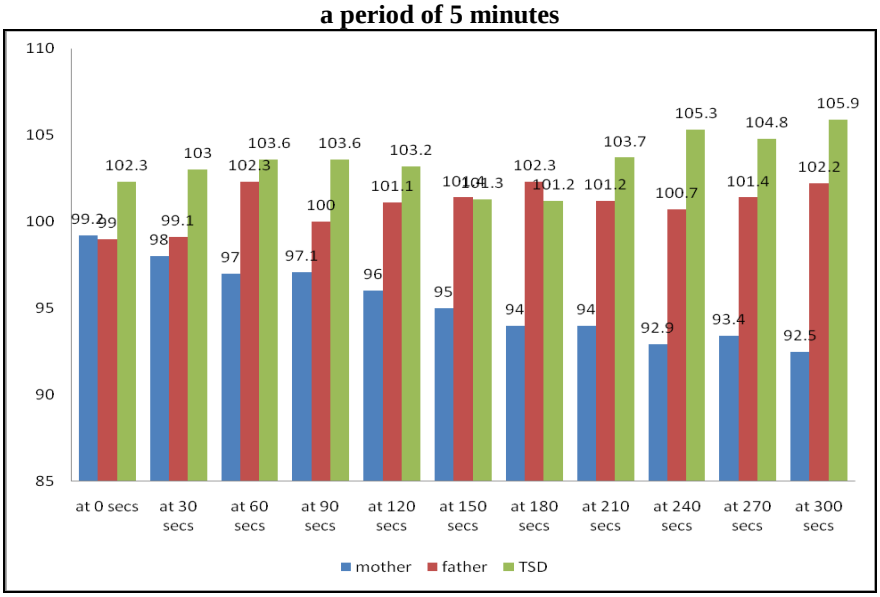
Results

Forty five (45) of the forty six participants completed the entire protocol (one subject dropped out) and participated in the full duration of study: fifteen (15) in group A, fifteen(15) in group B and fifteen(15) in group C. Oral screening and prophylaxis was completed for each group. Average heart rate over the entire treatment period was significantly lower (p=0.05) among children in group B (Live Modeling by mother) than among those in group A (Tell-Show-Do method) and group C (Live Modeling by father). The difference between group mean heart rates was 6.50 beats/min between group A and B, 5.19 beats/min between group B and group C and 1.36 beats/min between group A and group C. This difference was even more highlighted when oral prophylaxis was performed (which involved use of piezoelectric scaler). The heart rate measurements for this particular period are represented from data points E6 to E11 (Table 1 and Graph 1).

Table 1: Intergroup comparison of difference between mean heart rates (beats per minute) at data entry point (E) from 0(E1) to 300(E11) seconds at 30 second interval between Group A, Group B and Group C

Heart rate measurement	Comparison of study group	Difference between group mean heart rates (beats/min)
Mean E1-E5	Group A vs Group B	-2.8400
	Group A vs Group C	-5.6800
	Group B vs Group C	-2.8600
Mean E6-E11	Group A vs Group B	-7.9000
	Group A vs Group C	-10.0667*
	Group B vs Group C	-2.1667
Mean E1-E11	Group A vs Group B	-5.1900
	Group A vs Group C	-6.5000*
	Group B vs Group C	-1.3600

Graph 1: Mean heart rates (beats per minute) (X-axis) for each group at 30 second time interval (Y-axis) over a period of 5 minutes



Discussion

Of particular interest in this study was comparing relative efficacy of Tell-Show-Do and Live Modeling techniques of behavior management by analyzing the physiologic response of child in terms of heart beat variations given that any alteration in heart rate corresponds with a change in level of anxiety.[12] The results of the study indicate that children who were 'pre exposed' to Live Modeling, with mother as a live model (Group B) elicited lowest spikes in heart rate values as compared to children who watched father as live model (Group C) and those who were instituted Tell-Show-Do technique (Group A) as a pre-treatment modality. The peak heart rate values in descending order were: 105.9 beats per minute for Tell-Show-Do at 300 second Data Entry point E11, 102.3 beats per minute for father as live model at 60 second, data entry point E3 and 99.2 beats per minute for mother as live model at 0 second, data entry point E1.The results are discussed in following context. Tell-Show-Do (TSD) technique was first described by Addleston in 1959.[13] The technique incorporates verbal explanations of procedures in a jargon appropriate to the developmental level of child (Tell); demonstrations for the patient of the sensory aspects of the procedure in a neatly defined, cordial setting (Show); and then, replicating the procedure in real time (Do).[14] The treatment must be performed immediately without delays as recommended by Kriences[15], which was followed in the present study as 4 minutes TSD application time was immediately followed by 5 minutes of treatment session. The ease of application and non-aversive nature puts TSD on top of the universally practiced techniques by dentists.[16] However, an active involvement of parent in effective behavior guidance has been a focus of exploration since parents can also play an important part in reducing a child's anxiety and allowing the dentist to form a treatment coalition.[17] Parental influences can play a crucial role in how a child copes with the stresses and stimuli of dental treatment.[18]. Modeling, a derivative of social learning theory, is a method in which a child observes behavior exhibited by another person, the model, that potentiates the probability of the child adopting the observed behavior.[19] According to Fayle,

this approach also has the advantage that the behavior exhibited by the model is entirely predictable and the dentist must assert his acumen to bring the desired results while choosing a model.[20] Compiling above stated observations, the role of parents as live models was included in the study. The difference between group mean heart rates (beats per minute) was higher between Group A and Group C along the complete course of treatment (data entry point E1 to E11), which was statistically significant, (-6.5000,$p<0.01$) compared to Group A and Group B (-5.1900), and Group B and Group C (-1.3600). The results are comparable to the pioneer work done in Lebanon by Faraht-McHayleh et al, in which Live Modeling was inferred better as compared to TSD. In the present study also, mother as live models were favored more compared to TSD. A possible explanation for this can be the positive influence of mother's behavior on child while he/she actively gains motivation from mother while watching her being examined by dentist, in an apparent role of a live model. The reproducibility of Live Modeling has been further documented by Roberts et al.[21] Also, the results during data entry points E6-E11, were statistically significant, between Group A and Group C (10.0667, $p<0.01$). This period corresponded with use of ultrasonic equipment for oral prophylaxis, consequently being the most stressful phase; reflecting in the results markedly. A study conducted by Alrshah et al comparing Live Modeling and TSD found the former to be more effective and validates annotations of the current study.[22] A more vigorous analysis of confounding variables like, age, gender, level of education of child and usage of live models apart from parents can be deemed as limitations of the present study and investigating their co-relations could be an area of future research, which were not recorded in the present study. The present study was also done on suburban Indian population, which can be expanded to rural as well as urban areas for broader understanding of the topic.

