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COVID-19: Challenges, opportunities, and way ahead for dentistry

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COVID-19 has changed the world forever. Every aspect of our life has been impacted from how we live, interact with each other, the way we work, communicate and travel. Decisions made now will have a profound effect on many generations to come and will reshape our society in many lasting ways. People wearing face mask and social distancing have become the new norm. The effects of global health crisis and strategies implemented to ameliorate the pandemic across the globe have had unparalleled consequences on dentistry. Regular dental practice was brought to a virtual standstill during the nation-wide imposed lockdown. COVID-19 has seen cessation of all non-urgent dental care in India.

The Ministry of Health and Family Welfare, India, have categorised dentists, auxiliaries as well as patients undergoing dental procedures at high risk of cross-infection as most dental procedures require close contact with the patient's oral cavity, saliva, blood, and respiratory tract secretions. Saliva is rich in COVID 19 viral load. Many patients who are asymptomatic may be carriers. For this reason, it is suggested that all patients visiting a dental office must be treated with due precautions. But we have to understand the fact that we cannot rely only on providing emergency dental care to the patients. A country like India which has large unmet dental needs cannot afford to neglect oral health care delivery as there is shortage of resources to tackle the existing burden of oral diseases. Also delayed dental care can have varied consequences whether it is due to non-provision of regular dental care or reluctance of patient to seek oral health care during the pandemic. Untreated dental caries due to delayed dental care may lead to formation of pus, ulceration, fistula, abscess or other infections eventually increasing the sufferings of patient, thus escalating the cost of treatment and also resulting in poor oral health related quality of life. Routine dental care also provides an opportunity for preventive care, screening for systemic diseases through their oral manifestations which might otherwise be missed. Thus, the recent state of affairs has put forth various challenges and opportunities in re-configuring the dental practice globally.

The key points in reforming and re-structuring dental practice

1. The pandemic obligates the need to strike a balance between the safety of the healthcare professionals yet providing optimum dental care to the patients. Dental health care personnel need to understand the potential risk and implications of transmission of (SARS)- CoV-2 virus in clinical set up. Hence, they need to keep themselves updated with any new information regarding this disease.
2. Dental settings should balance the need to provide necessary services while minimizing risk to patients and dental healthcare personnel (DHCP) with recommended measures like regular upgradation of their knowledge and skills regarding infection prevention and control, implementation of triage protocols, encourage physical distancing, PPE supply

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optimization etc. For a detailed guideline for dental practice see Guidelines for Dental professionals in COVID-19 by Ministry of Health and Family Welfare, India [1] and Guidance for dental settings by Centres for Disease Control and Prevention. [2]

3. Until the COVID-19 vaccine is available, personal protective equipment (PPE) and infection prevention and control strategies will play a key role in prevention of transmission or cross-infection with (SARS)-CoV- 2 virus. A buddy system which involves a team of two or more persons who share responsibilities for his/her partner's safety and well-being in the context of (i) appropriately donning and doffing of PPEs, (ii) maintaining hand hygiene and (iii) taking requisite steps on observing breach of PPEs can be followed to ensure prevention of breach of infection prevention and control. In clinical set up the dentist and the auxiliary staff can act as buddy to ensure there is no breach in infection prevention control practices. [1]
4. Usage of PPEs, sanitization and disinfection at regular intervals, single use chair covers increases the cost of providing dental care to the patient, the increased cost can be shared by the patient and the dentist. Also, the government can provide fiscal support by providing subsidised quality PPEs,
5. Throughout this crisis the dental community has continued to work together in partnership with dental council of India and Indian dental Association to ensure the best quality education and treatment are available to dental students and patients respectively. It is also required that all the state and national level representative dental bodies keep work in tandem along with the government to mitigate the impact of COVID- 19.
6. Restructuring of dental education is needed to equip the dental graduates with technological and scientific advancements. Dental graduates should be skilled enough to diagnose basic health conditions or read ECG/CT scan, the focus should be laid more on teaching of evidence-based medicine and dentistry to enable them to better understand the co-dependence of dental health and overall health, thus, preparing them better in dealing with any medical emergencies in their practice and they can also be utilized in case of national health emergencies like COVID-19 to provide basic health care services.
7. Usage of tele-dentistry which is gaining a stronger foothold and changing the outlook of dentistry. Tele-dentistry can be incorporated as an adjunct into routine dental practice as it offers a wide range of applications like tele-triaging, teleconsultation, tele- diagnosis, telemonitoring etc.
8. Technological innovations in clinical practice. As we move towards resumption of routine dental care, we need to find creative ways to provide safe oral health care for patients.

There is uncertainty surrounding the timeline for the resolution of this pandemic and this health emergency will not be the last one the dental fraternity will be facing, thus we must be better equipped for any such health emergency in the future

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Original Research Article

Evaluation of root resorption after orthodontic treatment: A clinical study of contributory factors

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ABSTRACT

Introduction: The aim of this study was to evaluate the contributory factors of external apical root resorption.

Materials and Methods: Sixty subjects who had undergone complete orthodontic treatment were selected. The difference of the root length between pre and post-treatment was measured. The degree of root resorption was scored according to the index proposed by Levander and Malmgren.[1] The mean root resorption score (MRRS) was calculated. Mann Whitney test was done to compare the groups. Pearson correlation was applied.

Results: There was no statistically significant difference in root resorption among males and females. Tooth extraction was correlated with MRRS. Except for upper posterior teeth, the duration of treatment was positively correlated with MRRS. For overjet, there was a positive correlation between upper and lower anterior teeth and MRRS.

Conclusion: Orthodontic treatment should be carefully performed in patients who need extraction, great retraction of maxillary incisors and prolonged therapy.

1. Introduction

During orthodontic treatment, the movement of the teeth occurs inside the bony socket. Application of force to the teeth and their periodontium leads to remodelling of bone and cementum which helps in correcting the position and the malocclusion.[2,3]

External apical root resorption is defined as surface resorption with loss of cementum that is irreversible when involving dentin.[4,5] It is one the most common and undesirable iatrogenic effect of orthodontic treatment.[2,6,7] It occurs when the pressure on the cementum surpasses the reparative capacity of its cellular structures, exposing the dentine to activated odontoclasts causing irreversible loss of root structure.[8,9] Root resorption begins near hyalinised tissues. And, its pathogenesis is associated with the removal of the necrotic tissue from the periodontium that gets compressed by orthodontic forces.[9,10]

The normal function of a tooth is unaffected in mild cases of external apical root resorption, but in severe cases of external apical root resorption, orthodontic treatment should be stopped immediately as it allows the cementum to heal.[3,8]

Several studies have been done to find the contributory factors associated with external apical root resorption but still, it is difficult to predict whether the patient will develop it or not[11,12] The factors associated with apical root resorption, due to orthodontic treatment, can be either patient-specific or treatment specific.[7,10] Severe resorption is considered to be a loss of more than 4 mm or more than one-third overall root length and affects 15% of orthodontically treated patients.[9,13]

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Knowing the etiology of external apical root resorption would allow the clinicians to predict the incidence, location and severity of root resorption before the commencement of orthodontic treatment.[14]

Orthodontists are still continuously concerned about this situation, so the present study was aimed to evaluate the patient-related and treatment-related factors of external apical root resorption. Thus, the following study was conducted to evaluate the patient-related and treatment-related factors of external apical root resorption, to score the root resorption level in the subjects and to assess the risk factors of external apical root resorption.

2. Methods and Materials

The study was conducted in the Department of our institute in India.

2.1. Sample selection

Sixty patients (30 males and 30 females) who had undergone fixed appliance orthodontic therapy were selected according to the following criteria: complete records of the patients including pre and post-treatment panoramic radiographs and no relevant medical history in the past. Patients excluded were those who had undergone orthognathic surgery, cleft lip/palate patients, low-quality radiographs, history of systemic illness, history of tooth injury, history of impacted teeth or history of parafunctional habits.

2.2. Examination of records

Pre-treatment data were recorded including gender, age at the start of treatment, overjet, type of treatment (extraction or non-extraction) and treatment duration.

2.3. Examination of panoramic radiographs

Standardized Pre and Post-treatment panoramic radiographs of 60 patients were analysed. Root lengths of all maxillary and mandibular teeth from central incisors to first permanent molars were measured on the pre and post-treatment radiographs of all patients.

2.4. Root resorption measurement

A Digital Vernier calliper with an accuracy of 0.01 was used for measuring root length**.** Tooth length was measured as the distance from the root apex to the midpoint of the incisal edge or cusp tip**.** (Figures 1 and 2) Root resorption was calculated by the difference of the tooth length between the pre and post-treatment measurements. The tooth length was measured for the left and right central incisors, lateral incisors, premolars and first molars on both jaws.

The degree of external apical root resorption (EARR) was scored according to the index proposed by Levander and Malmgren[1] (Figure 3), using a 0 – 4 scale of severity, as follows:

Score 0: Absence of changes in the root apex

Score 1: Irregular root contour

Score 2: EARR of less than 2 mm

Score 3: EARR from 2 mm to one-third of the original root length

Score 4: EARR exceeding one-third of original root length

The mean root resorption score (MRRS) for every patient was calculated for four segments in each patient: upper anterior, upper posterior, lower anterior and lower posterior teeth, using the formula.[6]

$$Mean\ root\ resorption\ score = \frac{Sum\ of\ the\ scores}{Number\ of\ teeth}$$

2.5. Statistical analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences computer software (SPSS version 16.0) to analyse the data. Significance level was fixed as 5% ($\alpha = 0.05$). Shapiro-Wilks test was carried out to assess the normality of variables in the study. Descriptive statistics were performed for root resorption values recorded in groups. Mann Whitney U test was used to compare root resorption levels between male and female, and extraction and non-extraction cases. Bivariate correlation and analysis were undertaken between the type of therapy, duration, overjet, and MRRS after treatment. Using the MRRS as the dependent variable, and age, gender, type of therapy, overjet and duration of treatment as independent variables, multiple regression analysis was done.

2.6. Method error

The same observer performed all assessments of root resorption. Twenty patients were randomly selected and panoramic radiographs before and after orthodontic treatments were measured by the same examiner after a 10-day interval to determine reliability. The intra-class correlation coefficient between the 2 examinations was 0.93. The difference between the first and second measurements was not significant (Table 1).

3. Results

3.1. Demographic data

39 patients were treated with extraction and 21 without extraction. The average age of males was 16.05 ± 2.6 years and of females was 15.2 ± 3.5 years at the initiation of the treatment.

MRRS score was more in extraction cases as compared to non-extraction cases. Upper anterior teeth had more MRRS scores as compared to other teeth in both extraction and non-extraction cases(Table 2). Root resorption was compared on the basis of gender using the Mann Whitney

U test. Since the P-value was more than 0.05, there was no statistically significant difference in root resorption among males and female cases.(Table 3)Root resorption was also compared between extraction and non-extraction groups using the Mann Whitney U test. There was a statistically significant difference present between the two groups. ($P < 0.05$)(Table 4). Tooth extraction had a statistically significant correlation with the mean root resorption score. Except for upper posterior teeth, the duration of orthodontic treatment was positively correlated with MRRS. For overjet, there was a statistically significant correlation with upper anterior and lower anterior teeth MRRS (Table 5). MRRS was used as the dependent variable and age, gender, overjet, type of treatment (extraction or non-extraction) and duration of the treatment were taken as independent variables.

All factors, except age and gender, had a statistically significant correlation with root resorption. Treatment type had a positive correlation with root resorption upper anterior and lower posterior teeth. Treatment duration was correlated with upper and lower anterior teeth root resorption. Over jet had a correlation with the resorption of upper anterior teeth only (Table 6).

4. Discussion

External apical root resorption is a common side effect of orthodontic treatment. It is a sterile, local inflammatory process that induces shortening of the roots and weakening of teeth.[4,15] It has a multifactorial etiology. It might be occurring due to individual biology and the effects of mechanical factors. Root resorption is considered as clinically important when 1-2 mm of length is lost. Severe root resorption during orthodontic treatment (>5 mm) occurs very rarely just in 5% of patients.[1]

The mechanism of root resorption is not completely explored. According to Brudvik and Rygh, inflammatory root resorption induced by orthodontic treatment is a part of the process of elimination of hyaline zone.[16] It is considered that the occurrence of root resorption can be induced by the strong force through orthodontic treatment and hyalinization of periodontal ligament induced by increased activity of cementoclasts, osteoclasts. During tooth movement, areas of compression, where osteoclasts are inducing bone resorption and areas of tension where osteoblasts are inducing bone deposition are formed. Thus, a tooth moves towards the side of bone resorption. Any imbalance between bone resorption and deposition results in loss of protective characteristic of cementum which may contribute to the osteoclastic activity, resorbing areas of the root. Tooth root surface under the hyaline zone resorbs.[10,16,17]

Several studies have been done to find the contributory factors associated with external apical root resorption.[4,9,11,15] Patient-specific factors can be age, gender, type of malocclusion, oral habits like thumb sucking, genetics, the shape of the root, bone morphology, etc. Treatment-specific factors include extractions, the orthodontic technique used, treatment duration, amount and direction of force applied, type of tooth movement etc.[4,7,10,11,13]

The clinical diagnosis of root resorption is based mainly on routine radiographic procedures, such as periapical radiography, panoramic radiography, CBCT and CT scans. Periapical radiographs are widely used in dentistry, but however limited in their coverage of the maxilla-mandibular structures and multiple films are needed for a comprehensive examination.[6] Periapical films are accurate and localised but the amount of radiation exposure, a patient is subjected to, increases.[1]

Conventional extra-oral radiographs such as the lateral cephalogram can achieve better coverage, but anatomical structures of the facial skeleton that are not in the midline cannot be measured accurately because of distortion. Bilateral structures produce two images and it is difficult to differentiate between right and left sides.[6,7]

A panoramic radiograph is another commonly used radiograph that has overcome many limitations of extraoral radiography including controlled magnification in the vertical dimension, decreased overlapping of tooth contact areas and single point contact of the rotating beam onto the object to allow for a sharper, well-defined image. Panoramic radiographs are advantageous as the information of all teeth, dento-alveolar bone and jaws can be taken from a panoramic film**.**

CT scans and CBCT provide more accurate three-dimensional images of teeth.[7] However it has got limitations compared to conventional radiographs, which includes increased cost and amount of radiation. The effective dose of CBCT is 1.5 to 3.3 times higher than that associated with panoramic radiographs.

