



ISSN 2320-7302  
eISSN 2393-9834

# Journal of Dental Specialities JDS

Volume 7, Issue 2, September 2019  
[www.its-jds.in](http://www.its-jds.in)

*Bibliographic Listings:*

Index Copernicus International, EBSCO,  
HINARI, OAJI, Cite Factor, ISI Database,  
SIS Database, DOAJ, ISRAJIF, DJQF, Academic Keys,  
JI Factor, INFOBASE Index, Advance Science Index,  
International Scientific Indexing, Academia.edu



Publication of  
**I.T.S Group Dental Institutions**

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## Forensic Odontology -A misfit or misunderstood



**Prof. (Dr.) Vinod Sachdev**

Director-PG Studies, I.T.S Centre for Dental Studies and Research, Muradnagar  
Editor-in-chief

Dear Readers!

Greetings and welcome to the latest edition!

Forensic odontology is a speciality of dentistry which deals with dynamic overlaps of dentistry with legal and forensic medicine. Keiser -Neilson defined forensic dentistry that in the interest of justice deals with the proper handling and examination of dental evidence and the proper evaluation and presentation of dental findings.<sup>1</sup> This is one of the most interesting field yet often most misunderstood field of all the areas of dental profession.

History of forensic odontology frequently, takes us back into Ancient Roman era of 49 AD where the identification of Lollia Paulina was done by Agrippina by visual recognition of Lollia's distinctive teeth. In history, there are several other cases which show us the glimpse of forensic science at work along with the hard work of different dentists such as Dr Paul Revere, Dr Parkman but the honour of being called father of forensic odontology is bestowed upon Oscar Amoedo. Oscar Amoedo a Cuban dentist working in Paris at the time of Bazar de la Charite fire which happened on May 4, 1897 in Rue Jean-Goujon. He reported in his textbook *L' Art Dentaire en Medecine Legale* many aspects of the use of teeth for legal purposes, the outcomes of the work done by other dentist after the fire.<sup>1-3</sup> After the Bazar de la Charite fire many authors published case studies on the use of odontology in both single and multiple fatality incidents which indicated an awareness of the value of the dentition in the identification of the deceased. These cases provide evidence of increased formalisation and consistency of the methods of victim recovery and scientific identification practices. However, the use of forensic odontology was still sporadic in most countries even until the 1960's.<sup>3</sup>

In India the first forensic identification was done by Gahadavala dynasty, (1191) a great monarchy which was

destroyed by Muhammad's army. Raja Jayachandra Rathore of Kanauji died in battlefield and was identified by his false anterior teeth.<sup>4</sup> Even though, with such an early start in the field of forensic odontology, the field is still in its nascent stages in our country. In India, 313 dental institutes with nearly 1.3 lakh students graduating as dentists and workforce of more than 2.7 lakhs,<sup>5</sup> but yet no dental institute is yet offering a council-recognised master's program for forensic odontology. Several organisations such IAFO- Indian Association of Forensic Odontology and Indian Dental Association (IDA) conducts certificate courses and fellowship programs in forensic odontology throughout the country, while Indian Universities recognised and affiliated by University Grant Commission (UGC)<sup>6,7,8</sup> i.e. Gujarat Forensic Sciences University (GFSU)<sup>8</sup> has 2-year master's programme in Masters in Forensic Odontology. And, foreign trained forensic odontologists who are mostly graduating from countries such as Belgium, Australia and UK who are offering their services to academic and judico-legal field, trying to establish the forensic odontology in India.

Currently the subject of forensic odontology is not introduced as a separate subject in undergraduate curriculum. But, under revised bachelor of dental surgery (BDS) course, as part of 2007 regulation, forensic odontology is added into the syllabus with both lecture and practical sessions, first part of which is taken as part of Department of Oral Pathology in first and third year curriculum, while the clinical aspect of this branch is taken by Department of Oral Medicine in Fourth year BDS curriculum.<sup>9</sup> Recognition and qualifying are a major step in establishing any field, unfortunately the master's or diploma courses in India and abroad are not recognised by the governing body of dentistry in India. Even though this is the scenario on one side, on the other hand, some of the dental institutes of the country are establishing a separate forensic odontology branch or with the support of oral pathology and

oral medicine departments. The forensic odontologists trained in India and abroad are recruited as faculty in such departments while others are part of identification and profiling team in medical colleges for unidentified human remains where they also impart services in the other areas of forensic odontology.

A multispectral approach of forensic odontology along with the forensic medicine department, forensic science laboratories (FSLs), forensic anthropology department and legal department is mandatory for the successful evolution of forensic odontology in our country. As this branch of dentistry has the potential to act as bridge between the Ministry of Health, Ministry of Home Affairs in every state and central governing bodies allowing interaction and work flow between the departments of disaster management, military, foreign and judicial affairs.<sup>10</sup> I strongly recommend one chance should be given to this field of dentistry before we make decision whether forensic odontology is a misfit or misunderstood branch of dentistry, and this would allow us to unveil what forensic odontology has in store.