Conclusion

Based on methodology and criteria of the study, it can be concluded that:

1. Live Modeling is a tangible technique in list of non-pharmacological techniques of behavior management and can be safely incorporated in routine clinical practice.
2. Mother as live model can be a highly effective regimen for concrete delivery of oral health care in a child patient.
3. More elaborate clinical trials are needed to establish legitimacy of Live Modeling in Clinical Dentistry for child patient.

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Christ Siemen Touraine syndrome - a case report

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Abstract

Christ Siemen Touraine (C.S.T) syndrome is characterised by classical triad of hypohidrosis, hypotrichosis and hypodontia. The oral manifestations are characteristic for this particular syndrome. It is necessary to identify this disease at its early stage in order to render prompt treatment. This article, presents a case report of a one year six month old boy, with C.S.T syndrome with various investigations like radiographic, dermatoglyphics, sweat pore count and treatment plan.

Keywords: Christ Siemen Touraine Syndrome, X-linked hypohidrotic ectodermal dysplasia, Dermatoglyphic.

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Introduction

The National Foundation for Ectodermal Dysplasia (NFED) defines ectodermal dysplasia (ED) as a genetic disorder in which there are congenital birth defects (abnormalities) of 2 or more ectodermal structures. These structures may include skin, hair, nails, teeth, nerve cells, sweat glands, parts of the eye, ear and other organs[1]. Freire –Maia and Pinhero described 117 possible varieties of ectodermal dysplasia involving all possible Mendelian modes of inheritance[2]. From the clinical point of view two main forms have been distinguished:

1. Hypohidrotic form/Christ -Siemens-Touraine Syndrome
2. Hidrotic type /Clouston syndrome

Christ-Siemen-Touraine (CST) syndrome, also referred to as hypohidrotic ectodermal dysplasia, belongs to a group of genodermatosis known as ectodermal dysplasia.The disorder hypohidrotic ectodermal dysplasia affects 1-7 per 100,000 live births[3,4]. This disorder is inherited as an X-linked trait. The hypohidrotic form is characterized by a triad of signs comprising sparse hair (hypotrichosis), abnormal or missing teeth (hypodontia or anodontia), and an inability to sweat because of the lack of sweat glands (anhidrosis or hypohidrosis). In the oral cavity, the most striking feature is oligodontia. The teeth that are present have abnormal crown form. Teeth in anterior region of maxilla and mandible are conical in shape[2]. The inability to sweat may result in permanent brain damage or even death[5], thus, early diagnosis and counselling of families are essential, including instructions for lowering the body temperature during hot weather or fever.

Case Report

A one year, six months, old boy reported to the Department of Pedodontics and Preventive Dentistry, with a complaint of lack of eruption of teeth and two conical teeth in upper anterior region of jaw. On general physical examination, child was moderately built but poorly nourished. He had dry skin with scanty hair distribution on body. Extra oral examination revealed characteristic features such as sparse hair on the scalp and eyebrows, prominent frontal bossing and supraorbital ridges, a depressed nasal bridge (saddle nose), cup ear deformity and protuberant lips. He was also intolerant to heat and gives history of recurrent fever in summers. Intra oral examination revealed only two malformed incisors in maxillary arch and rest all teeth were missing in both the arches. The parents gave history of consanguineous marriage and they were first cousins. Family history regarding similar features was positive. The patient's maternal grandfather had similar features (Table 1). Various investigations like radiographic, dermatoglyphic investigation and sweat pore count were performed.

Table 1: Clinical features of hypohidrotic ectodermal dysplasia[6]

System involved	Clinical features
Skin	Hypohidrosis, anhidrosis, heat intolerance, fever, dry, cracked skin eczema, dermatitis
Hair	Hypootrichosis, dry, brittle, light coloured hair
Nail	Deformed, brittle, thin, ridged nails
Teeth	Hypodontia, anodontia, delayed dentition, wide spaced, pointed, discoloured teeth
Facial features	Frontal bossing, saddle nose, malar hypoplasia, mandibular hypoplasia
Otolaryngologic features	Hypopastic alae nasi, atrophic rhinitis, ozena, Pharyngitis, laryngitis, laryngeal mucous hyposecretion, vocal cord palsy, voice changes
Ophthalmic features	Dry eyes, corneal dryness, pannus, vascularisation and scarring, ankyloblepharon, blepharitis, trichiasis, loss of eyelashes and eyebrows, malformed meibmian glands
Respiratory features	Asthma, recurrent infections
Gastrointestinal features	Feeding difficulties, recurrent vomiting, and chronic diarrhoea
Immune dysfunction	Depressed lymphocyte function, cellular immune hypofunction, increased susceptibility to recurrent nasal and respiratory infections Allergic conditions as asthma, eczema, pruritus

Radiographic findings: An orthopantomogram was attempted, but due to lack of patient's cooperation could not be made. Full mouth intraoral periapical radiograph revealed oligodontia.

Dermatoglyphic analysis by Cumin and Midlo's method[7]revealed (Table 2): Three arches on the finger tips of the patient. The finger ridge pattern was dissociated in the mother, which is characteristic. The axial triradius angle in the father left palm was 50 degrees, which is a major variant from normal cases.

Table 2: Dermatoglyphic Record & sweat pore count

	Finger print pattern	Finger ridge pattern	*Atd angle*	Fluctuating asymmetry in atd angle	Sweat pore count Number/cm^2
Patient	LT-ALLLL RT-LAALL	Continuous	40^o 42^o	2^o	10
Patient mother	LT-LLLLL RT-WLALL	Dissociated	34^o 35^o	1^o	11
Patient Father	LT-LLLLL RT- LLLLL	Continuous	50^o 44^o	6^o	12

Sweat pore count revealed (Table 2): The sweat pore count in 1 cm^2 of the patient's palm, his mother's and father's were 9, 11 and 12 respectively, which was on the lower side of normal count.