Therefore, in the present study, panoramic radiography was used for measuring root resorption because of three main reasons. They are:

1. A panoramic film is routinely ordered as the primary pre-treatment and post-treatment radiograph.
2. Less radiation exposure, less chairside time, less operator time and better patient co –operation.
3. Panoramic radiographs have the added advantage of displaying the entire maxilla-mandibular region on a single film. It provides increased coverage of the dental arches and associated structures, relatively undistorted anatomic images, reduced radiation dosage for the patient and simplicity of operation.

There are two methods to assess root resorption: one that measures the length of the root directly to determine the amount of root resorption, the other marks the degree of root resorption.[6] In this study, the difference between the total tooth length was measured for evaluating the amount

of root resorption. The same method was used by Jung et al., [17]

In this study, apical root resorption was classified according to widely accepted index proposed by Levander and Malmgren. [1] This method has been used in many root resorption studies performed after orthodontically induced tooth movement. This method does not depend on standardization of initial radiographs. [1,13]

In the present study, the factors associated with external apical root resorption were treatment involving extractions, longer treatment duration and greater overjet at the initiation of treatment. It was difficult to compare the prevalence and extent of external apical root resorption in our study with that of other studies because of the variations of methods and techniques employed. In this study, there was no statistically significant difference in root resorption among males and females. This is in contradiction to the results of studies done by Spurrier and Hall[6] who found females had more resorption than males. But it is in agreement with studies done by Linge and Linge, Jiang et al., and Jung et al. [6,17]

According to Linge and Linge, external apical root resorption was dependent on age. They found out that patients starting treatment after 11 years of age experienced significantly more root resorption than those starting earlier. The concept was that the root resorption increases with age because of reduced ability to repair root resorption in older patients. [6,14] But it is disapproved by Jung et al., and Han et al. [17,18] This study also showed no relationship between root resorption and the age of the patient.

In our study, anterior maxillary teeth proved more likely to present higher mean root resorption scores in both the extraction (0.44±0.21) and the non-extraction (0.40±0.19) groups than the teeth located in the mandibular arch. A similar finding was found in other studies. [13,17] Few studies [17,19,20] found that the maxillary central incisors were the most resorbed, with 27% undergoing greater than 1 mm of root resorption and premolars and canines were relatively unaffected. Proximity between the roots of maxillary central incisors and the cortical bone of the socket, the incisive canal and the alveolar bone on the buccal surface, combined with the type of movement may explain the higher incidence of severe root resorption these teeth. [13] Whereas in mandibular arch, the extraction space is usually used to relieve the crowding, so, the incisors might not be submitted to major retraction. [14]

According to the present study, the treatment duration (mean: 20.36 ± 6.2 months) was significantly correlated with external apical root resorption. This was in agreement with other studies, [3,6,13,14,17] although Linge and Linge [15] did not agree with this finding. Difficult treatment plans, appointment intervals and poor patient compliance act as confounding factors and increase the treatment duration which is related to external apical root resorption. [17 13]

In this study, the average treatment duration in the extraction group was 24 ± 4.2 months, longer than in the non-extraction group (14.4 ± 4.2 years). Also, the extraction group showed more external apical root resorption in comparison with the non-extraction group. According to Sharpe et al., the incidence of external root resorption was 3.72 times higher in the extraction group than the non-extraction group. [17] This can be due to the longer treatment time needed for finishing orthodontic treatment. It is assumed that the extraction of teeth could increase the amount of movement and treatment duration. [13,17] After doing multiple regression correlation analysis, the resorption of the upper anterior and lower posterior had a positive correlation with extraction cases ($P < 0.01$).

Overjet had a positive correlation with external apical root resorption in maxillary and mandibular anterior teeth in the present study. This can be because of the correction of large overjet. This finding can also be seen in some studies. [13–15] To correct large overjet, anterior teeth were moved long distances to reduce maxillary anterior protrusion and active torque with rectangular wires was also given, which resulted in external apical root resorption. but, according to Jung et al., there was no correlation between the overjet and root resorption. [17]

Fig. 1: Pre-treatment tooth length

Fig. 2: Post-treatment tooth length

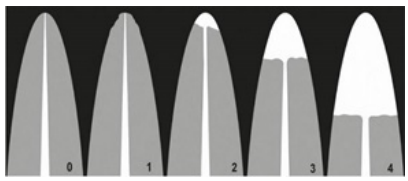

Fig. 3: Root resorption score Index - Levander and Malmgren

This study suggests that the orthodontic treatment should be carefully performed in patients who need an extraction,

Table 1: Intra class correlation coefficient

	Intra class correlation	95% Confidence Interval		F Test with true value 0			
		Lower bound	Upper bound	Value	df1	df2	Sig
Single Measures	.939	.906	.960	31.623	79	79	.000
Average Measures	.968	.951	.980	31.623	79	79	.000

Table 2: Average MRRS for different segments among extraction and non-extraction cases

	Upper anterior	Upper posterior	Lower anterior	Lower posterior
Non-extraction cases	0.40±0.19	0.11±0.15	0.23±0.25	0.04 0.04±0.07
Extraction cases	0.44±0.21	0.18±0.17	0.24±0.20	0.18±0.16

Table 3: Mann Whitney U test comparing MRRS among males and females.

MRRS	Upper anterior	Upper posterior	Lower anterior	Lower posterior
Mann-Whitney U	409.500	417.500	395.000	339.000
Z	-.622	-.514	-.845	-1.760
P value	.534	.607	.398	.078

a. Grouping variable: Gender

Table 4: Mann Whitney U test comparing Root resorption on the basis of the type of treatment.

MRRS	Upper anterior	Upper posterior	Lower anterior	Lower posterior
Mann-Whitney U	31.000	293.000	118.500	174.000
Z	-6.092	-1.931	-4.687	-3.914
P value	.000	.054	.000	.000

b. Grouping variable: Type

Table 5: Correlation coefficients of the bivariate correlation analysis between treatment type, duration, overjet and mean root resorption score after treatment for the upper and lower anterior and posterior teeth

Correlation coefficient	MRRS Upper anterior	MRRS Upper posterior	MRRS Lower anterior	MRRS Lower posterior
Type	0.802**	0.262*	0.585**	0.467**
Duration	0.819**	0.201	0.722**	0.296*
Overjet	0.502**	0.018	0.341**	0.159

**P<0.01 *P<0.05

Table 6: Correlationcoefficients of the multiple regression analysis of MRRS

	Upper anterior	Upper posterior	Lower anterior	Lower posterior
Gender	-0.08	0.04	-0.09	0.09
Age	-0.04	0.12	0.07	-0.13
Type	0.39**	0.25	0.05	0.578**
Duration	0.43**	0.07	0.64**	-0.15
Overjet	0.23**	-0.09	0.14	-0.39

greater retraction of maxillary incisors and prolonged therapy.

5. Conclusion

External apical root resorption is a relatively common iatrogenic outcome of orthodontic treatment, which can be seen in routine panoramic radiographs. Age and gender were not an influencing factor in root resorption. Overjet and overbite had a statistically significant correlation with post-treatment root resorption. There was a statistically significant difference between extraction and non-extraction groups for root resorption. There was a statistically significant correlation between treatment duration and the amount of root resorption: the longer the duration, the more severe the root resorption. Overjet greater than or equal to 5 mm had a statistically significant correlation with external apical root resorption.

6. Source of Funding

None.

7. Conflict of Interest

None.

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Original Research Article

Variations in mandibular coronoid process-A morphometric treatise

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ABSTRACT

Introduction: The Coronoid process is a triangular upward projection from antero-superior part of ramus of mandible giving attachment to two important muscles of mastication.
Aims: The aim of our study was to observe the variations in shape and size of coronoid process and establish the morphometric profile in Indian population.
Materials and Methods: The material for this study comprised of 500 adult human mandibles. The shape of coronoid process was observed and its height and length were measured.
Results: Three variants of coronoid process were observed (round, triangular and hook) with incidence percentage 46, 42 and 12 respectively. The mean value of height and length of coronoid process came out to be 60.62 mm and 12.53 mm respectively.
Conclusions: This morphometric treatise provides valuable inputs relevant for anthropological comparisons, forensic investigations and reconstructive procedures.

1. Introduction

Coronoid process in Greek means “like a crown”. In lower animals, separate coronoid bones are present which articulate with the splenial, angular and supra angular bones to form a common “dentary bone” which is homologous to mandible in humans.[1]

The coronoid process of mandible is of clinical significance for maxillofacial surgeons for reconstructive purposes as it is used as graft for reconstruction of osseous defects in oral and facio-maxillary region.[2] Anatomical variations in the coronoid process can result in extremely narrow vestibular space due the close proximity of the medial aspect of the coronoid process to the distal molar.[3]

The present morphometric treatise focuses on variant anatomy of the coronoid process in Indian population.The study provides baseline data for Indian population which has clinical implications and repercussions.

2. Materials and Methods

The material for the present study comprised of 500 adult human mandibles. These mandibles were obtained from the different medical colleges in the state of Punjab. Any mandible broken or dysmorphic were excluded from the study.

The coronoid height was measured as distance between the coronoid and most protruding portion of inferior border of the ramus of mandible (Figure 1).

The length of coronoid process was taken from the line tangential to the deepest part of mandibular notch to apex of the coronoid process (Figure 2).

3. Results

The shape of coronoid process was classified into 3 types: (Figure 3)

1. Triangular: tip pointing directly upwards
2. Rounded: tip rounded
3. Hook: tip pointing backwards

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Three incidence percentage for round, triangular and hook shaped coronoid processes came out to be 46, 42 and 12 respectively. The mean value of height and length of coronoid process was determined to be 60.62 mm and 12.53 mm respectively. (Tables 1 and 2)

4. Discussion

The coronoid process develops as a discrete entity within the mass of the temporalis muscle anlage, subsequently it unites with the main portion of mandibular ramus at approximately eight weeks of age.[4]The largest portion of temporalis muscle is attached to the apex, whole of the medial surface and anterior part of lateral surface of coronoid process. The remaining part of lateral surface provides attachment to anterior fibres of masseter. These two are important muscles of mastication which show morpho functional dependence.

Several authors have described the various shapes of coronoid process. According to which, some processes are triangular, hook shaped and rounded[5–7] whereas others have described it as beak shaped.[8] The shape and size of coronoid process is influenced by dietary habit, genetic constitution, hormonal and mainly by temporalis muscle activity.[9] In the present study, the incidence of the rounded shape was the highest followed by the triangular shape. In most studies in India the triangular shape was most commonly observed. In previous studies in Turkish population[10] and Bangladeshi population[11] the most common shape observed was the hook shape. (Tables 3 and 4)

The coronoid process projects upwards and slightly forwards. It has a top border and is convex in shape, while its lower part is concave in shape. Its margins and medial surface provide attachment to temporalis muscle. The coronoid process is suitable for paranasal augmentation. Its clinical application is also favourable because its size and morphology fits into the paranasal region, with the additional advantages of biocompatibility, availability, and reduced operation time for harvesting.[12,13] The present study focuses on the height and length of coronoid process of mandible with the aim to characterize the morphological profile of the coronoid process in Indian population. This will benefit dental surgery, anthropological and forensic practice.

Coronoid process enlargement may be seen in some pathological conditions like osteochondroma, exostosis, osteoma and other developmental anomalies. Though fracture of mandible is common, but incidence of coronoid fracture is rare (2%) and requires no treatment unless impingement on the zygomatic arch is present. Coronoid process hyperplasia is a very rare cause of mandibular hypomobility. So, it is usually underdiagnosed, but a thorough background anatomical knowledge can help in examining the patient clinically and radiologically.[14,15] This ultimately will help in the line of management and a better clinical outcome.[16]

The coronoid process can be removed intra-orally without any functional deficiency and facial disfigurement. It is expected that a knowledge of the morphometric profile of the coronoid process in different populations will aid the clinician in reconstruction procedures such as those pertaining to orbit floor, alveolar defects, paranasal sinus augumentation, non union fracture mandible, osseous defects reconstruction and other repair procedures in cranio-maxillo facial surgeries.[17,18]

Fig. 1: Showing measurement procedure for coronoid height

Fig. 2: AB is length of coronoid process

Fig. 3: Showing the triangular, hook shaped and rounded coronoid processes (left to right)

Table 1: Showing variations of shape of coronoid process in mandible

Shape	Number of Mandibles	Percentage Incidence
Triangular	210	42%
Hook Shaped	060	12%
Rounded	230	46%

* The coronoid process was rounded in the majority of cases (46%)

Table 2: Showing metric parameters related to coronoid process of mandible

Parameters	Mean Value	Standard Deviation
Height	60.62	5.95
Length	12.53	2.75

* Identifies the morphometric correlates pertaining to the coronoid process in the study sample

Table 3: Comparison of shape of coronoid process in different populations

Authors (Year)	Population	Triangular	Hook Shaped	Rounded
Khan TA and Sharieff JH[5] (2011)	South India	67%	30%	3%
Prajapati VP et al[6](2011)	Western Indians	54.17%	21.25%	24.58%
Desai VC et al[7](2014)	South-west Indians	136 (68%)	48 (24%)	16 (8%)
Pradhan S et al[1] (2014)	Eastern Indians	86 (46.73%)	33 (17.93%)	65 (35.3%)
Present study (2020)	Indians	210 (42%)	60 (12%)	230 (46%)

Table 4: Showing comparison of coronoid height of mandible in different populations

Authors (Year)	Population	Mean ± SD
Koyama M[12] (1965)	Japanese	98.27±5.2 (male) 91.85±5.6 (female)
Kumar MP and Lokanadham S[13] (2013)	South-east Indians	59.37±5.03
Sandeepa NC et al[14] (2017)	Saudi	74.18±5.78 (male) 63.28±5.06 (female)
Present study (2020)	Indians	60.62±5.95

5. Conclusions

Our study of coronoid process suggest that round shape is the most common presentation(46%) followed by triangular(42%) and then hook shaped(12%). This morphometric treatise provides valuable inputs relevant for anthropological comparisons, forensic investigations and reconstructive procedures.

6. Source of Funding

None

7. Conflict of Interest

None

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Original Research Article

Decoding the facial asymmetry

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ABSTRACT

Introduction: When degree of facial asymmetry is noticeable, it negatively affects facial and smile esthetics. It may due to discrepancies in size and position between cranial base and maxilla/ mandible. Asymmetry due to occlusal interference may result in functional shift of the mandible which usually poses a challenge. So diagnosis and functional examination are keys to an esthetic and stable outcome.
Objectives: This case report addresses the facial asymmetry in an adult patient who sought for improvement infacial appearance and occlusion.
Case Description: A 26-year old male patient reported with chief complaint of noticeable facial asymmetry and irregularly positioned teeth. Clinical examination revealed mild facial asymmetry. Intraorally patient showed crowding, non-coincident dental midlines, anterior cross bite, missing 23 and root stump 46. Starting point in diagnosis and treatment of this case was establishing centric relation through guiding the mandible into centric relation rather than centric occlusion. During functional examination we observed discrepancyin CR-CO which was confirmed using PA-Ceph in centric rest position. Treatment was planned as deprogramming splint followed by fixed mechanotherapy. Post muscle deprogramming we were able to achieve "true" anatomic relationship of the mandible to the maxilla.
Conclusion: Thus, the present case report aims at addressing important aspect of functional examination to be considered by the orthodontist while reaching an accurate diagnosis and treatment plan in such patient's with challenging asymmetry.