I am very thankful to our readers for encouraging and showing faith in us. This has made us pursue success with our every upcoming subscription. I wish you all magnificent reading experience. Please feel free to reach out to us as “your feedback is very significant for our growth”.

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**How to cite the article:** Sachdev V. Forensic odontology - A misfit or misunderstood. *J Dent Specialities* 2019;7(2):64-5.

## Comparative evaluation of 2.0mm miniplates over Champy's miniplates in mandibular fractures in rural population of Chhattisgarh

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### Abstract

**Introduction:** Mandible is the largest and strongest facial bone, by virtue of its position on the face and its prominence, it is commonly fractured when maxillofacial trauma has been sustained. The main disadvantage of conventional bone plate/screw systems is that the plate must be perfectly adapted to the underlying bone to prevent alterations in the alignment of the segments and changes in the occlusal relationship during screw tightening.

Introduction of 2.0 mm locking plate/screw plating systems for the treatment of mandibular fractures works on the principle of restricted backout and function as internal fixators, achieving stability by locking the screw to the plate with unique advantage of obviating the need of intimate contact of the plate with the underlying bone. So the study was planned with an aim for comparative evaluation of use of 2.0-mm stainless steel locking miniplates with Champy's miniplates in mandibular fractures in terms of stability, postoperative healing & associated complications.

**Materials and Methods:** This cross sectional prospective interventional analytical study was carried out in Department of Dentistry at Raipur Institute of Medical Sciences, Raipur over a period of 10 months from September 2016 to July 2017. A total of 60 patients were enrolled in two study groups of 30 each. Detailed clinical, laboratory and radiological examination was followed by standard operative procedures described by the various authorities using two different Miniplates. The results were documented in Microsoft Excel and statistical analysis was done using Epi-info.

**Results:** Both the study groups were having 30 patients each. 26 males and 4 females in group I whereas 28 males and 2 females in group II. A total of 54/60 patients were male and 6 females. Road traffic accident was the most common cause of mandibular fractures in 37/60 (61.66%). Parasymphysis was the most common site of fracture (40%). There is no significant difference in working time, post-operative infections but significant difference is observed in terms of post-operative occlusion, mobility of fractured segments, pain at various point of time measured on visual analogue scale when tested with various tests of significance

**Conclusion:** The use of 2.0mm locking plate system with its advantages of improved handling characteristics, increased stability, less occlusive discrepancy, low infection rate, less mobility, less pain appear to be an effective and reliable alternative to Champy's miniplates in mandibular fractures.

**Keywords:** Locking plate system, Working time, Postoperative occlusion, Post-operative mobility.

### Introduction

Mandible is the largest and strongest facial bone. By virtue of its position on the face and its prominence, it is commonly fractured when maxillofacial trauma has been sustained. Its peculiar curved pattern and prominent contour, forming the so called jaw line makes it very susceptible to trauma.<sup>1</sup> It has been observed, that fractures of the mandible occur twice as often as mid-facial fractures even though almost four times as much force is required to fracture the mandible versus the maxilla.<sup>1</sup> The mandible is amongst the most significant bones of the face. Its fracture deserves special attention as it prevents the patient from performing life's normal activities like speech, mastication, and deglutition as well as maintaining aesthetics. In complicated cases, the airway and hence the breathing of the patient may also be hampered.<sup>2</sup>

Techniques for treatment of mandibular fractures have evolved significantly in the past decade which ranges from closed reduction with maxilla-mandibular fixation (MMF), to open reduction with wire osteosynthesis, to open reduction with either rigid internal fixation or adaptive miniplate fixation.

External appliances fixed to a head cap and semi-rigid immobilization by wire suspensions were cumbersome to

the patients and entailed long period of immobilization. Many failures resulted from early attempts at plate and screw fixation, probably owing to the lack of knowledge of the biomechanics of these systems. These plates had many disadvantages like risk of injury to the neurovascular bundle and teeth due to bicortical screws. They were bulky and uncomfortable for the patients and resulted in subsequent complications like exposure, infection etc. which often entailed a second surgery for their removal.<sup>2</sup>

Transoral placement of noncompressive miniplates has recently gained popularity by using the principles of Champy and are commonly referred to as the 'miniplates'. The main disadvantage of conventional bone plate/screw systems is that the plate must be perfectly adapted to the underlying bone to prevent alterations in the alignment of the segments and changes in the occlusal relationship during screw tightening. These plates may even rebound after bending, resulting in screw loosening.<sup>3</sup>

Introduction of locking plate/screw plating systems for the treatment of mandibular fractures works on the principle of restricted back out and function as internal fixators, achieving stability by locking the screw to the plate with unique advantage of obviating the need of intimate contact

of the plate with the underlying bone, making plate adaptation easier. So the study was planned with an aim for comparative evaluation of use of 2.0-mm stainless steel locking miniplates with Champy's miniplates in mandibular fractures in terms of stability, postoperative healing & associated complications.