Fig. 1: Facial view of the patient

Fig. 2: Side profile view of the patient

Fig. 3: Scaly skin

Fig. 4: Dry skin

Fig. 5 & 6: Intra oral view of the patient

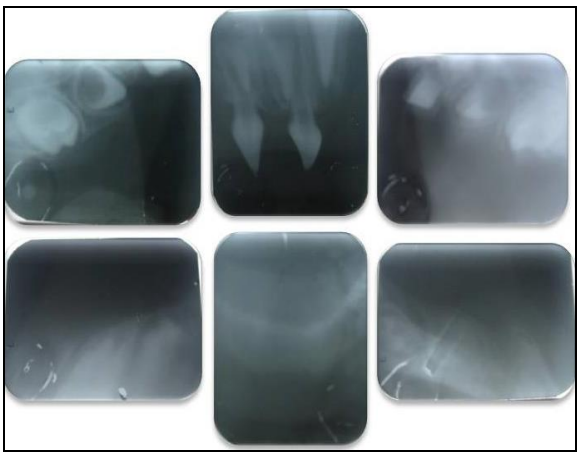

Fig. 7: Full month IOPA radiographs of patient

Discussion

Diagnosis was not just based on clinical triad, but also on family history, radiographic findings, dermatoglyphic findings, sweat pore counts which all were suggestive of C.S.T syndrome. Often in hereditary disease like Turner disease and Down syndrome, palmar and plantar ridges may be abnormal, which is also true for diseases involving skin appendages[8]. Another basis for considering dermatoglyphics as a genetic marker for ectodermal dysplasia is that both primary palate and finger bud develop around the same time i.e., during 6^{th}-13^{th} week of intrauterine life. Both are ectodermal in origin and develop from the same site[9]. Genetic message contained in the genome normal or abnormal is deciphered during this period and is reflected by dermatoglyphic.

The word Dermatoglyphic was coined by Cummins and Midlo in 1926, meaning dermi-skin and glyphe -carving[7]. The method of recording dermatoglyphics in the present study was ink stamp method and for palm record, duplicating ink was used. Dermatoglyphic pattern are broadly classified into three major types: whorl, loop and arches. These patterns are present on finger buds/tips, whereas whole of human palm show certain other features such as axial triradius (ATD) angle, H loop, IV Loop, and t-triradius. In the present case finger print pattern, finger ridge pattern and ATD angle were compared with the normal values.

On a genetic level, in ectodysplasia, defect in signal transduction pathways are the basis of the syndrome. Epithelial cells in hair follicles, endocrine sweat glands and developing teeth use this pathway during morphogenesis. Therefore, genetic defects result in aplasia, hypoplasia or dysplasia of these structures. They also lead to disturbances in the enamel matrix and tooth buds and subsequent hypodontia and hypoplasia of teeth[11]. Kargul B et al. also reported striking dermatoglyphic finding in patients of ectodermal dysplasia[11].

The reduced sweat pore count from the normal individuals explains heat intolerance in these patients. Frias and Smith[5] found a total absence of sweat pores in affected males in their study which is supporting the findings in our case.

Treatment of a child with ectodermal dysplasia requires a multidisciplinary approach. An individual affected by Hereditary Ectodermal Dysplasia, is prone to hyperthermia, hence, advised to maintain cool surrounding temperature with air conditioning, light clothing, plenty of fluids and avoiding direct sunlight. Topical emollients are required for dry eczematous skin and dermatological consultation for infective and allergic skin conditions. Alopecia can be managed by using wigs for cosmetics. The feeding difficulties due to maldevelopment of teeth and malabsorption due to mucosal inflammation may affect the growth of the child. This would require prompt evaluation by gastroenterologist and a dietician for nutritional advice.

Speech and language therapist, otolaryngologist and respiratory physician play a major role in vocal development and treatment of chronic respiratory conditions. Genetic counseling may be helpful to the entire family and helps in preventing further consanguineous marriages. Dental treatment depends on the severity of the disorder; therefore, treatment varies according to age, growth and development of the stomatognathic system of the patient[12]. In the present case, considering the child age and expected cooperation level, no dental treatment was done. Successful management of these children can be achieved by following means[13]

1. Making the child accustomed to the dental operatory.
2. Establishing a friendly relationship with the child.
3. The dentist should have complete knowledge for handling the special problems associated with the treatment.
4. Providing interdisciplinary approach.
5. A "tell show do" approach
6. By using materials and techniques which require minimum intraoral working time and which do not produce any unpleasant reaction in the mouth.
7. By educating the patient and parents about continuous follow up appointments needed for prosthesis adjustment and replacement.

Till and Marques[14], recommend initial prosthesis be delivered before the child begins school, so that the child has the time to adapt to it. According to Gukes *et al*[15] child's consciousness for self-image fairly completes by 4-5 yrs. Early intervention provides the child the opportunity to develop normal forms of speech, chewing, swallowing, improved temporomandibular joint function and most importantly improved self-esteem. As the child grows, the denture should be relined and rebased to accommodate for the growth. Once the growth is complete, the acrylic dentures may be replaced by fixed type of prosthesis using osseointegrated implants.[16]

Conclusion

Dentists are often the first, who diagnose the patients. Therefore, they should be aware of the clinical manifestations of this syndrome. This will be helpful in proper diagnosis, early interventions and appropriate therapies for these patients.

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Single visit reattachment of an Ellis class III fracture of maxillary central incisor

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Abstract

Fracture of maxillary central incisors is the most common dental injury seen in today's hectic life due to increased road accidents, contact sports or other accidents. It not only causes pain but affects the patient's esthetics to a large extent. This always is the first concern of the reporting patient. Reattachment of the fractured fragment is possible when patient seeks immediate dental treatment along with the fractured fragment. The following case report describes the treatment of fractured right central incisor using fractured fragment along with prefabricated post. The fragment was attached using composite. This re-established the functions and esthetics of the patient in single visit. During follow up appointment, clinical and radiographic examination revealed no complications. This suggests the efficiency of single visit endodontic treatment and importance of retaining fractured fragment of the tooth.