1. Introduction

The term "asymmetry" is used to make reference to dissimilarity between homologous elements. Asymmetry of the face and dentition is a natural phenomenon. Facial asymmetry is defined as a difference in the size or shape of the sides of the face.[1] The face often presents with a mild degree of asymmetry, also known as relative symmetry or subclinical asymmetry. Minor facial asymmetry is common and can be observed in every individual.[2] Facial asymmetries can be classified as either developmental (agenesis, hypoplasia, or hyperplasia of the facial bones) or acquired (resulting from trauma, infection, or functional shifts).[3] Functional shift due to CR-CO discrepancy is challenging type of malocclusion for orthodontists. It is clinically characterized by facial asymmetry. There is a general agreement within the dental professional regarding achieving the ideal functional occlusion for our patients: centric relation. Centric relation (CR) can be termed as a musculoskeletal position which is anatomically determined and is repeatable as well as reproducible. On the other hand, centric occlusion (CO) or maximum intercuspation is a dental determined position. The mandible will shift (pathological or laterotrusion with secondary effects like abrasion) from CR to CO whenever the teeth make contact, if the dental occlusion is not stabilized in centric relation. Treating our patients in this position is one of our biggest challenge in orthodontics. This will provide long-term stability, improved functionality and esthetics, healthy

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muscles and joints. Thus, the present case report aims at addressing important aspect of functional examination to be considered by the orthodontist while reaching an accurate diagnosis and treatment plan in such patient's with challenging disharmony.

1.1. Diagnosis and etiology

A 26 year old male patient reported to the Department of Orthodontics with the chief complaint of noticeable facial asymmetry and irregularly positioned teeth. Clinical examination revealed facial asymmetry with mandibular shift to the right side, straight profile (Figure 1). On manipulation to centric relation (CR), the interference was spotted on the lower anterior tooth region. To avoid this interference the patient habitually shifts the mandible to the right, distracting the condyles Facial midline was not coinciding with dental midline which is shifted towards left. The lower midline was shifted approximately 3 mm to the right (Figure 2)**.**

Intraorally the patient showed crowding, non-coincident dental midlines, and class I molar on left side and anterior cross bite, congenitally missing 23 and root stump in relation to 46 (Figure 3).

Cephalometric analysis (Table -1) showed skeletal a class III relation, horizontal growth pattern, right laterognathia, retroclined upper incisors and upper lip retrusion (Figures 4, 5 and 6).

1.2. Treatment Objectives

Masseter and Temporalis are the key players in the action of mastication and in cases with CR-CO discrepancy the forces generated by the muscular activity changes. Thus muscle deprogramming can be used to induce a forced relaxation of the temporalis, masseter and pterygoid muscles allowing the temporomandibular joints to rest in a functionally comfortable position in the glenoid fossa. This functional asymmetry is reversible if caught in time and treated with bite plane therapy or permissive splint therapy. So muscle deprogramming to eliminating functional shift of mandible, correct CR-CO discrepancy and anterior cross bite was done in this patient. For most orthodontists, splint treatment prior to fixed appliance treatment would help to achieve accuracy of dental decompensation and long term stability by establishing a functional occlusion with healthy temporomandibular joints.

1.3. Treatment procedure and progress

Treatment began with full-time wearing of a deprogramming splint. The splint was made according to acentric bite registration. The dental casts were then mounted on a semi adjustable articulator (Figure 7). A full maxillary coverage splint with a flat occlusal plane touched every buccal cusp or incisal edge of the mandibular teeth (Figures 8, 9 and 10). After deprogramming, the patient's face looked more symmetric than pre-treatment (Figure 11). The new mandibular position(Figure 12) was then retained by bite-blocks (Figure 13).

Fig. 1: Pre-treatment extra oral photographs

Fig. 2: Pre-treatment Intra oral photograph

Fig. 3: Pre-treatment Intra oral photograph

Fig. 4: Pre-treatment lateral cephalogram

2. Discussion

The face often presents with a mild degree of asymmetry, also known as relative symmetry or subclinical asymmetry.

Fig. 5: Pre-treatment PA-Ceph

Fig. 6: Pre-treatment OPG

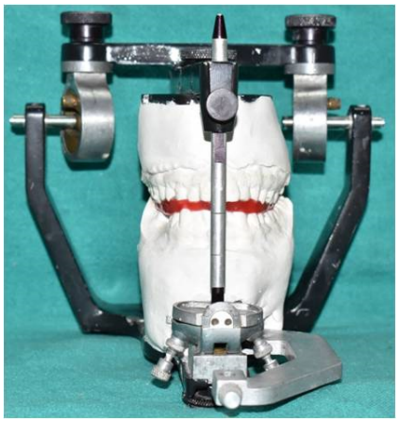

Fig. 7: Articulator mounted models

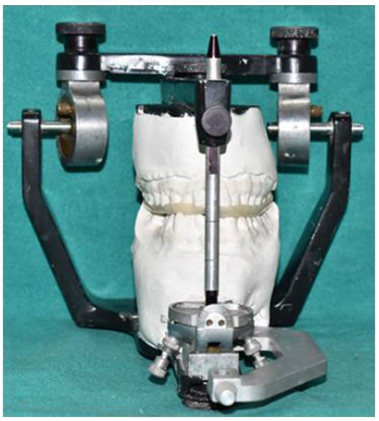

Fig. 8: Casts with maxillary splint

Fig. 9: Cold-cure acrylic maxillary splint

Fig. 10: Cemented maxillary splint

Minor facial asymmetry is common and can be observed in every individual. Facial asymmetries can be classified as either developmental (agenesis, hypoplasia, or hyperplasia of the facial bones) or acquired (resulting from trauma, infection, or functional shifts).[4] Functional shift due to CR-CO discrepancy is challenging type of malocclusion for orthodontists. In present casefacial asymmetry was due to functional shift. Patient had a CR-CO discrepancy resulting from the MFS which was caused by the discrepancy of the dental arch forms and the occlusal interferences. His mandible was forced to shift to the right to establish a workable occlusion; this suggested

Fig. 11: Extra oral post splint photograph

Fig. 12: Intra oral post splint photograph

Fig. 13: Bracket placement and the adhesive bite-blocks

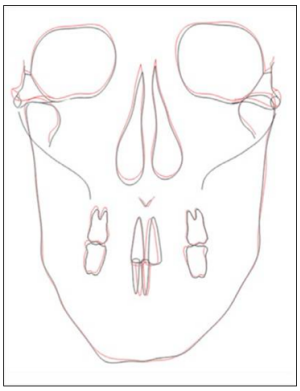

Fig. 14: Pre-post operative postero-anterior cephalometric superimposition

that the adaptive mandibular position and occlusion were established as compensation to the mandibular functional shift (MFS) and occlusal interference which resulted in skeletal asymmetry. Following the use of deprogramming splint which repositioned the laterally shifted mandible back to its physiologic position; which helped the mandibular midline to coordinate with the facial midline. The patient's style of opening became normaland stable functional occlusion was achieved with no occlusal interference. Similar studies by Wood et al. (2002)[4] on the importance of the seated condylar position in orthodontic correction they found thatfulltime wearing of the splint would eliminate the impact of dental interference and would allow physiologic condylar seating. McKee et al.[5] in 2005 compared condylar positions achieved through bimanual manipulation to condylar positions achieved through masticatory muscle contraction against a deprogrammer splint which showed good stability, suggesting that the combination of splint and fixed appliance treatment is an effective method for treating MFS. Kusayama et al.,[6] in 2003 compared the relationship between transverse dental anomalies and skeletal asymmetry and stated that primary goal of treatment is to eliminate the asymmetry. If this remains during orthodontic treatment, the dental midline deviation and facial asymmetry would also remain while occluding. However, McKee (2005)[5] evaluated articulated models in the seated condylar position from a deprogrammed population reported that condylar displacement may increase after splint treatment. According to Bryndahl et al.,[7] at the habitual occlusal position, the patient is able to make more occlusal contacts but at the cost of the health of the TMJ and muscles of mastication. If left unattended the patient may ends up in TMD with derangement of condyle disc assembly. The deprogramming splint given to the patient to deprogram the muscles from this distracted position and to move the condyle to a more optimal and stable position. So the objective should be to establish centric occlusion (CO) in CR position (CR = CO). The outcome of splint treatment in our case was satisfactory: the patient's face became symmetric, and the MFS was corrected. This meant that no intermaxillary elastics were needed to correct the midline discrepancy during fixed appliance treatment. According to McLaughlin et al.[8] as long-term wearing of intermaxillary elastics might damage the TMJ, avoiding their use will benefit the stability of the newly acquired mandibular and condylar positions. However, the positions were not stable because there was only one contact point in the right canine region, and all teeth on the left side were contacting cusp to cusp. Therefore, we used an adhesive bite-block in the posterior area to hold this new mandibular position.For an inexperienced orthodontist, if the shifted mandible is not repositioned before fixed appliance treatment, the correction of maxillary arch form compensation will be difficult and inaccurate.

3. Conclusion

Facial and dental asymmetries are a difficult problem to treat which makes a comprehensive diagnosis based on precise and detailed information In spite of the fact that in some cases with facial asymmetry orthognathic surgery may be indicated at the beginning of treatment, for considerable improvements in facial and dental esthetics but in our case careful functional examination helped us to successfully manage the facial asymmetry with Class III malocclusion with cross bite by deprogramming the muscles. Thus, the present case report aims at addressing important aspect of functional examination to be considered by the orthodontist while reaching an accurate diagnosis and treatment plan in such patient's with challenging asymmetry.

4. Source of Funding

None.

5. Conflict of Interest

None.

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Case Report

MTA apexification as a savior of questionable tooth: A Case report

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ABSTRACT

Treatment of traumatized immature teeth poses a challenge for clinician. Apexification is considered to be the treatment of choice for non-vital young permanent teeth. The present report, highlight the case of traumatized young permanent tooth where apexificationwas achieved in a previously endodontically treated tooth. Endodontic treatment of immature permanent teeth without apical barrier leads to failure of treatment due to incomplete sealing of the canal. Also, the success of endodontic treatment is determined by the quality of obturation. In wide canals, traditional obturating technique may result in spaces being left in the canal space. Obturation using rolled cone technique to achieve a good seal is used in the present case.

1. Introduction

Trauma to anterior teeth is common during childhood. Traumatic injury to young permanent teeth accounts for almost 30% of the trauma in children.[1] The diagnosis and treatment of immature permanent tooth which is followed by traumatic injury is a challenge for clinician. Traumatic injuries often result in pulpal inflammation or necrosis which hampers the development of dentinal wall and root apices in immature tooth, resulting in short roots (altered crown root ratio) with very thin walls producing a greater risk of fracture.[1–3]Obturation of tooth with blunder buss canal is considered difficult due to lack of apical barrier resulting in a seepage for bacteria and toxins to leach out to the periapical space.[4,5]

Apexification is considered to be a choice of treatment in such cases where young permanent tooth is traumatized and apical barrier is to be achieved. Initially, calcium hydroxide was used as the material of choice, however recently mineral trioxide aggregate (MTA) has gained a lot of popularity as material for apexification. MTA has superior properties than calcium hydroxide.[6]

In the present case report, the authors highlights achieving apical seal with MTA and obturation of root canal with rolled cone technique as a retreatment modality in a failed RCT treated tooth.

2. Case Report

A 17 year old female patient reported with a chief complaint of sharp, shooting pain in upper front region since 4 months. Patient gave the history of trauma 10 years back and treatment of the same tooth 4 months back. No relevant past medical history was reported by the patient. On examination, tooth 11 was discolored, fractured and tender on percussion (Figure 1 A). A provisional diagnosis of Ellis Class IV fracture with respect to tooth 11 was made. On radiographic examination, root canal space was found to be filled with radiopaque material suggestive of an attempted root canal treatment (RCT) previosuly (Figure 2 A).

Re-RCT was planned for the patient. In first appointment, guttapercha (GP) points were removed from the canal using H-files. While removing GP points, there was profuse bleeding from the canal. Radiograph was repeated on removal of GP points. Radiograph revealed open apex and very thin dentinal walls (Figure 2 B). After removal of GP points, canal was irrigated with 2.5% sodium hypochlorite

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and 2% chlorhexidine followed by placement of calcium hydroxide powder mixed with saline as an intracanal medicament for 1 week.

In second appointment calcium hydroxide was removed followed by irrigation of canal, drying of canal and placement of MTA. MTA was placed at the apex to obtain apical seal and also on the lateral walls of the root canal as dentinal walls were very thin (Figure 2C). Temporary dressing was given and patient was recalled after 3 days. In third appointment, temporary restoration was removed, canal was dried followed by obturation with rolled cone technique and composite build up (Figure 2 D and Figure 1 B).

Though the tooth had poor prognosis owing to very thin dentinal walls and even discontinuity in the canal walls, an attempt was made to save the tooth as the patient insisted for the same and the patient was recalled on regular follow up. Patient was asymptomatic till 6 months, then composite veneer was placed after 6 months of obturation and was advised for placement crown. To achieve esthetic cervical margins, crown lengthening was performed using diode laser (Figure 1 C) followed by tooth preparation (Figure 1 D) and placement of composite over it (Figure 1 E).

After 1 year also, patient is asymptomatic and composite veneer was not replaced by crown due to unwillingness of the patient.

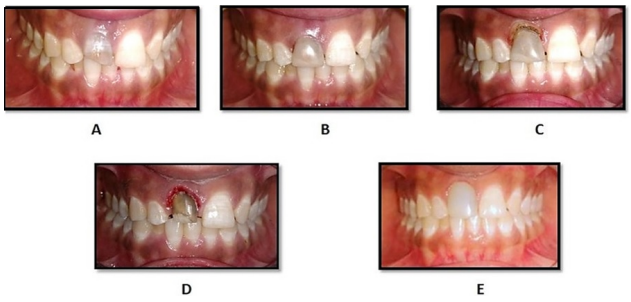

Fig. 1: Intraoral photographs showing: A: Pre-operative; B: Composite build up; C: Crown lengthening using diode laser; D: Crown preparation for composite veneer; E: Placement of Composite veneer

3. Discussion

Apexification is a process of forming a mineralized apical barrier in immature non-vital young permanent teeth.[7] Till 1966, surgical approach was used in the clinical management of the "Blunder buss" canal for achieving of an apical seal using retrograde barrier formation technique for fragile and flaring apex. However, this approach further used to reduce the root length resulting in an unfavorable crown-root ratio.[1,8] Thus, apexification is the treatment of choice for necrotic young permanent teeth. The goal of apexification is to obtain an apical barrier to prevent the passage of toxins and bacteria into periapical tissues from root canal.[1,5] Afailure to do so may result in failure of treatment.

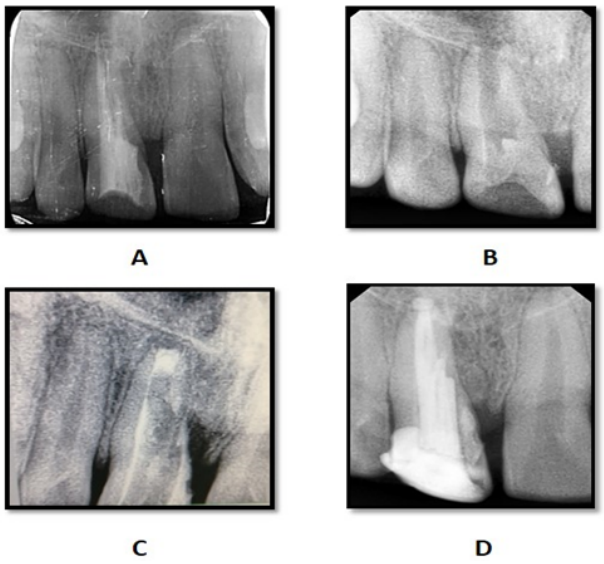

Fig. 2: A: Pre-operative radiograph; B:Radiograph after removal of GP; C: Radiograph showing Placement of MTA on apex and lateral walls of canal; D: Radiograph showing obturation using rolled-cone technique

Literature reports the use of various materials for apexification, such as calcium hydroxide in combination with sterile water, saline, local anesthetic, CMCP,[9] zinc oxide paste with cresol and iodoform,[10] polyantibiotic paste and tricalcium phosphate,[11] biodentine and MTA. Amongst these, the Most commonly used are calcium hydroxide, and MTA.

MTA as a one-step technique is gradually replacing the traditional use of calcium hydroxide to achieve apexification. Calcium hydroxide can alter the mechanical properties of dentin thus making the tooth more susceptible to root fracture.[3,12] MTA is a biocompatible material and also helps in the formation of bone and periodontium around its interface.[4,13] A case series by Güneş B et al. (2012) reported supreme healing of the apical lesions and the regeneration of peri-radicular tissues after 1 year and 18 months follow up of MTA apexification.[14]

MTA has advantages over other materials owing to less leakage, better antibacterial properties, high marginal adaptation and short setting time (4 h). MTA provides scaffold for hard tissue formation by stimulating the release of interleukins and cytokines.[14] In the present case very thin dentinal walls were present, thus, MTA was chosen as the choice of material as it promotes hard tissue formation, which increases the fracture resistance of the teeth.

The aim of the root canal filling is to achieve a hermatic seal. In cases of wide canals, instead of the lateral

condensation other methods of obturation may have to be employed.These include, constructing a custom guttapercha point or use of one of the heated guttapercha techniques.[15] Custom made roll cone technique is advised in case of blunder buss canal. A large master cane was prepared by heating several large gutta percha cones and rolling the mass between two glass slabs. The complete sealing of root canal is ensured through a radiograph. Uneventful healingwas observed after a period of 1 year.

4. Conclusion

Apical seal using mineral trioxide aggregate resulted in apical plug formation and reinforcement of the thin dentinal walls at the apex. Thus, increasing the prognosis of the tooth. The treatment of young permanent tooth poses a challenge for dentist. The success of the treatment depends upon an appropriate diagnosis and treatment planning.

5. Source of Funding

None.

6. Conflict of Interest

None.

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Case Report

Multiple odontogenic keratocyst: A case report and review of literature

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ABSTRACT

Odontogenic keratocysts (OKCs) may occur in two different forms, either as solitary (non syndromic OKCs) or as multiple OKCs (syndromic OKCs). Multiple OKCs are usually associated with Gorlin–Goltz syndrome with features like skin carcinomas and bifid ribs, eye, and neurologic abnormalities. We report a rare case of Gorlin–Goltz syndrome in a 35-year-old male patient who presented with a swelling in lower left back teeth region since 1 week. Apart from these, other findings observed in the patient were frontal bossing, depressed nasal bridge, ocular hypertelorism, prominent supra orbital ridge, and mild mandibular prognathism. On the basis of clinical and radiological evaluation, Enucleation was planned in all the three quadrants and histopathological evaluation revealed multiple OKC's. Patient was followed-up multiple times for the duration of six months. This case report highlights the important findings and presentation of a rare case of Gorlin Goltz syndrome along with its review of literature.

1. Introduction

Odontogenic keratocysts (OKCs) are cysts of developmental origin arising from remnants of dental lamina.[1] They may appear either as single entity or as multiple cysts associated with syndromes like Gorlin–Goltz syndrome.[2] Jarish and White (1984) first reported this syndrome and later, Gorlin and Goltz documented other features such as multiple jaw cysts, nevoid basal cell carcinomas (BCCs), bifid ribs, and other features; hence, this lesion is called Gorlin–Goltz syndrome or basal cell nevus syndrome or jaw cyst bifid rib syndrome, or multiple nevoid BCC syndrome.[3] This lesion is inherited as autosomal dominant trait and is characterized by total penetrance and variable expressivity. Diagnosis is based upon established major and minor clinical and radiological criteria and ideally should be confirmed by DNA Analysis[1,3].

Various treatment modalities have been suggested in literature for multiple OKCs. For small lesions enucleation is preferred and for larger lesions marsupialization is preferred. After surgical enucleation, the application of Carnoy's solution has been suggested to prevent recurrences. Complete treatment of syndromic OKCs involves a team of dental, medical, and genetics specialties. A periodic follow-up is recommended for these lesions due to their high recurrence rates.[4,5] This paper is presenting a rare case of Gorlin–Goltz syndrome with a brief discussion about its pathogenesis, diagnostic criteria, and differences between syndromic and asyndromic OKCs.

2. Case Report

A 35-year-old male patient reported to the department of Oral Medicine and Radiology with a chief complaint of swelling in the left mandibular posterior region since 1 week. The swelling was initially smaller in size and gradually increased to attain the present dimensions. The history revealed that patient had undergone extraction of 37 due to deep caries from a dentist 1week before, which was

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followed by a swelling in the same region. The patient's past medical history is not associated with any relevant findings. All the vital signs were in normal range.

On Extra oral examination; frontal bossing, depressed nasal bridge, ocular hypertelorism, prominent supra orbital ridges and mild mandibular prognathism were observed (Figure 1). Intra-orally, there was a diffuse swelling noticed involving the vestibular sulcus extending from mesial aspect of 33 till the mesial aspect of 36 tooth; measuring about 1.5 cm × 2 cm in size. There were no signs of any perforation and pus discharge. On palpation, all the inspectory findings were confirmed; swelling was firm and tender with normal overlying mucosa. On Intraoral examination no other areas showed evidence of swelling but mild vestibular tenderness was observed in the 2^{nd} and 4^{th} quadrant on palpation. Based on clinical examination, a provisional diagnosis of benign odontogenic cyst was given. (Figure 1).

A radiographic examination was carried out that comprised of a panoramic and specialized imaging Cone Beam Computed Tomography (CBCT) scan. On evaluation, OPG revealed multiple well defined radiolucencies in the mandibular and maxillary region. A large well defined, corticated, multilocular radiolucency with curved septa and scalloped borders was noticed in the mandibular anterior region crossing the mid-line wrt 41, 31,32,33,34, 35and 36. Second, well defined radiolucent lesion can be appreciated at the left angle of the mandible in 38 region of approx 1x1.5cm in size. Third well defined, corticated radiolucent lesion of approx 2X2.5cm in size can be appreciated in #48 region involving anterior aspect of ramus. (Figure 2). Fourth, a mixed radiolucent and radiopaque lesion of approx 1x1.5cm in size can also be appreciated on the left posterior region of maxilla wrt 27 and 28.

3. CBCT Report: (Figures 3 and 4)

3.1. Right ramus

1. A well-defined ovoid unilocular radiolucent non-expansile lesion is noted in right
2. Inferior - ascending ramus regions. Margins are distinct and corticated.
3. The lesion measures approx. 1.7cm x 0.9cm x 1.4cm in greatest antero-posterior, transverse and supero-inferior dimensions.
4. There is thinning of adjoining mesial – lateral cortices of right ramus.
5. The internal structure is radiolucent without internal calcifications or septae

3.2. Left Symphysis – Parasymphysis of Mandible

1. A well-defined ovoid corticated unilocular non-expansile osteolytic radiolucent lesion is noted from mandibular midline till the #35 region .
2. Lesion extends from mesial peri-radicular & apical peri-radicular region of #31 till the distal peri-radicular & periapical region of #35 with distinct – corticated margins.
3. The lesion measures approx. 2.9cm x 1.0cm x 1.9cm in greatest antero-posterior, transverse and supero-inferior dimensions.
4. There is thinning-scalloping of adjoining labio-buccal-lingual cortices with intermittent effacement of the labio-buccal cortex in #31 – 33 regions.
5. The internal structure is radiolucent without internal calcifications or septae.
6. Obvious root divergence of #32 & 33 noted; however, associated teeth show largely intact root outlines.
7. Acute disto-buccal dilaceration of apical third of #35 root also seen.

3.3. Left Body of Mandible

1. A well-defined ovoid corticated unilocular non-expansile osteolytic radiolucent lesion is noted in #36 region from mesial peri-radicular & apical peri-radicular region of #36 till the distal periradicular & periapical region of #36, with distinct – corticated margins.
2. The lesion measures approx. 1.8cm x 1.1cm x 1.3cm in greatest antero-posterior, transverse and supero-inferior dimensions.
3. Focal contiguity of the lesion to anterior left parasymphysis-symphysis lesion is noted in distal #35 areas.

3.4. Left body-ramus

1. A partially well-defined irregular shaped, unilocular radiolucent non-expansile lesion is noted in left posterior body-ramus regions with an elongated superior partially corticated part and a small ovoid inferior corticated part.
2. The medial – superior margins of the superior elongated part of lesion are deficient or indistinct.
3. Lesion extends from lingual peri-radicular area of #37 socket & pericoronal region of #38 till inferior – ascending left ramus regions of mandible, measuring app. 3.5cm x 0.9cm x 3.0cm in greatest antero-posterior, transverse and supero-inferior dimensions.
4. Thinning-effacement of the lateral cortex of left IAN and lateral displacement of the IAN noted in relation to the corticated inferior component of the lesion.
5. The internal structure is radiolucent without internal calcifications or septae.

Radiographic Diagnosis of Multiple OKCs with presence of Odontome in left posterior region of maxilla was made. After the radiographic evaluation,, patient was advised to go for chest and skull x-rays.

With a provisional diagnosis of multiple odontogenic cysts, an enucleation of the cysts was performed under General Anesthesia. Microscopic examination showed a parakeratinized corrugated stratified squamous epithelium cystic lining that is thin, folded, and collapsed. The cystic lining appeared 3–4 layer thick without any rete ridges. Basal layer showed intensely basophilic palisaded arrangement of nuclei. Underlying connective tissue stroma reveals presence of odontogenic island undergoing keratin formation. Diffuse chronic inflammatory cells were also seen.(Figures 5 and 6)

Based on the histopathological findings, a diagnosis of keratinizing cystic odontogenic tumor in relation to lower right and left posterior teeth region was made. After evaluating clinical, radiological, and histopathological confirmation, a final diagnosis of Gorlin–Goltz syndrome was given.

It was decided to carry on the treatment of the patient after seeking the medical opinion. We planned for removable prosthetic rehabilitation after the excision of the lesions. The patient was referred to Department of oral surgery for further treatment.

Fig. 1: Profile and intraorally

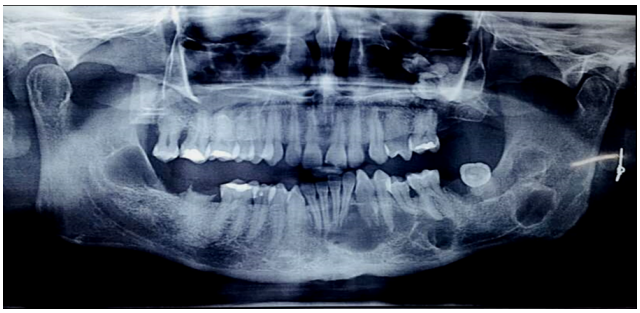

Fig. 2: OPG

4. Discussion

Gorlin–Goltz syndrome is usually associated with multiple OKCs as its first manifestation; hence, dentists have an important role in its early detection thereby achieving proper management of this syndrome.[6] Studies have been documented with an incidence of about 1 in