Keywords: Anterior crown fracture, Reattachment, Post, Composite

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Introduction

Any trauma to the oral structure has a great brunt on the teeth, mostly because of the forward positioning and the nature of trauma. The teeth, being hard tissue in nature aren't as resilient and tend to fracture on trauma. Commonly, injury to permanent teeth occur secondary to falls, traffic accidents, violence, and sports injuries.[1] The anterior teeth, due to their great esthetic value, demand a faster and natural restoration. In this period of advances in adhesive technology, various techniques and materials are available to the dentist in order to provide patient with good esthetic and functional results. A multidisciplinary approach helps in achieving the aforementioned goals. Fragment reattachment is the most conservative option which re-establishes functional as well as esthetic harmony. The most natural restoration could be nothing but the fragmented tooth itself, provided it gives a complete seal over the remaining tooth structure. The aim of such a treatment should be relief from pain and an acceptable aesthetic result for the patient.

Case Report

A 29 year old female patient, reported to the department of Conservative Dentistry and Endodontics at M. R. Ambedkar dental college and hospital, with a fractured anterior tooth and pain as the chief complaint. Patient had a history of fall a day before. There was complicated crown fracture in relation to the right maxillary central incisor. There was no soft tissue injury or swelling. Tooth was tender on percussion. On examination, the coronal fragments were still attached palatally by fragile soft tissue (Fig. 1). Since esthetics was a major concern for the patient, reattachment of the fractured fragment was planned. Under local anesthesia, the fragment was removed with forceps without damaging the soft or the hard tissues (Fig. 2). Complete pulp tissue was removed and fragment (Fig. 3, 4) was stored in saline. Working length was determined and cleaning and shaping was done by crown down technique, followed by obturation of the canals using lateral condensation technique. The sealer used was AH plus, for better sealability[2] and to eliminate any chances of discoloration[3]. Gingival contouring on palatal side was done to expose the palatal margin using electrocautery. The fracture line was horizontal and at the cervical third, it extended below the level of gingiva palatally. Guttapercha from the canal was removed, leaving apical 5 mm using a peeso reamer. Prefabricated metal screw post was selected and cemented into the canal using Glass Ionomer Cement (Fuji II, GC) (Fig. 4). Using a no. 4 round bur, retention box was prepared in the fragment to accommodate the head of the post (Fig. 5).

Fig. 1: Pre-operative photograph

Fig. 2: Extracted coronal fragment with extension beyond CEJ

Fig. 3: Intraoral post extraction of the fragment

Fig. 4: Cementation of a screw post after root canal treatment

Fig. 5: Ditch made into the crown to adjust the post head

For subgingival isolation, a 25% aluminum sulfate hemostatic gel (Tissue Goo, Clinical Research Dental) was used to impregnate and lubricate a knitted cord (UltraPak, Ultradent). Using an atraumatic cord placement technique, the cord was placed in the sulcus. The reason for using a hemostatic gel was to attain a better control on bleeding into the sulcus and the partially disrupted biological width area.

Both the fragments and teeth were etched using 37% phosphoric acid for 30 seconds and rinsed. Bonding agent was applied using an applicator tip and distributed evenly using a mild air blast from a three way syringe. Fragments were reattached using resin cement. Curing below the cementoenamel junction was aided by the retraction achieved. After final curing, excess was removed by polishing (Fig. 6, 7). Contact was relieved in all the protrusive and lateral movement. Teeth were kept in protected occlusion. Post-operative instructions were given. Patient was recalled after one week for review.

Fig. 6: Intraoral palatal view post cementation of the fragment

Fig. 7: Intraoral labial view post cementation of the fragment

Discussion

Various classification systems have been proposed for anterior teeth fracture such as Andreasen and Andreasen's classification; Spinas and Altana's classification. In the above mentioned case, the fracture was complicated crown fracture i.e. fracture of the crown involving the pulp[4]. Endodontic therapy not only provides pain relief and eliminates any further chances of infection because of a necrotic pulp, but, also provides space for post placement. For the purpose of reattachment various materials such as composite, dual cure resin, light cured GIC, etc. can be used[5]. Treatment decisions differ from case to case depending on the patient's desires and viability of the treatment options. Tooth reattachment technique produces good esthetic and functional result. Moreover, patient's self-esteem remains positive due to maintained natural tooth appearance and esthetic. Important factors for tooth reattachment are as follows, the degree of the fragment adaptation to the remaining structure; fragment retention; fracture location; and pattern. The quality of fit between the radicular and the reattached segments is clinically an important factor for the longevity of the reattached crown. Use of prefabricated post provides retention as well as the distribution of forces along the root to the apical area. According to the amount of the restoration, screw posts or cast posts could be used for supporting the fragment[6]. Cavalier et al., reported that reattachment of the crown fragment appeared to have a better long term prognosis than composite resin restoration[7]. During the procedure, the fragment must be stored in sterile saline or distilled water or coconut water to avoid dehydration[8]. The dehydrated fragment is lighter than the remaining fracture remnant. Return of the natural color may need time or may never occur.[9]

Conclusion

Dental trauma can have better outcomes if the people in general are better aware of the first-aid measures and the need to seek immediate treatment. Fragment reattachment is a conservative and economical approach in crown fracture cases compared to other options such as ceramic crowns and composite build up. In addition, this approach provides one of the best aesthetic results as well.

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Atrophied maxilla restored with a pterygo-maxillary implant – a case report

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Abstract

It is well documented that restoration of posterior atrophied maxilla with implants is a complex entity in itself. Since, implant placement in this area is often accompanied by sinus lift which itself is a morbid procedure with questionable success rate, a new approach of placement of implants in Pterygo maxillary area was explored.

The purpose of this article is to present a case report in which Pterygo-maxillary implant has been successfully placed to restore atrophied posterior maxilla without the sinus lift using 3D imaging technique - Cone Beam Computerised Tomography (CBCT). Thus, making it an easy procedure for placement of implants in the areas previously considered to be unapproachable.