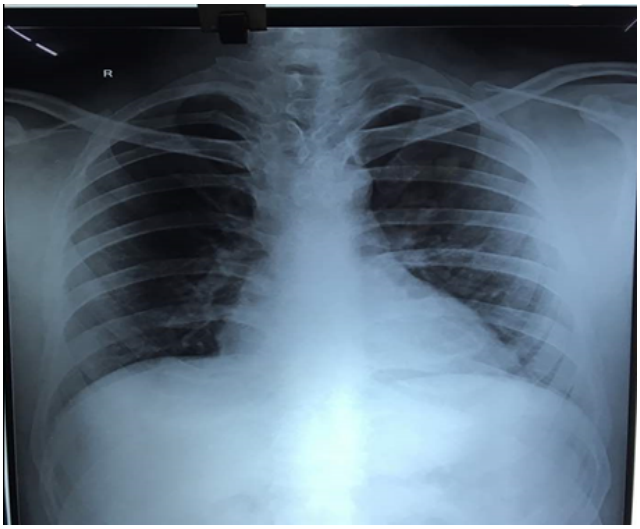

Fig. 3: Chest X-ray

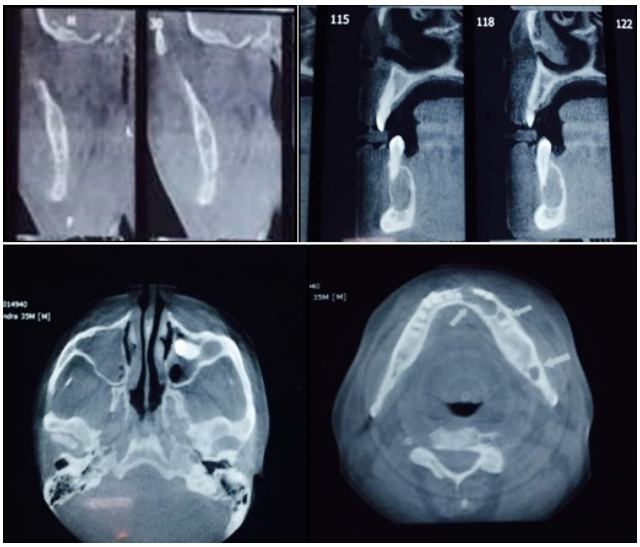

Fig. 4: CBCT Images

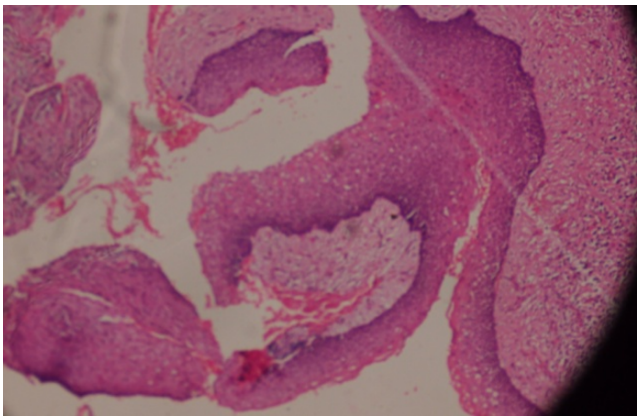

Fig. 5: Parakeratinized palisaded corrugatede pithelium

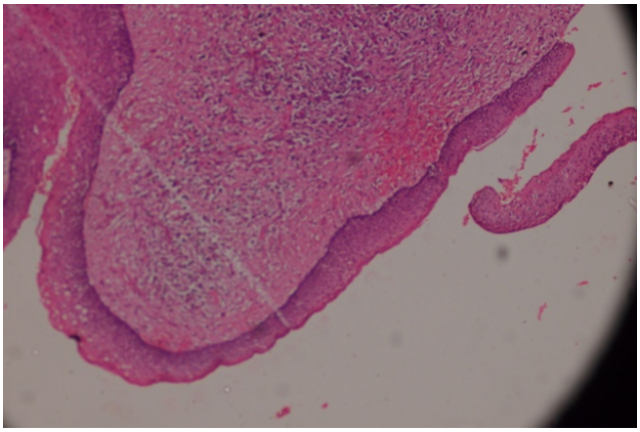

Fig. 6: Islands invading in connective epithelium

50,000–150,000.[7] Apart from Gorlin–Goltz syndrome, multiple OKCs are seen in other syndromes. The lesion is inherited in a dominant pattern. The pathogenesis revealed mutation of the protein patched homolog (PTCH) gene, which is mapped to 9q21-23 chromosome. The genetic studies show that in this syndrome there is an abnormal hedgehog signaling pathway. PTCH acts as a receptor for sonic hedgehog gene, having a primary role in embryogenesis. PTCH is shown to have two constituents. Smoothened (Smo) has a role in cell growth and differentiation and in hedgehog signaling pathway, Hh binds to the other component Patched (etc) and releases Smo. PTCH gene mutation results in abnormal hedgehog signalling, which is unable to bind to PTC, thus inhibiting Smo thereby affecting cell growth and differentiation and may result in abnormalities such as neoplasms and others.[7,8]. Gorlin–Goltz syndrome shows a spectrum of clinical manifestations that can be broadly put in six categories Table 1.

Table 1: Clinical manifestations of Gorlin- Goltz syndrome

Anomalies	Manifestations
Cutaneous	Basal cell nevi, basal cell carcinomas, benign dermal cysts and tumors, dermal calcinosis, and palmar and plantar keratosis
Dental	Multiple OKCs, mild mandibular prognathism
Osseous	Frontal bossing, bifid ribs, spina bifida, kyphoscoliosis, and brachymetacarpalism
Eye	Hypertelorism, congenital blindness, and internal Strabismus
Neural	Dural calcification, mental retardation, and Medulloblastoma
Sexual	Hypogonadism, ovarian tumors

These clinical manifestations are categorized into major and minor diagnostic criteria. Evans et al., and Kimonis et al., suggest that to diagnose a patient to have Gorlin–Goltz syndrome, two major or one major and two minor criteria should be present Table 2.

Table 2: Major and minor diagnostic criterion of Gorlin–Goltz syndrome

Major criteria	Minor criteria
Multiple basal cell carcinomas or one BCC below 20 years	Macrocephaly (adjusted for height)
Multiple OKCs	Congenital malformation: Cleft lip or palate, frontal bossing, and moderate or severe hypertelorism
Three or more palmar or plantar pits	Other skeletal abnormalities: Sprengel's deformity, marked pectus deformity, marked syndactyly of the digits
Bilamellar calcification of the falx cerebri	Radiological abnormalities: Bridging of the sella turcica, vertebral anomalies such as hemivertebrae, fusion or elongation of the vertebral bodies, modeling defects of the hands, and feet or flame shaped hands or feet
Bifid, splayed, or fused ribs	Medulloblastoma
Close relative having syndromic OKCs characteristics	Ovarian fibroma

In our patient, the diagnosis was confirmed as he matched two major criteria (multiple OKCs, splayed ribs,) and five minor criteria (frontal bossing, nasal bridge depressed, ocular hypertelorism, prominent supra orbital ridge, and mild mandibular prognathism).[8–10]

Gorlin–Goltz syndrome is usually seen in younger age group with a range between 10-30 years. Our patient was 35 years old. Generally, females are predominantly affected, whereas ours was a male patient. The multiple OKCs for Gorlin–Goltz syndrome is frequently found in maxillary molar area; our case presented with multiple cysts bilaterally at posterior mandible, ramus area and maxillary molar area.[9,11]. Radiologic characteristics of OKCs show unilocular, well-defined radiolucent lesions, usually associated with unerupted tooth. But, Our case showed unilocular radiolucency in relation to right and left mandibular third molars region along with ramus area and maxillary left posterior region. Generally, "multiple cysts" means the presence of more than one cyst at a time, whereas in this case multiple cysts means presence of more than one cyst in one's life time.[1,11,12] Histologically, OKCs show corrugated para- or orthokeratinized surface, almost equal uniform thickness of the epithelium, basal cells showing tomb stone or picket fence arrangement. The presence of daughter or satellite cells in the underlying connective tissue can be seen which shows more recurrence rate. Parakeratotic

OKCs are more common and more aggressive than orthokeratotic OKCs. In case of Gorlin–Goltz syndrome, parakeratotic OKCs are seen. The major differences between OKCs associated with Gorlin–Goltz syndrome and solitary OKCs are listed in (Table 3). [12,13]

Table 3: Differences between syndromic OKCs and solitary OKCs

Feature	Syndromic OKCs	Solitary OKCs
Age	Younger individuals	Middle or older aged individuals
Cysts	Multiple in number	Single
Site	Maxillary posterior region commonly	Mandibular posterior region
Recurrence rate	Higher (82%)	Lower (61%)
Epithelium	Less thickness	More thickness
Odontogenic islands	More frequent	Less

Our case showed three to four layered thick parakeratinized corrugated stratified squamous epithelium and presence of Odontogenic Island in underlying connective tissue. OKCs are usually removed out by either enucleation or marsupialization. Carnoy's solution is used to prevent the recurrence of these cysts. We treated cysts by enucleation with adjuvant application of Carnoy's solution. The studies have shown that multiple OKCs are detected almost 10 years before the appearance of other symptoms of Gorlin–Goltz syndrome. Hence, a dentist plays an important role in documenting this syndrome as he will be the first person to observe the oral findings and predict occurrence of syndrome in future. An interdisciplinary approach is required for the comprehensive treatment of this syndrome as well as genetic counseling. [12,14]

5. Conclusion

A rare case of Gorlin–Goltz syndrome that showed its uniqueness in that it was seen in a male patient and the site of the cysts was bilaterally at posterior mandible and ramus area which is not commonly seen. We suggest that patients with multiple OKCs should be thoroughly evaluated as they are the major component of Gorlin–Goltz syndrome and early findings of this syndrome. These patients should be followed for a long time with proper medical care and genetic counseling so as to prevent the development of other complications such as malignancies.

6. Source of Funding

None

7. Conflict of Interest

None.

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Case Report

Treatment of angular bone defect using flap with GTR membrane and bone graft substitute with 1 year follow up: A case report

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ABSTRACT

Aim: The aim of this study was to evaluate the efficacy and the role of a resorbable membrane Guided Tissue Regeneration (GTR) with a bone graft substitute in the management of angular bone defect.
Methodology: An angular bone defect of 10 mm was evident between the maxillary second premolar and first molar. After proper debridement, the defect was filled up with a bone graft substitute and covered with a resorbable GTR membrane.
Results: The site showed significant bony fill at the end of 9 months with the reduction in probing depth. The results were well maintained at the time of last follow- up which was 1 year post-operatively.
Conclusion: In this case, where angular defect was associated with localised periodontitis, good results were obtained with bone fill in relation to probing depth reduction. The results were excellent and stable till the last follow up at 1 year.

1. Introduction

Periodontitis is an oral infectious disease. Periodontitis involves gingival inflammation, clinical attachment loss, alveolar bone resorption and, periodontal pocket formation.[1,2] Hence, periodontal regeneration is the main objectives of any periodontal therapy which also restores the alveolar bone, cementum, and periodontal ligament.[3,4]

The treatment of periodontitis with bony defect using bone graft substitutes has been widely reported and reviewed. Bone Grafts studies with true periodontal regeneration has not been concluded. This has made researchers constantly discuss newer materials which could give better results and help in regenerating the lost periodontium.

Melcher studied and reported that the infill of periodontal defects was due to four tissues: epithelium, connective tissue, bone and periodontal ligament. As the epithelium had the highest rate of formation, it filled the defect first and was important landmark study.[5]

From this study and result the concept of periodontal guided tissue regeneration (GTR) came to light. This highlighted on the fact the it would give periodontal ligament time to regenerate and would not interfere with its formation. For this a membrane is placed between the epithelium and connective tissues and the tooth surface to prevent them from forming an attachment and allowing reformation of a periodontal ligament.

Hence based on this concept our case was done using a resorbable GTR membrane and bone graft substitute to combine the advantages of both and give a better result.

2. Case Report

A female patient who was 40 years old, she came with the chief complaint of bleeding and swelling of gums in relation to right upper tooth region since 1 month. On examination there was a periodontal pocket of 10 mm in between 15 and 16 (Figure 1a). There was also grade I mobility in relation to 16. There was no tenderness or pus discharge in relation

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to the tooth. Radiograph revealed angular bone defects in between 15 and 16. (Figure 1 b) The treatment planning was done so as to carry out a complete debridement in 15 – 16 region and placement of a GTR membrane with the bone graft substitute to fill the defect for regeneration of tissues.

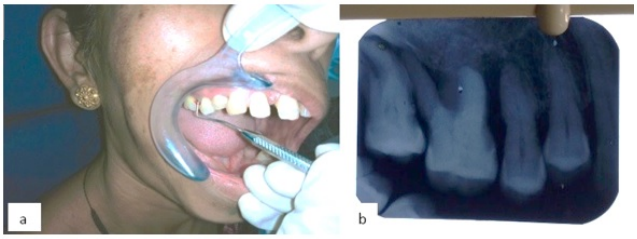

Fig. 1: a) Pre- operative view (Periodontal pocket 10mm); b): IOPA of the preoperative site

2.1. Surgical Technique

All the aseptic measures were taken. Local anesthesia was administered. After which a full thickness flap was raised in the desired region, to ensure maximum coverage of the grafted site. Granulation tissue was removed and complete debridement was performed. The roots were thoroughly scaled and planed by using hands and ultrasonics instruments. The surgical sites were then rinsed with sterile saline. After which an evident angular defect was clearly noticed (Figure 2).

Fig. 2: Full thickness flap with evident angular defect

The bone graft substitute used in this case was of alloplastic material, which was placed in the defect to fill the area completely (Figure 3a) and then it was covered with a resorbable GTR membrane (Healiguide) (Figure 3 b). The flap was then sutured back approximating it on both buccal and palatal aspects so as to completely cover the membrane and lastly periodontal pack was placed

2.2. Post surgical treatment and follow-up

The patient was advised with analgesics. Plaque control instructions were given. She was given 0.12% Chlorhexidine rinse twice daily after 24 hours and also it was instructed to avoid tooth brushing in the operated

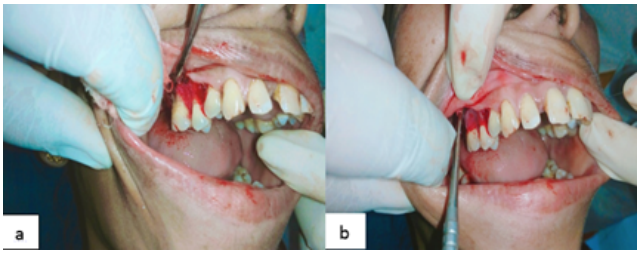

Fig. 3: a) Filling the defect with bone graft substitute; b): Placement of a resorbable GTR membrane (Healiguide)

quadrant. The patient was recalled and the sutures were removed 10 days after surgery. The patient was put on regular recall at 1, 3, 6, & 12 months. The symptoms of bleeding and swelling had disappeared following 1 month. (Figure 4 a, b). There was reduction in probing depth and no mobility could be encountered at the six-month recall and by the 3-month recall the patient was comfortable with no recurrence of symptoms (Figure 5 a, b). At the 9-month recall, radiograph showed significant bony fill, evident as increase in radioopacity and these results were maintained at the time of the last recall at 12 months (Figure 6 a, b).