Keywords: Pterygo Maxillary Implants, Atrophied Maxilla, Pterygoid Implants, Sinus Lift, Bone Augmentation

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Introduction

The posterior region of the maxilla has many limitations for the placement of dental implants,[1,2,3] such as poor bone volume (usually a Class III or IV according to Lekholm and Zarb), the presence of the maxillary sinus and the difficulty in hygiene they entail.[4,5] In addition to these anatomic peculiarities, there is high occlusal loading in the molar regions in comparison with the other areas which leads to lower success rate than elsewhere in the maxilla or the mandible.[6] To resolve these problems, a variety of modalities have been reported in the literature like bone grafts, sinus lifts and altered implant locations like in zygoma and pterygoid region.[1,2,7] The use of pterygoid implants were described by Tulasne[8] and subsequently used by many other researchers. They are generally anchored in the pterygoid bone, however, in some studies they are placed in a more anterior position i.e. in the pterygo maxillary area, parallel to the posterior wall of the sinus. These implants have merits over other techniques as they allow anchorage in the posterior atrophied maxilla without sinus augmentations or bone grafts, achieving good stability and long-term success. In addition, cantilever extensions can be eliminated and axial loading is improved.[9] The literature describes two anatomic locations where implants are placed: the Pterygoid process (Fig. 1) and the Pterygo-maxillary region (Fig. 2).[8] This article describes the placement of implant in the left pterygo maxillary region.

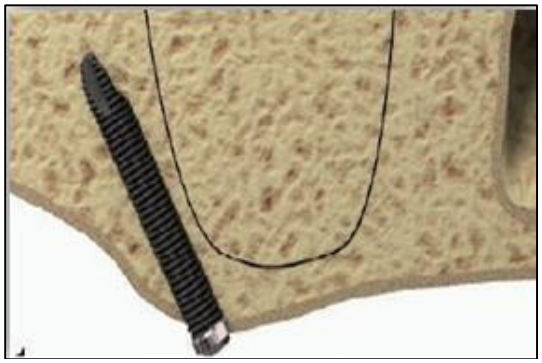

Fig. 1: An implant in the pterygoid process

Fig. 2: An implant in the pterygo-maxillary region

Case Report

A 53 year old female patient reported to Department of Prosthodontics with a chief complaint of difficulty in eating food. Intra-oral examination revealed 16 cantilevered with 15. Porcelain fused to metal (PFM) crowns in relation to 21, 22, 23, 24, 25 and 26 were present. 27 was grossly mutilated.

Lower arch was also restored completely with PFM crowns extending from 38- 47. Patient was advised to go for CBCT for evaluation of bone quantity and

quality for placement of implants in the region of 16, 17 and 27 (Fig. 3).

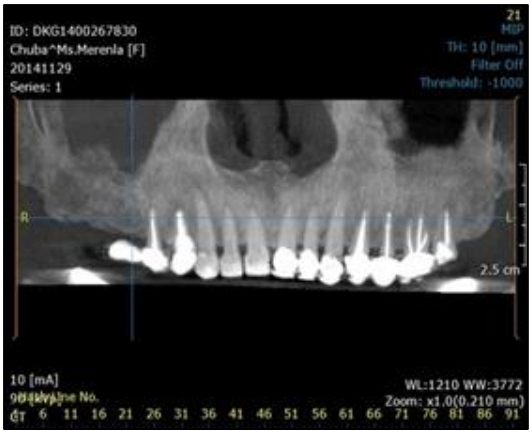

Fig. 3: Pre- operative radiograph

It was observed that root canal treatment of 14, 15, 24, 25, 26 and 27 was done. Periapical radiolucency was present in relation to 27.

Focal defect is noted in the crestal third of 17 region suggestive of partially remineralized socket. Coarse trabeculations were noted in 15 and 27 regions and normal to coarse trabeculations were noted in 16 and 17 region.

Table 1: Dimensions of bone available in the desired implant sites (Fig. 4, 5, 6)

S. No	Implant site	Width of Bone (mm)	Length of Bone(mm)
1	17	5.95	12
2	16	5.94	10.99
3	27	9.85	8.29

However, in the 27 region, the available bone width was corresponding to the width of grossly decayed 27. The height of the available bone was reduced further because of the radiolucency associated with 27.