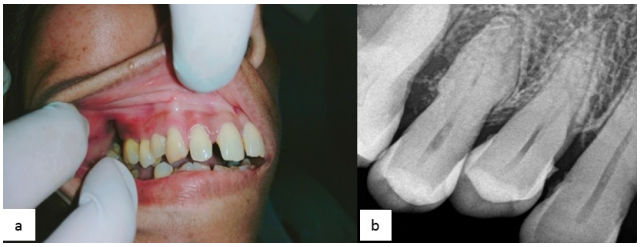

Fig. 4: Post- operative after 1 month

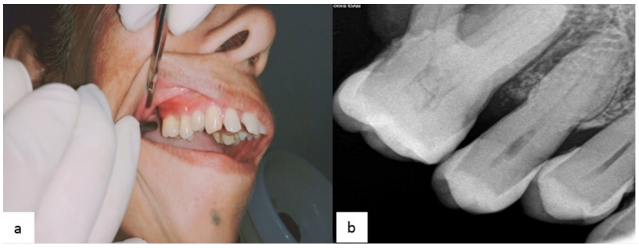

Fig. 5: Post- operative after 3 months

3. Discussion

Periodontal Materials is extensively being studied so that great results can be obtained. From the past 40 years it is being researched and will continue to advance with increasing knowledge in medical field. A lot of studies are undergoing constantly which could show successful clinical results with collagen membranes for GTR therapy.[6]

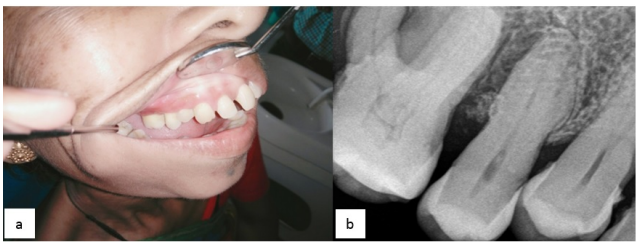

Fig. 6: Post operative after 12 months

The main rationale behind using collagen as a barrier membrane was because of the fact that the main constituent is type-1 collagen. This type of collagen is present in periodontal connective tissue. Collagen materials also have lot of functions such as for fibroblasts it possess chemotactic function, it also has hemostatic property, weak immunogenicity and osteoblast adhesion activity.[6] However, in case of GTR for complete periodontal regeneration the space underneath the barrier membrane is maintained for long period of time so as to help during healing process. In some of the cases where the membrane is seen collapsing into the defects or to the roots, the results were not good and less amounts of bone were formed. This was because of limited amount of space available for periodontal ligament cells to regenerate and repopulate.[7,8] Hence, because of the failures of membranes available and to compensate for the lack of space-maintaining effect of membranes bone grafting materials were used as adjuncts to the GTR technique. The would enhance and promote bone formation.

In our case the result was found to be excellent and proven to be good as correction of both pocket depth and mobility was observed. There was reduced pocket depth . Healing was uneventful. Our results are also good compared to other authors who have also performed such studies with GTR membrane and bone replacement grafts.[9–12] These findings support the hypothesis that the presence of physical support is necessary under the membrane because it maintain the position when the flaps are sutured back. Also, the bone grafts are essential as it contributes to wound stability. Stability of it is a very important factor for obtaining periodontal regeneration.[13]

On the other hand , other researchers have reported that the results obtained with the combined use of GTR and bone grafts were not significant and different from those with GTR alone.[14–16] These authors have given hypothesis that the biomaterial which is used under the membrane may hinders the coronal migration and proliferation of progenitor cells from the periodontal ligament into the defect site.

4. Conclusion

A combination of a resorbable GTR membrane with alloplastic bone graft substitute in a properly selected defect results in excellent healing with evidence of bone fill. As a result of the constant innovations through research in the field of biomaterials to improve the predictability of periodontal regeneration it is likely that some combination technique may ultimately prove to provide the ideal regeneration.

5. Source of Funding

None.

6. Conflict of Interest

None.

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Case Report

Treatment of class-II recession with autologous connective tissue grafts using trapdoor technique

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ABSTRACT

This article describes the use of the sub epithelial connective tissue graft (SCTG) as a donor source for root coverage. The success of these grafts has been attributed to the double-blood supply at the recipient site from the underlying connective tissue base and the overlying recipient flap. The application of connective tissue grafts has become a widely accepted therapeutic option in aesthetically oriented periodontal plastic surgery. Connective tissue grafts are a versatile treatment method in periodontal plastic surgery and peri-implant soft tissue plastic surgery. Their strengths are ease of handling and good prospects of success. Harvesting techniques that are minimally traumatic but aimed at maximizing tissue volume ensure multi-purpose usability of connective tissue grafts.

1. Introduction

Obtaining predictable root coverage has been a goal of reconstructive periodontal plastic surgery since a long time. Initially, the rationale for mucogingival surgery was function and health.[1] Eliminating recession has always been addressed but improving cosmetic appearance was not considered crucial.[2] The appearance of free gingival type graft that has been coronally positioned is not acceptable to many of esthetically minded patients.[3] The amount of keratinized gingiva available is not adequate. The subepithelial connective tissue graft (SCTG) is a consistent technique to esthetically achieve predictable root coverage.[4–7] This technique has the advantage of closer blend of the graft with the adjacent tissue avoiding the "keliod" healing present with free gingival grafts. Since it was described by Edel in 1974, the technique has continued to develop in terms of its indication, usage and harvesting techniques. The purpose of this paper is to describe that SCTG technique can be used to gain total root coverage in isolated and multiple sites.

1.1. Case details

A 30 year male patient reported with a chief complaint of downward shifting of gums. On intra-oral examination gingival recession was present in relation to lower left central incisor with recession depths and widths of 3x3m. A diagnosis of Miller Class II recession in relation to 31 was given. The patient was on maintenance phase (Phase IV) after phase I.

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1.2. Surgical procedure

Facial skin was scrubbed with 5% Povidine iodine before the surgical procedure. Patient was given local anaesthatic block with (2%lignocaine,1:80000 adrenaline). A surgical template was made to measure the recipient site.

1.3. Technique

1.3.1. Recipient site

A partial thickness flap was created with two vertical incisions placed with atleast one half to one tooth wider mesiodistally than area of gingival recession. The coronal margin of flap was started with horizontal sulcular incision to preserve all existing radicular gingiva. The interproximal papillae were left intact. The flap dissection was partial thickness leaving connective tissue over the existing bone and/or root surfaces. Care was taken to extend the flap to the mucobuccal fold without perforations which could seriously affect the blood supply. Periosteum was left covering the bone.

1.4. Donor site

A second surgical site was created on the palate. The length was determined by combined width of teeth to be covered. A horizontal incision was made approximately 5-6 mm from the gingival margins of the maxillary teeth to the desired. It was continued apically as an inverse bevel incision towards alveolar bone. A second parallel horizontal incision was made 1 1/2 mm to 2mm coronal to the first incision. The palatal bone was scored to enable the operator to remove the connective tissue wedge. The connective tissue and epithelium between the two horizontal incisions were excised and all adipose tissue is removed. Leaving an epithelial strip on the graft was originally intended to provide a better transition to the existing epithelial border when treating recessions (Langer and Langer,1985,1993). As the covering epithelium necrotizes within the first 5 days (Oliveret.al 1968; Langer and Bernimoulin,1974) the underlying connective tissue determines the nature, shape and color of the newly formed epithelium (Charring et.al 1975). Hence it is recommended in terms of predictability that no epithelial layer should be left on SCTG as shown in earlier publications (Langer and Calagna,1980, 1982; Langer and Langer, 1985; Raetzke, 1985; Harris, 1992). If an epithelial strip is not harvested with the graft, access can be achieved with:

1. Single incision technique
2. Two (Angular Incision Technique)
3. Three (Trapdoor Technique)

In the present case, the trapdoor technique was done to achieve root coverage. It is advisable to suture the palatal flap back into position immediately after taking the donor tissue in order to reduce the size of blood clot which might cause tissue necrosis.

The flap from donor site was closed into a position approximating primary intention healing. The donor connective tissue and epithelium were sutured to underlying connective tissue interproximally using 4-0 non absorbable surgical needled suture (Mersilk). The needle used was 16mm, 3/8 reverse cutting and interrupted sutures were given. The lip or cheek was then moved, checking to ensure that graft was well stabilized. The partial thickness, recipient flap was positioned coronally in a manner to cover as much of the graft as possible and sutured in this position. No attempt was made to completely cover the graft as this would create an excessive pull on the vestibular fold. The recipient site is dressed with periodontal dressing and the patient is instructed in normal post surgical management. A dressing is optional on the palate. The patient was instructed not to pull the lip back, not to tooth brush in the surgical site or chew firm food in the area for 2 weeks. Patients were started immediately on Chlorhexidine rinses twice daily for 10 days and use external ice packs for 48 hours. The patient was recalled at 1, 2 and 4 weeks interval. Some loose sutures were removed at 1 week and others at 2 weeks**. (Figures 1, 2, 3, 4, 5 and 6**1A-1H). Healing was uneventful with no pain or discomfort to the patient. An overall of 90% root coverage was achieved. There was an increase in width of keratinized gingiva. As the postoperative time increased, the progressive adaptation of the edges of the flap to the surrounding tissue was observed.

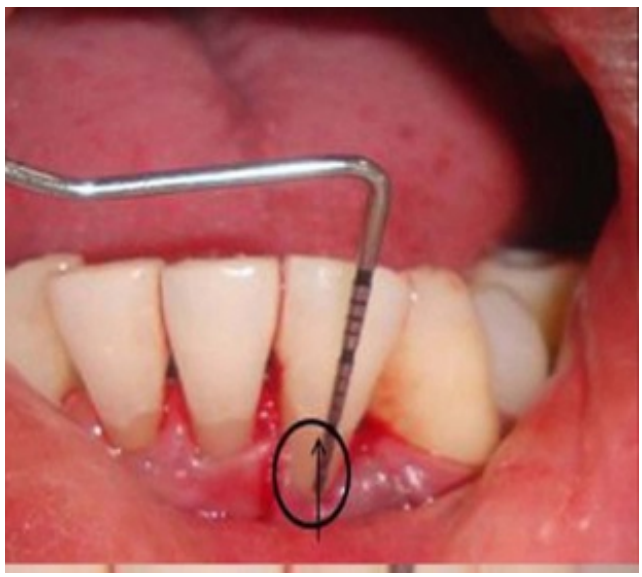

Fig. 1: 1A: Gingival recession (ClassII) with depth and width of 3x3mm

Fig. 2: 1B: Scalloped papillary incision

Fig. 3: 1C: Partialthickness flap raised with vertical incisions

Fig. 4: 1D: Trap-Door Technique

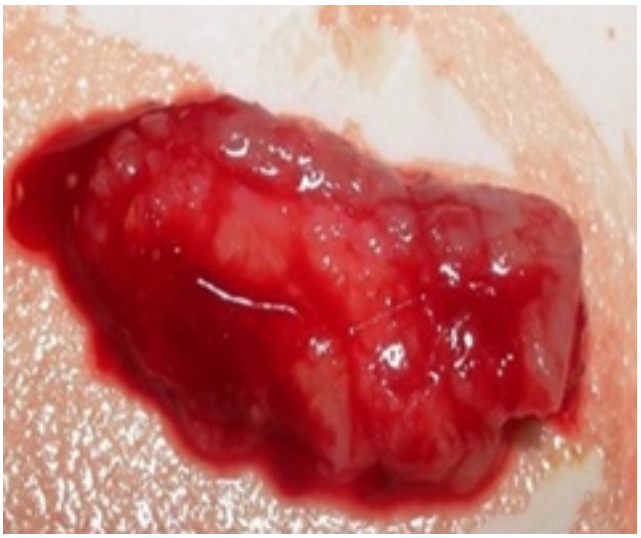

Fig. 5: 1E: Harvestedsub-epithelial connective tissue graft

Fig. 6: 1F Sutures placed

Fig. 7: 1G:Recipient site(3Months) 1x2mm

Fig. 8: 1H : Donor site showing healing following(3 month)

2. Discussion

The use of subepithelial connective tissue graft offers a combination of both pedicle flap and the free gingival graft. The pedicle flap allows for possible root coverage since it retains its apical blood supply and therefore survives over an avascular root surface. The free gingival graft supplies a resilient type of connective tissue with a genetic predisposition which ensures thickness and keratinization. The ability to combine both procedures offers the flexibility not achieved by either technique alone. If atleast one- half to two-third of the graft is covered by the flap, the remaining portion which is not covered will survive over the denuded root. The double blood supply i.e. that from the underlying periosteum and the overlying flap, seems to be enough to nourish the entire graft.The technique gains its clinical predictability by use of bilaminar flap (Nelson 1987;Harris, 1992) design to ensure graft vascularity and high degree of gingival cosmetics. Compared to free gingival graft, the donor site in this procedure heals with less discomfort since it is a smaller wound that heals by primary intention and usually does not require a periodontal pack. However excessive undermining of primary donor flap could lead to tissue necrosis and subsequent post-operative discomfort as described by Edel.[8] To avoid "tire patch" look often associated with free gingival grafts (FGG) Jahnke and colleagues[9] in 1993 compared FGG to SCTGs, and found the connective tissue grafts to be significantly($p<.03$) more effective than FGG.

3. Conclusion

This procedure has the advantage of increasing keratinized gingival height, width and thickness. This technique allows an esthetic color match of the gingiva. Completed in one procedure and less traumatic donor sites versus a free gingival graft. The collateral blood supply is adequate and hence no occurrence of flap sloughing. However this technique requires high degree of technical skill required, complicated suturing. Significant ecchymosis and edema have been experienced with this procedure.

4. Source of Funding

None.

5. Conflict of Interest

None.

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Case Report

Treatment of gingival recession on lower lateral incisor lingually using Mucograft® A Case Report

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ABSTRACT

Treatment of lingual recession on the mandibular anteriors is not a regularly implemented procedure owing to its anatomical restraints, difficulty in isolation as well as lack of esthetic importance. The present case report describes the application of Mucograft® as an alternate to connective tissue graft in the treatment of mandibular lingual recession using minimally invasive tunneling technique. The surgical technique comprises preparation of full thickness tunnel to treat a narrow and deep gingival recession of 5mm midlingually with minimal attached gingiva and keratinized tissue width of 1mm in the right mandibular lateral incisor region and then placement of a mucograft within the prepared tunnel and securing it in place using sling sutures. 21 days follow up showed satisfactory results both in terms of root coverage as well as reduction of dentinal hypersensitivity.

Thus, it can be concluded that lingual root coverage with a minimally invasive full thickness tunneling technique and Mucograft® successfully resolves the problems of dentinal hypersensitivity, proper plaque control along with the restoration of periodontal soft tissues.