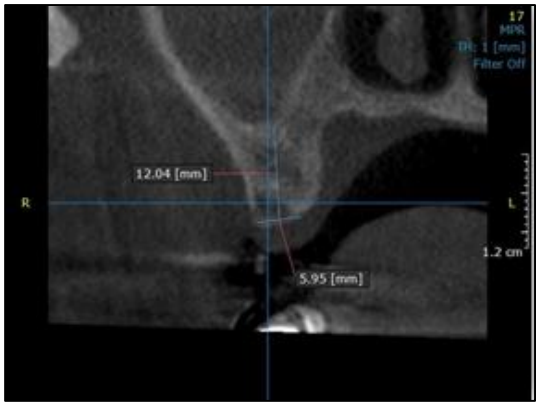

Fig. 4: CBCT section of 17

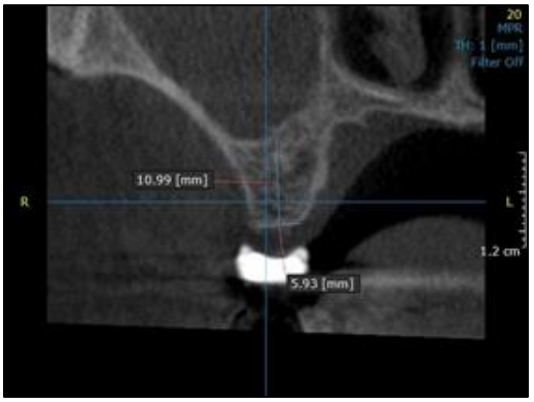

Fig. 5: CBCT section of 16

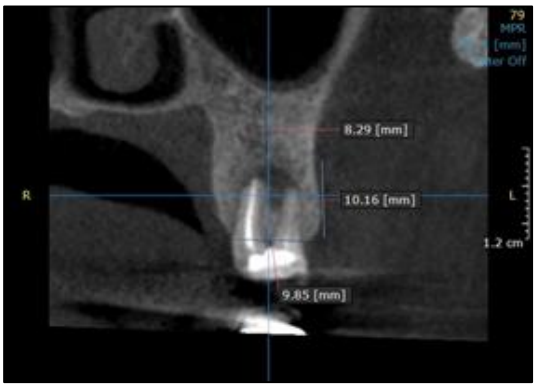

Fig. 6: CBCT section of 27

Treatment plan

Taking into account the findings of CBCT, following treatment plan was decided

1. Removal of the cantilever crown in relation to 16.
2. Placement of two implants in 16 and 17 regions (tapered Nobel Biocare - 4.3 X 10mm for both regions)
3. Extraction of 27 and immediate placement of implant through the extraction socket in the pterygo maxillary area (tapered Nobel Biocare - 4.3 X 16mm), since no sinus lift procedure was planned.
4. In the subsequent second stage surgery, healing abutments to be placed on the implants till the gingival collar is formed.
5. Implant level impressions for fabrication of PFM crowns.
6. Implant protected occlusion to be established by removing all cuspal contacts in eccentric movements and 15 µm disocclusion in centric occlusion.

Procedure

The cantilever on 15 was removed, mucoperiosteal flap was raised and osteotomy site was prepared for placement of implant according to the implant sizes as guided by the Cone Beam Computed Tomography (CBCT). Implants were placed in 16 and 17 region. The flap was approximated and sutured back for the second

stage surgery. 27 was atraumatically extracted and socket was debrided. It was noted that the socket was in close approximation to the distal root of 26. Since, the posterior sinus wall was tapering towards the roots of 27; osteotomy site for 27 region was prepared to get primary anchorage from the pterygo-maxillary area as guided by CBCT. Implant was placed in the pterygo-maxillary area distal to the maxillary sinus and the flap was approximated and sutured for second stage surgery. During subsequent follow-ups, healing was found to be satisfactory and patient was placed for second stage implant surgery for rehabilitation of missing tooth. (Fig. 7)

Fig. 7: Post-operative OPG

Discussion

Pterygoid implants are inserted using a protocol that requires surgical expertise and detailed knowledge of the anatomy of that area. The implant is placed in the pterygoid plate of the Sphenoid bone, with an angulation between 35º and 55º, which depends on the floor of the maxillary sinus and the height of the bone available at the tuberosity region.[9,10] The distance from the internal maxillary artery to the lower end of the pterygomaxillary suture is 25 mm, as, the artery passes 1 cm above the pterygopalatine suture before entering the pterygopalatine fossa.[11] This is a safe working area for the operator because of the absence of vital structures in the insertion area. The placement of implants in the pterygo-maxillary region is within the maxillary tuberosity or parallel to the posterior wall of the sinus. The surgical procedure is comparable to that of implants anchored in the pterygoid process.[12] The angulation should be 10^0 to 20^0 to simulate the angulation of second molar/third molar. Bahat et al considered it necessary to have the patient's mouth open to a minimum of about 35 mm to achieve desirable implant angulation.[7] Both these implant location sites to restore the posterior maxilla have a distinct advantage over the conventional sinus lift procedure. Although, the procedures performed to increase the quantity of bone such as sinus lift gives good results but these procedures are always associated with complications like rejection of graft/implant and increase in overall morbidity of the patient.[13,14] In the case of implants with sinus lift, longer period of healing is required before loading. Therefore, temporization of implants with bone augmentation is often contraindicated. This causes further discomfort to these patients. The pterygoid implants offer immediate loading solutions since the bone present in that region is predominantly cortical (Type I- Type II).[8] Therefore, it is observed that over the last few decades, given the excellent results achieved with pterygo-maxillary implants, this procedure has gradually established itself as not only a reliable treatment option but also one that offers good long-term results.[15] It is also considered as a rehabilitation treatment option in case of atrophic maxilla in the context of post-trauma, post-cancer and serious malformations.

Conclusion

The newer radiographic tools like CBCT have enabled us to place implants in previously inaccessible areas like pterygomaxillary region. We are able to successfully restore the posterior atrophic maxilla without the augmentation of the deficient bone with sinus lift procedures. This procedure, like any other procedure has certain disadvantages like the site of implant placement is anatomically complicated and poorly understood. Further, inadequate mouth opening restricts both the placement as well as prosthetic restoration of implants in this area. Though, the results are promising, case selection is paramount and a thorough understanding of the risks involved with the procedure should be kept in mind.

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Retreatment of mandibular canine with two roots: a case report

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Abstract

The successful outcome of the endodontic therapy requires an adequate knowledge in context to anatomy of the root canal system. In most cases, the mandibular canines are thought to have just one root canal. Those presenting with an extra root and canal are usually rare, ranging from 1% to 5%. Thus, in spite of this low prevalence, variations in the anatomy and number of root canals in mandibular canines should always be taken into account. This paper presents a case of a mandibular canine with two distinct and separate root canals.

Keywords: Endodontics, Mandibular Canine, Root Canal Anatomy

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Introduction

The main objective of an endodontic therapy is to eliminate infective microflora from the root canal system.[1,2] However, factors such as lack of adequate knowledge of root morphology and incomplete removal of infection from the root canal may lead to failure of endodontic treatment. The main causative factor in the failure of endodontic therapy is the failure to locate and fill a canal appropriately.[3] A canal can be left untreated if its presence is not recognized. There is always a perception in the mind of the clinicians that a particular tooth will have a specific number of roots and /or canals. The variations in the root canal configuration of mandibular canines have been reported by many investigators.[4-19] This paper reports a clinical case of mandibular canine with two roots.

Case Report

A 52-year-old female patient was referred to the post graduate clinic of the Department of Conservative Dentistry and Endodontics, I.T.S centre for Dental Studies and Research, Ghaziabad with severe pain in the left mandibular canine. The patient had undergone root canal treatment from a general dentist for the same tooth. At the time of examination, tooth was symptomatic. Intraoral examination revealed a normal crown anatomy with a temporary restoration on occlusal surface. The tooth was sensitive to percussion. Radiographic evaluation of the affected tooth revealed an over-extended root canal filling (Fig. 1). From the radiographic findings, it was diagnosed to be a case of over-extended root canal filling and retreatment was planned for the pretreated canine. As the patient was traumatized and apprehensive because of her past experience, rubber dam application could not be accomplished.

Fig. 1: Pre-operative radiograph showing overextended root canal filling

Endodontic retreatment of mandibular canine: The tooth was anaesthetized and temporary restoration was removed. The previous root canal filling was removed with the help of H-files (Dentsply/Maillefer, Ballaigues, Switzerland). A radiograph was obtained at this stage to confirm the complete removal of root canal filling. On careful examination of this radiograph, it was suspected that the mandibular canine had two separate roots and canals (Fig. 2). The access cavity was modified and the missed buccal canal was located. Working length was established using electronic apex locator (Root ZX; JMorita Co, Kyoto, Japan) and confirmed radiographically (Fig. 3). The canals were instrumented by rotary protaper system (Dentsply Maillefer) using crown-down technique. A 3% sodium hypochlorite (Prime dental products) along with 17% EDTA (Prime dental products) was used as irrigant at every change of instrument. The canals were dried and obturated with

Protaper guttapercha (Dentsply Maillefer) using AH plus sealer (Dentsply Maillefer). A post-operative radiograph was taken which showed dense root canal filling (Fig. 4).

Fig. 2: Radiograph showing presence of two roots

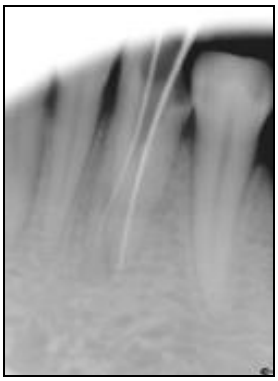

Fig. 3: Working length radiograph showing two separate roots and canals

Fig. 4: Post-operative radiograph

Discussion

The morphological features of the root canal may adversely affect the outcome of endodontic procedure. A thorough knowledge of the root canal anatomy is an important aspect of root canal treatment and is extremely important for the highest possible chance of success. Inability to find and treat an additional root canal is the most widely recognized reason for the failure of root canal treatment. In the teeth especially with extra root canal or anatomical varieties, root canals are regularly left untreated because the clinicians are unable to distinguish their presence. The presence of the additional canals can be found if the clinician is aware of the clues that suggest their presence. An exhaustive and cautious radiographic assessment and endodontic investigation may prompt recognizable proof or suspicion of extra canals. Radiographs taken from different angles and some with a file in place may be very useful in finding and locating extra canals. In the present case, an extra root canal was identified on marginally angulated radiograph. Therefore, the diagnostic radiograph should be carefully examined as it might indicate bifurcation or trifurcations. Despite the fact that the prevalence of the extra root canals inconsistencies is low, they should be distinguished via watchful examination. Detailed knowledge of the anatomical varieties in the endodontic system and attention to their arrangement is the key to success.

Conclusion

Endodontic success depends on the adequate debridement of the root canal system, as well as, on the knowledge of variations in the root canal anatomy. Mostly, mandibular canines are reported to have one root and root canal, but 15% of them are reported to have two canals, and a fewer number may have two distinct roots, both of which should be identified and managed.

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Diagnosing and managing the prodigious gingivae with distinct etiologies – a fight for reinstating big smile from the big gum: a case series

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Abstract

Introduction: Gingival hyperplasia (GH) not only predisposes to the functional but also to esthetic concerns of the patients. For rendering a possible treatment a periodontist should recognize the underlying pathology, be it inflammatory, neoplastic, iatrogenic, idiopathic or in association with any underlying systemic disease.

Materials and Methods: A thorough individual history was obtained with clinical presentation of GH, according to which they were grouped under six sections. First, was drug induced (phenytoin), second was unilateral idiopathic enlargement, third was inflammatory, fourth demonstrated GH due to orthodontic treatment, fifth was stated as inappropriate gum to tooth ratio due to altered passive eruption and lastly was pregnancy induced GH.

Results: The cases presented were treated with full mouth oral prophylaxis following which, surgical intervention was done if indicated.

Conclusion: The present case series highlights different types of gingival enlargement, their underlying etiology and emphasizes on various treatment modalities that can be employed.

Keywords: Gingival Hyperplasia, Diagnosis, Management, Laser, Conventional, Idiopathic, Neoplastic

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Introduction

An abnormal growth of the gingival tissues is defined as gingival enlargement, which sways patient's psychological and functional concerns. Among various predisposing factors for gingival enlargement (GE), drug induced gingival enlargement is the most recognized one. Out of vast variety of drugs prescribed for overall benefit to human health, certain antiepileptic (Phenobarbital, Sodium Valproate, Phenytoin) a group of antihypertensive drugs, like calcium channel blockers (Amlodipine, Nifedipine, Diltiazem, Verapamil) and immunosuppressant drug like Cyclosporine possess a risk of causing gingival hyperplasia as their side effects.[1] Other than drugs, as an etiological factor, gingival enlargement may also occur as a result of inflammatory retaliation to certain local factors like dental plaque, iatrogenic cause like orthodontic therapy, systemic conditions like pregnancy and also can be due to neoplasms, either benign or malignant.

However, GE when associated with progressive increase in connective tissue element of submucosa, the condition is termed as gingival fibromatosis (GF). Though, the etiology and pathogenesis of GE are still not well established, but the most common cause of GF is genetic inheritance or it may be idiopathic.[2]

The treatment is strategized on the perception of the probable cause and basal pathologic changes. Hence, the aim of this case series is to diagnose and render minimally invasive treatment to the patients with gingival hyperplasia attributed to distinct etiologies.

Case 1

Patient, 26 year old male reported to the Department of Periodontology and complained of swelling in the lower anterior gums since 1 year. He also gave the history of taking medications for epilepsy since past 3 years. His physician had prescribed him Phenytoin 100 mg B.D. The gingival surface in the lower anteriors appeared to be fibrotic and had pebble like appearance (Fig. 1a). Pseudo pockets were observed while probing the involved teeth. Provisional diagnosis of drug induced (phenytoin) GE was established. Phase I therapy was rendered. Patient was then referred to the physician for possible substitution of the drug Phenytoin. Gingivoplasty was performed using electrocautery in involved papillary region (Fig. 1b).