1. Introduction

Gingival recession is the apical shift of the gingival margin with respect to the cemento-enamel junction (CEJ); which is associated with attachment loss and exposure of the root surface to the oral environment.[1] It causes dentinal hypersensitivity, unaesthetic appearance and if left untreated may lead to root caries, abrasion or cervical wear, erosion and an increase in accumulation of dental plaque.[2] There are various etiological factors which may contribute to gingival recession some of which may include various periodontal disease such as bone resorption, periodontal pockets, accumulation of plaque and calculus, mechanical forces such as improper flossing and tooth brushing, improper occlusal relationships, iatrogenic factors such as orthodontic tooth movements, anatomical factors including alveolar bone dehiscence, tooth mal-position,[3] aberrant frenal attachment as well as gingival morphology[4] and tongue piercings in case of lingual recession.[5]

Treatment of gingival recession on the lingual surface of mandibular anteriors is quite challenging, owing to difficulty in accessibility as well as anatomical constraints of this region. The goal of periodontal therapy is to regenerate the lost attachment of the tooth. Accordingly, it has become apparent over the past decade that a variety of regenerative procedures have the ability to correct gingival recession defects through augmentation of the height and width of keratinized gingiva, plus to gain partial or complete root coverage.

The widely used among these procedures include periodontal plastic surgical (mucogingival) graft techniques, either alone or in combination with guided tissue regenerative procedures.[6] Treatment of mandibular lingual recession is not a regularly performed treatment procedure due to its lack of esthetic significance, which is one of the most common suggestions for recession coverage.[7]

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Sub-epithelial connective tissue graft (SCTG) is considered as a gold standard for treatment of recession defects, however it requires a donor site. Owing to this, there is always a quest for substitute techniques with lesser morbidity.

The "Tunnel" technique also known as "Supraperiosteal envelope" technique is a modification by Allen(1994) of Raetzke's 1985 "envelope" technique. The tunnel technique has a minimally invasive nature since the interdental papillae are left intact and vertical incisions are not performed leading to better esthetic results.[8] This technique entailed the placement of a connective tissue graft in the tunnel. Bio-materials which can be used as a substitute in place of connective tissue grafts such as Mucograft® (Porcine) has gained importance recently due to its ease of application and no requirement of a previous preparation or hydration.[9]

Geistlich Mucograft® is a collagen matrix meant for recession defects and for the gain of keratinized tissue where open healing is required. It is stated to be designed to provide a requisite, reinforcing matrix and a signaling source for regenerative wound healing.[10,11]

2. Case Report

A 28 year- old male patient reported to the Department of Periodontology and Oral Implantology, I.T.S. Centre for Dental Studies and Research, Murad Nagar with the chief complaint of dentinal hypersensitivity on the lingual side of the mandibular left lateral incisor. The patient described severe sensitivity to hot and cold liquids and a constant uneasiness in the mandibular lingual area. No relevant medical history was recorded and also there was no history of any type of habits.

Further, the periodontal evaluation revealed normal probing depths on the recessed tooth with mild plaque accumulation and minimal bleeding on probing. The patient presented with a narrow and deep gingival recession defect of 5mm and a lack of attachment on the lingual surface with respect to #32. No recession was there on the labial aspect of the same tooth. There was no mobility in any of the central and lateral incisors. The recession can be classified as Miller's Class 2 on the facial with no interproximal bone loss and recession extending up to the mucogingival junction.[12] On radiographic examination, periapical radiographs revealed mild periodontal ligament space widening with mild to no horizontal bone loss interdentally.

After discussing the clinical findings, treatment options, and risks associated with the patient, oral and written consent was obtained for the same.

The treatment plan was divided in three phases: Presurgical phase which consisted of inflammation control through oral hygiene instructions, full-mouth debridement, and occlusal adjustment followed by Surgical phase which involved periodontal regenerative surgery of the area; and finally Maintenance phase, involving a strict supportive periodontal therapy (SPT).

2.1. Pre surgical phase

A full-mouth debridement along with slight occlusal adjustment were performed. Few necessary oral hygiene instructions were given and after re-evaluation the regenerative periodontal surgery was suggested.

2.2. Surgical phase

The patient was asked to rinse with 0.2% chlorhexidine digluconate solution prior to surgery. Local anesthesia of 2% lidocaine with 1/100,000 epinephrine was administered following which the exposed root surface was debrided with curettes.

Intrasulcular incisions were made on lingual surface of #31-33 with #15 blade. In order to undermine the lingual soft tissue, Orban's knife (1/2 Allen Modified Orban Knife) was used. Further, Crescent Blade (CB01-2.5mm, 20 gauze) was used simultaneously in order to make the tunnel carefully and not to perforate it extending beyond the level of the mucogingival junction leaving interdental papillae intact. The mucoperiosteal tunnel was extended by full thickness preparation and laterally extended beyond the recession site up to #31-33 sites. All the attaching muscles and inserting collagen fibers were separated and released from the inner aspect of the tunneled flap in order to get the tension free flap which can be easily mobilized coronally. The interdental papillae were gently undermined to get complete mobilization of flap and thus a sub-periosteal tunnel or a pouch was created. Special care of interdental papillary tissues were taken and flap perforation was successfully avoided.

After tunnel preparation it was irrigated with saline and moist gauze was placed over it.

Further, a tin foil of appropriate size to be used in the receded area was measured and cut. Then the mucograft was cut according to the size of the tin foil. The Mucograft of appropriate size thus obtained was then moistened in saline solution and inserted within the prepared tunnel and stabilised using sling sutures.

2.3. Maintenance phase

The patient was prescribed 500 mg of amoxicillin TID for 7 days to prevent potential infection, 400 mg Ibuprofen BID for pain management and twice daily rinse with 0.12% Chlorohexidine rinse for 2 weeks. Patient was instructed to not brush the surgical area for at least 2 weeks. Sutures were removed at 2 weeks after surgery and returned to regular post-operative oral hygiene at 1 month and regular dental recall appointments.

Fig. 1: Crevicular incision

Fig. 2: Tunnel prepared

Fig. 3: Template

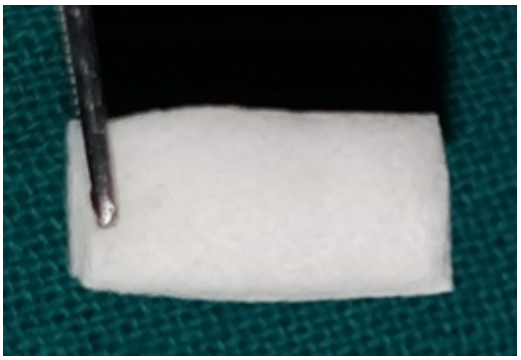

Fig. 4: Mucograft®

Fig. 5: Mucograft tunneled underneath papila

Fig. 6: Mucograft stabilized using sutures

Fig. 7: Post-operative (21 days)

3. Result

In the present case report, follow-up was done at 21 days which showed satisfactory root coverage as compared to the baseline. At baseline a gingival recession of 5 mm was recorded in the lingual aspect of mandibular incisor. After 21 days there was a reduction in gingival recession of up to 1.5mm. The surgical site was also completely healed. The patient expressed satisfaction as dental hypersensitivity was no longer reported.

4. Discussion

Gingival Recession is the apical migration of the gingival margin which leaves the root surface exposed to the oral environment leading to sensitivity, plaque deposition, caries etc along with unaesthetic appearance for the patient. Patients therefore often seek treatment for the gingival recession, which usually requires surgically covering the recession. Inflammation caused by calculus, prominent lingual freni, tongue piercings and deleterious habits are the most common etiological factors for lingual recession. But treatment for the same is not easy owing to the anatomical restraints which poses difficulty in any surgical procedure to be done, poor accessibility and difficulty in instrumentation of the area, tongue position, continuous salivary flow etc.

A case report by Vrushali et al., (2018)[13] in the treatment of Mandibular Anterior Lingual Recession Defect with Minimally Invasive Laterally Closed Tunneling Technique and Sub-Epithelial Connective Tissue Graft concluded that it is possible to successfully and predictably treat isolated lingual recession defects with a laterally closed tunneling technique and that the connective tissue graft still dominates effective method to cover exposed roots.

Moreira et al. (2013)[14] reported a clinical case using Mucograft® for root coverage with coronally positioned flap in a 4 mm recession Miller Class I. The results were satisfactory and, after 3 and 6 months of follow-up, the recession was completely covered. After 12 months, the gingival margin remained stable, and there was a maturation of the gingival tissue. According to the authors, the use of membrane for covering Miller Class I gingival recessions can be successful, but more randomized clinical trials demonstrating the predictability and efficiency of the material are necessary.

Another case report was done by Rotunda et al., (2012)[15] on the use of a new collagen matrix (Geistlich Mucograft®) for the treatment of multiple gingival recessions which showed three women with maxillary gingival recessions and were treated by means of the envelope flap technique associated with a novel collagen matrix as a substitute for the connective tissue graft. At 1 year, complete root coverage was achieved in 9 treated sites, with a mean keratinized tissue width of 3.1 mm, complete resolution of dental hypersensitivity, and a high level of esthetic satisfaction.

The SCTG which is considered a gold standard for treatment of gingival recession requires a donor site as well as long surgical procedure and patient discomfort. So in this present case report a minimally invasive tunneling technique along with Mucograft® has been presented that can restore the functional properties of lingual gingiva of the mandibular anterior teeth by repairing gingival defects and re-establish the integrity of the zone of keratinized gingiva.

Geistlich Mucograft® which is a porcine derived collagen matrix has shown optimal soft-tissue regeneration. It provides an alternative to autogenous soft-tissue grafts. Harvesting of the patient's tissue is avoided, providing a benefit to both patients and clinicians.

However, a limitation of the graft is that it is not very economic and hence is not easily available.

There are very few case reports regarding the treatment of lingual recession and this case report is first of its kind to the author's best of knowledge depicting use of Geistlich Mucograft® for lingual recession. However longer follow-up period is required to be more conclusive about the current technique used in this study.

5. Conclusion

It can be concluded that the Mucograft can be used as an alternative to sub epithelial connective tissue graft in the treatment of mandibular lingual recession with satisfactory result. However a longer follow up period is required to better assess the clinical outcome.

6. Source of Funding

None.

7. Conflict of Interest

None.

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Case Report

Mucormycosis revisited: Case report with review of literature

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ABSTRACT

Invasive fungal infections caused by the members of Mucoromycotina (mucormycosis) are relatively rare but have increased in the last years. These aggressive and highly destructive infections fail to induce disease in most immunocompetent persons but can do so in those with impaired host defenses. Compared to other fungal pathogens, such as Aspergillus fumigatus or Candida albicans, only little is known so far on the fungal properties leading to successful infection and host immune response to the various representatives of the Mucorales. This article explains the new nomenclature, clinical manifestations, risk factors and focuses on virulence traits associated with mucormycosis. Early diagnosis and prompt treatment can reduce the mortality and morbidity of this lethal fungal infection.

1. Introduction

Mucormycosis is a rare opportunistic fulminant fungal infection caused by saprophytic fungi.[1] According to Brown, mucormycosis ranked third among opportunistic deep fungal infections, after Candidiasis and Aspergillosis.[2] It is frequently found in soil, residue plants, spoiled food and upper respiratory tract of healthy individuals.[3] It becomes pathogenic when associated with predisposing factors such as immunocompromised states, most commonly (60–81%) diabetes mellitus.[4,5] The other predisposing factors are malignancies like lymphomas and leukemia's, renal failure, organ transplant, long term immunosuppressant therapy, cirrhosis, burns, protein energy malnutrition and acquired immunodeficiency syndrome. It can manifest as any one of the different clinical forms such as Rhino 0rbito-cerebral, Pulmonary, Gastrointestinal, Central nervous system, Cutaneous and Miscellaneous (bones, joints, heart, kidney, mediating).[6]

Early diagnosis, and prompt treatment can reduce the mortality and morbidity of this lethal infection. Therefore, this article with the help of a case report encompasses complete review on the nomenclature, risk factors, virulent traits, early diagnostic methods and treatment modalities associated with mucormycosis.

2. Case Report

A 60-year-old female reported to the dental clinic, with the complaint of severe pain in right upper jaw since past 2 months. She reported of an assault 2 months ago, with impact forced directly over the right temporal region. The patient had severe continuous pain extending from the temple region superiorly to the level of the corner of the mouth inferiorly, and from the midline to the external ear posteriorly, which showed reduction in intensity to taking analgesics. Extractions were done for 16, 17, 18 teeth at a private clinical setup.

On intraoral examination, the mucosa overlying right palatal and alveolar process of maxilla was showing bluish discolouration and hard non-pitting tender swelling with white pus discharge from multiple sinus openings overlying the buccal cortical plate adjacent to 12, 13, 14, 15 teeth region. Greyish-white denuded necrotic bone was present in

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the unhealed extraction sockets of 16, 17, and 18, covered with scrapable grey slough. All the teeth in the first quadrant were grade II mobile, showing tenderness on percussion and palpation; with mobility extending to the whole of the maxillary alveolar and palatal processes, though no occlusal discrepancy was observed. (Figure 1)

There was moderate nasal congestion, with continuous discharge of small amounts of white mucous from the nose, with no history of fever, chills or bleeding, vision impairment or facial paraesthesia.

Routine blood investigations were carried out to rule out HIV, Hepatitis-B and diabetes mellitus. Random blood sugar levels were found to be as high as 461 mg/dl indicating uncontrolled diabetic status; hence, the patient was referred to a general physician for diabetes control, who started with Human MIXTARD- 20 IU in the morning and 10 IU in the evening. The OPG view revealed fracture at the junction of the alveolar process and the zygomatic process of right maxilla with hazy radio opacity in the right maxillary sinus, and unhealed sockets in the right maxilla, posterior to 15 region (Figure 2).

The CT scan in the sagittal and coronal planes showed involvement of right maxillary sinus with isodensity extending up to the middle and inferior conchae of the right lateral nasal wall. (Figure 3)

A bone biopsy was performed and the histopathologic report revealed showing branching aseptate PAS positive mycelia suggestive of Mucormycosis of the right maxilla (Photomicrographs Figures 4, 5 and 6).