Fig. 1a: Phenytoin induced gingival enlargement pre-operative view

Fig. 1b: Immediate post-operative

Case 2

A 19 year old female patient, came to the Department of Periodontology and complained of swollen gums involving the upper and lower teeth, since last 2 years, causing difficulty in mastication, speech and also poor esthetics due to incompetent lips. No relevant medical history or any history of drug intake was contributed by the patient. On examining the gingiva, it was found to be fibrotic, firm and pink in color (Fig. 2a). A provisional diagnosis of idiopathic gingival enlargement was concluded as there was no family history and also inconsistency of the amount of plaque and calculus when correlated with the severity of enlargement. After Phase I therapy, gingivectomy and gingivoplasty procedures were conducted in the affected area, using combination of scalpel and diode laser. Healing was uneventful and patient soon recouped normal functions of mastication and speech (Fig. 2b).

Fig. 2a: Idiopathic gingival enlargement pre-operative view

Fig. 2b: Post-operative healing after 2 weeks

Case 3

A 45 year old female patient reported to the Department of Periodontology, complaining of bleeding and swollen gums since 7-8 months. Medical history was also non-contributory. On clinical examination the gingiva appeared to be soft and edematous with subgingival calculus deposits and had tendency to bleed on slight provocation. Diagnosis of chronic inflammatory enlargement was concluded. Phase I therapy was rendered. After 4 weeks (Fig. 3a) when most of inflammatory component resided, conventional approach for external bevel gingivectomy was planned. After marking the bleeding points, gingivectomy knives were used to contour the gingival margins (Fig. 3b). Healing was uneventful, which further resulted in attaining healthy contour of gingiva (Fig. 3c).

Fig. 3a: Pre-operative view

Fig. 3b: External bevel incision given

Fig. 3c: Two months post-operative

Case 4

An 18 year old female was referred to the Department of Periodontology from the Department of Orthodontics for assessing her gingival condition during active phase of orthodontic treatment. Clinical

examination showed generalized enlargement of papillary and marginal gingiva. Iatrogenic (bracket induced) gingival overgrowth was considered as its provisional diagnosis. Re-evaluation of phase I therapy was done after four weeks (Fig. 4a). It was then decided to correct the residual overgrowths of gingiva by electrocautery (Fig. 4b). Uneventful healing was observed after 2 weeks following which orthodontic treatment was resumed.

Fig. 4a

Fig. 4b
Pre-operative view

Case 5

A male patient, 35 years of age, reported, complaining of short teeth since eruption. On examining the gingiva was firm, resilient and exhibited normal surface texture.

The cervical third of crown was covered with gingiva that gave the appearance of altered passive eruption (Fig. 5a). Hence, an esthetic crown lengthening procedure was performed after phase I therapy using electrocautery. An increase of 2-3 mm in crown height was achieved that gave better esthetic outcome (Fig. 5b).

Fig. 5a: Pre-operative view

Fig. 5b: Immediate post-operatively

Case 6

A 26-year-old woman reported to the Department of Periodontology and complained of swelling of the gums in upper front anterior region (Fig. 6). Patient also complained of difficulty in chewing and showed concern for the aesthetics. Patient was 8 months pregnant, hence only oral hygiene measures were reinforced after scaling and root planning. No surgical intervention was rendered and was scheduled post-partum.

Fig. 6: Pregnancy induced gingival enlargement

Discussion

Among various etiological factors, GH can occur after pharmacotherapy that involves use of prescribed drugs like Phenytoin[3], Cyclosporine and Nifedipine. Kimball in 1939, first reported the case of gingival enlargement induced by Phenytoin.[4] 50% higher association of GH was observed with Phenytoin when compared to that of Cyclosporine and calcium channel blockers.[1] Drug induced GH in present case series is also associated with prescribed administration of Phenytoin. The most effectual treatment for drug-associated GE is withdrawal, substitution or dose alteration of the medication. This can be implemented by the concerned physician.

The commonest mode of genetic transmission for GF is mainly autosomal dominant[5], but in rare instances it may show idiopathic occurrence. Recurrence is usually observed within a few months after surgery and patient may need to undergo repeated gingivectomy procedures. However, further research is required to conclude which modality among laser, electrocautery or conventional causes, least recurrence.

Gingival hyperplasia can also be engendered due to other factors like improper oral hygiene[6],which often presents as slight ballooning of the interdental papillary region with/or without the involvement of marginal gingiva. Maintenance of proper oral hygiene along with surgical intervention, if indicated have shown promising results. However, laser and electrocautery hold an upper hand over the conventional, in terms of hemostasis, but are associated with demerits like delayed wound healing, lateral heat damage, higher cost and skill of the operator.[7] An assessment of initial healing after 7 days, revealed that healing of the quadrant operated by scalpel was best among all.

Challenge that an orthodontist frequently encounters is treatment associated soft tissue problems that majorly include gingival overgrowths. Conventional approach for recontouring of the gingiva may result in problems like increased intraoperative bleeding, post-operative swelling and pain. Electrocautery and soft tissue diode lasers provide a painless and also bloodless treatment option often more unhesitatingly accepted by the patients.[8]

Delayed eruption, certain arch deformities and also displacement of teeth can be consequences of GE apart from functional and esthetic concerns. Therefore, to establish a prompt diagnosis and render appropriate treatment, in-depth knowledge of various etiological factors responsible for GE is a must.

Gingival inflammation in pregnancy is also caused by bacterial plaque, as seen in non-pregnant individuals, however, pregnancy exacerbate the gingival response to plaque.[9] A greater correlation between gingival inflammation and amount of plaque after parturition was seen, when compared to pregnancy that suggested, that other factors are induced during pregnancy that aggravates the gingival response to local irritants.[10] Therefore, regular checkup and oral prophylaxis is of utmost importance.

Conclusion

Clinicians should focus on the non-surgical treatment modalities that include the removal of offending factors like associated drug, plaque or any other systemic or iatrogenic cause for treating GE. Later, if indicated periodontal surgical procedures in the form of periodontal flap or gingivectomy procedures can be performed to reduce the enlarged gingival tissues. The maintenance of treated cases should include meticulous home care and professional recalls.

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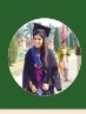

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