Fig. 1: Clinical examination showing lesion covered with grayish white slough

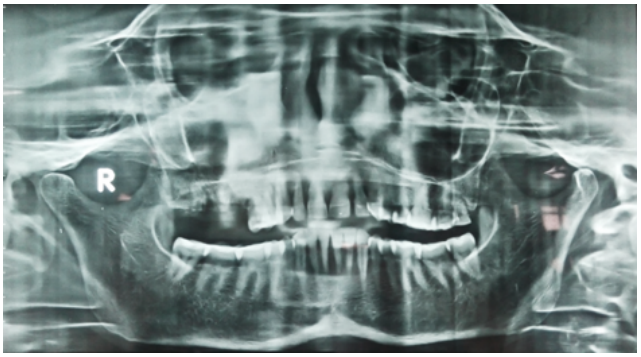

Fig. 2: OPG showing maxillary involvement in the right side alveolar bone and maxillary sinus

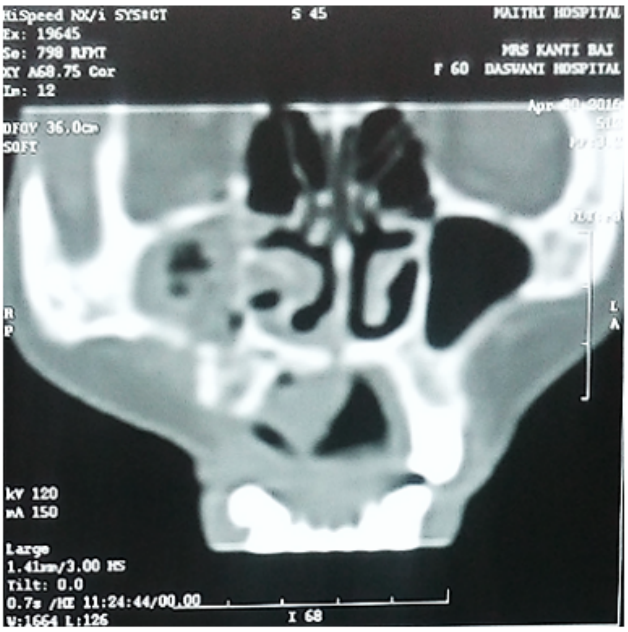

Fig. 3: CT scan showing bone involvement upto lateral nasal wall

3. Discussion

Fungi are eukaryotic organisms which may exist in tow forms -yeast and molds. Yeast grow as single cells that reproduce asexually. Molds grow as long filaments (hyphae) and form a mat (myecilium). Some form transverse walls (septate) as in Aspergillus, whereas others do not (non septate) as in Mucor. Most fungi are obligate aerobes, some facultative anaerobes but non obligate anaerobes. All fungi require a preformed source of carbon- hence their frequent association with decaying matter. The natural habitat of most fungi is therefore the environment. An important exception is Candida albicans which is part of the human oral flora.[7]

3.1. Nomenclature

Until more than a decade ago, the phylum Zygomycota comprised of the Mucorales, Entomophtorales and eight other orders.[8] A comprehensive phylogenetic reanalysis of kingdom Fungi, based on molecular methods, resulted in elimination of the polyphyletic phylum Zygomycota and placing the various taxa into

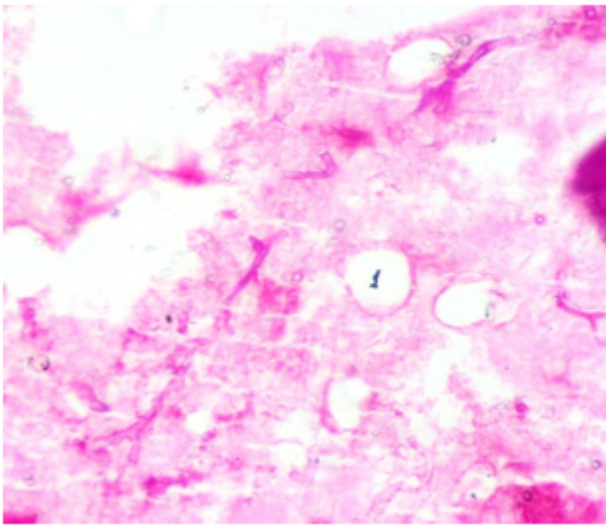

Fig. 4: Photomicrograph: Low power view of mycelia in PASstain 10x

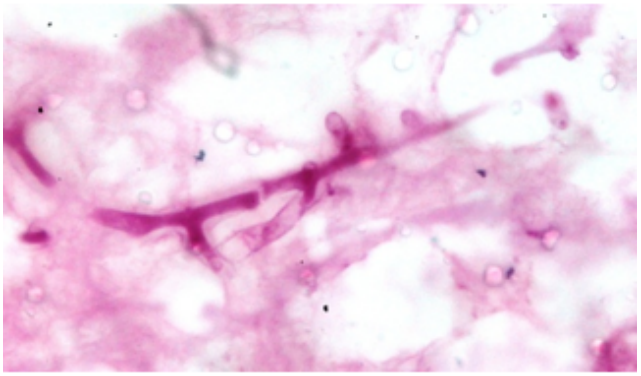

Fig. 5: Photomicrograph: High power view of PAS positive stained mycelia 40x

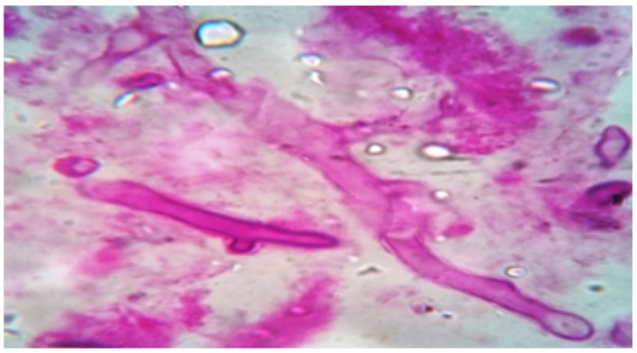

Fig. 6: Photomicrograph : 100x view showing aseptate PAS positive mycelia

the phylum Glomeromycota divided into four subphyla: Mucoromycotina, Entomophthoromycotina, Kickxellales and Zoopagomycotina (elevating the orders Mucorales and Entomophthorales to subphylum status).[9–11]

The changes in taxonomy were accompanied by a renaming of the disease caused by these aetiologic agents. The term "zygomycosis", defined by Ajello et al.,[12] and describing any invasive fungal infection caused by species of the former phylum Zygomycota was replaced by either “mucormycosis” or “entomophthoromycosis”.[13]

3.2. General characteristics

Mucoromycotina are saprophytic moulds found widely in the environment on decaying organic material or agricultural and forest soils. They are not dimorphic.They are fast growing organisms, characterized by large, ribbon-like, and irregularly shaped, nonseptate (coencytic), or sparsely septate, with branches often arising nondichotomously at right angles. The genera mainly involved in human disease are Cunninghamella, Lichtheimia (formerly Absidia), Mucor, Rhizomucor, Rhizopus, Apophysomyces and Saksenaea.[14,15]

3.3. Virulence traits

Mucoromycotina are thermotolerant and therefore able to grow at 37ºC, some at even higher temperatures. Nevertheless, according to Schwartze et al.,[16] no clear correlation between growth speed at host temperature and differences in virulence potential was detected. The second, virulence factor is iron acquition, as iron is an essential element for fungal cell growth and development. Three general mechanisms of iron uptake have been identified in fungi. These include a reductive iron uptake, a siderophorepermease that facilitates the uptake of siderophore-sequstered iron and an uptake system for acquiring iron from heam.[17] Recently, another factor, the glucose regulated protein 78 (GRP78) has been identified to enable invasion of the pathogen through endocytotic mechanism. Another aspect contributing to virulence of a pathogen is its capability to evade recognition and elimination by the host immune system.[18]

3.4. Risk groups

Highest at risk for the development of mucormycosis are those patients who either have decreased amounts of mononuclear and polymorphonuclear phagocytes, that would inhibit germination of spores in healthy humans, or whose underlying disease disturbs the function of their phagocytic cells such as those with haematological malignancies.[19] In diabetic ketoacidosis patients, elevated levels of free iron in serum are caused by a release of iron from binding proteins such as transferrin, which is due to a decreased pH level. The dysfunction of glucose and iron

metabolism, and regulation of this, was shown to result in decreased phagocytic function and intracellular killing of R. oryzae.[20]

3.5. Pathogenesis

These organisms are transmitted by air borne asexual spores and invade tissue of patients with reduced host defenses via respiratory tract, injured skin or via percutaneous route. Fungal hyphae have high affinity to the internal elastic lamina of arterial blood vessels and are extremely angioinvasive ensuing thromboembolism and cause subsequent thrombotic infarction. They proliferate in the walls of blood vessels particularly paranasal sinuses, lungs or gut and cause infarction and necrosis of the tissue distal to the blocked vessels.[21,22] Increased levels of free iron present in diabetic patients assist the growth of these organisms.[17]

3.6. Clinical Features

Rhino-orbital-cerebral form of mucormycosis defines an infection that originates in the paranasal sinuses, following inspiration of spores and possible extension to the brain. Sequentially nose, sinuses, eyes and brain are affected. Symptoms at early stage of disease might be sinus pain, nasal congestion, fever, soft tissue swelling and headache. Nasal ulceration might occur. Progression of disease is usually rapid if not treated and results in extension to neighboring tissues, thrombosis and further necrosis causing painful dirty brown-black eschar on the maxilla or nasal mucosa. Extension to the eyes is possible leading to blurred vision or complete blindness. From the eyes the disease can progress towards the central nervous system resulting in altered consciousness, cranial neuropathies or cerebral abscesses.[23]

3.7. Identification

Early diagnosis of mucormycosis is critical to enable early initiation of active antifungal therapy. The symptoms, signs and radiographic manifestations of mucormycosis are nonspecific and a definitive diagnosis requires direct identification of the characteristic hyphae or the recovery of organism in culture from specimens obtained from the site of infection.

Cytopathology: The hyphae may be difficult to observe on an unenhanced Potassium hydroxide wet mount and may not stain well with conventional Gram stain. The use of chitin binding stains, such as Calcoflour, Fungi-flour, or Blancoflour, may be used with a fluorescent microscope to identify hyphal elements on Potassium hydroxide wet mounts.[24]

Histopathology: The histological detection of mucorales organisms in tissue and their interpretation may be difficult. These organisms are typically difficult to observe on hematoxylin-eosin stains. On the other hand, Periodic acid Shiff and Gomori methenamine silver stains may be used for a fully characterized appearance of the organism. Microscopic characterization of nonseptate hypae, rhizoids, columellae, sporangia and sporagiospores help to define genus and species within the order mucorales.[24]

Culture: To optimize growth, clinical specimens should be inoculated onto appropriate media, such as Sabouraud's dextrose agar, and incubated at room temperature and 37ºC. Grinding or homogenization of tissue specimens may destroy the delicate hyphae, rendering culture results negative. Recovery in culture is enhanced if tissue is sliced or minced into small pieces before inoculation onto media. Close collaboration between clinicians and the microbiology laboratory is essential to ensure proper handling of the specimen. Although mucorales species are angioinvasive, blood culture results are rarely positive, unless there is luminal involvement of a vascular catheter. Colonies typically appear within 24-48 hours unless residual antifungal agents such as Amphotericin B are present which can suppress growth. The colonial appearance and growth pattern in culture help distinguish mucorales. Most mucoraceous species fill a culture disc in 3-5 days and demonstrate a grayish white, aerial mycelium with a wooly texture. The colonies readily separate from the agar surface.[25]

Radiography/ Imaging Techniques: Pre operative contrast–enhanced computed tomography (CT) is useful in defining the extent of the disease. Scan show the edematous mucosa, fluid filling the sinuses and destruction of the peri-orbital tissue and bony margins, although sinus CT is the preferred imaging modality, bony destruction is often seen only late in the course of the disease. Magnetic Resonance Imaging (MRI) is useful in identifying the intradural and intracranial extent of the disease, cavernous sinus thrombosis, or thrombosis of the cavernous portion of the internal carotid artery. Perineural spread of the disease can also be demonstrated with contrast enhanced MRI scan.[26]

3.8. Other Modalities

Thorough medical history, biochemical tests, and molecular analysis like Polymerase Chain Reaction systems enable rapid diagnosis.[24]

3.8.1. Treatment Modalities

It is critical to reverse /prevent underlying defects in host defense when treating patients with mucormycosis. Immunosuppressive medications, particularly corticosteroids, should be dose reduced or stopped if at all possible. Aggressive management to rapidly restore euglycemia and normal acid base status is critical in diabetic patients in ketoacidosis. Administration of iron should be avoided, because it exacerbates the severity of

infection in animal models.

Blood vessel thrombosis and resulting tissue necrosis during mucormycosis can result in poor penetration of antifungal agents to the site of infection. Therefore debridement of necrotic tissues may be critical for complete eradication of mucormycosis.[27]

Aggressive medical treatment with conventional antifungals and non–conventional therapeutics are corner stone for successful treatment.[28] Polyenes like Amphotericin-deoxycholates and lipid complex are primary therapeutic agents for mucormycosis. The dosage varies from 0.5-1.0mg/kg body weight once daily for not less than 4 weeks. There should be close monitoring of serum electrolytes, as polyenes are known to cause potassium imbalance.[29,30] Salvage therapy by Posaconazole or deferasirox are reasonable options for patients refractory to or intolerant to polyene therapy.[31] Non- conventional therapeutic agents like anti diabetics, iron chelating agents, statins, granulocyte transfusions,cytokines, and hyperbaric oxygen have increased the survival rates to 94%.Prevention always remains a gold standard.[28]

4. Conclusion

Mucormycosis is an aggressive fungal infection. It is an essential task for clinicians to pick these infections at early stage. Histopathological studies are of great help in determining the diagnosis. Oral surgeons play an important role as oral manifestations are first to appear, especially in severely immunocompromised patients. Thus, successful treatment of mucormycosis requires four steps 1) early diagnosis; 2) reversal of underlying predisposing risk factors, if possible; 3) surgical debridement where ever applicable; and 4) prompt antifungal therapy.

5. Source of Funding

None.

6. Conflict of interest

None.

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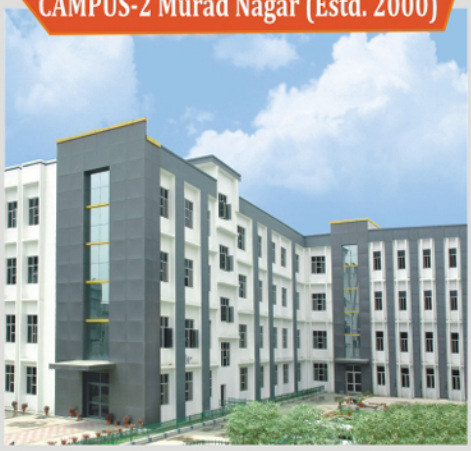

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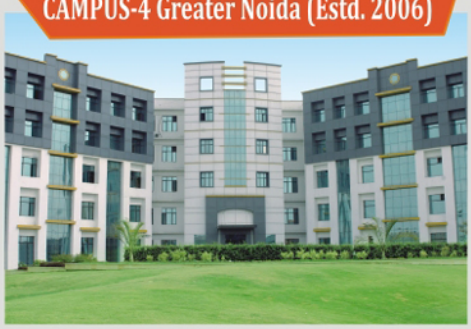

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