### Materials and Methods

This cross sectional prospective interventional analytical study was carried out in Department of Dentistry at Raipur Institute of Medical Sciences, Raipur over a period of 10 months from September 2016 to July 2017. After obtaining the institutional ethics committee approval a total of 60 patients of minimally displaced mandibular fracture were enrolled after taking the informed consent form patients with an inclusion criteria of age above 14 years, no history of Diabetes, hypertension or Ischemic heart disease, reporting within 7 days of trauma without any other associated fracture in facial skeleton. All the patients not complying to the above criteria as well as patients with poor dental hygiene, gross infection at site of fracture, smokers and tobacco chewers, as well as patients with less mandibular vertical height between root apex of teeth and lower border of mandible were excluded.

A thorough history was taken that included the time and date of accident, time of reporting, mechanism of injury and history of bleeding from ear, nose and oral cavity. The patient was also questioned about the history of unconsciousness, vomiting and convulsions as well as the history of amnesia. This was followed by a detailed clinical examination. The oral cavity was cleaned of blood clots, fractured tooth edges and other debris. A temporary stabilization was provided when deemed necessary. The face and the oral cavity were examined for signs of soft tissue injuries. All wounds were debrided and lacerated wounds were sutured with 3-0 silk. Inj TT 0.5 ml IM was administered and patient were started on antibiotics and analgesics.

The patients were grouped into two groups based on the miniplates used

**Group I:** 2.0-mm locking miniplates.

**Group II:** Champy's miniplates.

All patients were investigated for routine blood parameters like Haemoglobin estimation, CT, BT, TLC and DLC as well as for radiological assessment by orthopantomogram (OPG) was done. An OPG was taken preoperatively, while more OPGs followed postoperatively, one just after surgery and one after six months.

### Evaluation Parameters

The patients were assessed on 8 different parameters namely -1) Working time period in minutes, 2) Postoperative occlusion, 3) Postoperative pain (according to "visual analogue scale"), 4) Postoperative mobility of fractured segments, 5) Postoperative infection, 6) Incidence of tooth damage, 7) Incidence of plate failure & 8) Sensory disturbances.

All the patients were evaluated on the first post-operative day, 1 week post operatively and after 1 month. Patients were further kept on a follow up for a period of 6 month and evaluated clinically as well as radiographically.

### Operative technique

The method of surgical exposure of the fracture site and reduction of the fracture was similar to both groups of patients. All the plates and screws were placed through an intraoral approach or extraoral approach either under general anesthesia or local anesthesia. All the patients were kept under appropriate antibiotic cover pre-operatively and upto 5 days postoperatively. Intermaxillary fixation was achieved to settle the occlusion before surgery. Patients were sedated with diazepam 10 mg. I.V. and regional anesthesia was achieved with lignocaine 2% and adrenaline 1:100000, an inferior alveolar nerve block and infiltration anaesthesia.

**Group I:** Plate osteosynthesis was performed using 2.0 mm locking stainless steel miniplates with 2.0 mm self tapping locking screws. 4 hole plates with bar (gap) were used and 2 x 8 mm screws were used for symphysis, parasymphysis and body region and 2 x 6 mm screws were used for angle region. As the locking design did not mandate passive adaptation of the plate to the bone surface, exact contouring of the plate was not done and an offset of 1.0 to 2.0 mm was allowed.<sup>4</sup>

**Group II:** Following reduction, miniplates were applied along the osteosynthesis line as described by Champy. In symphyseal or parasymphyseal fractures, two plates were placed to overcome the torsional forces. One plate is placed above the imaginary line joining the mental foramina and one below the line with a 5 mm distance between the two plates. The plate below the line was placed first, followed by the plate above the line, to prevent development of diathesis at the lower border due to action of masticatory muscles. In angle region a single plate was adapted on the flat vestibular area of bone adjacent to the external oblique ridge or at the inferior border of the mandible. The stainless steel miniplates were adapted over the surface of the mandible with the help of modeling pliers and bar modeling levers. During drilling, the adapted plate was held firmly against the bone with the plate holding forceps. The drilling was then performed by 1.5mm stainless steel drill bit perpendicular to the surface of bone. Plates were fixed with 2 x 10 mm stainless steel screws at symphyseal or parasymphyseal fractures and with 2 x 6 mm stainless steel screws at angle region.<sup>5,6</sup>

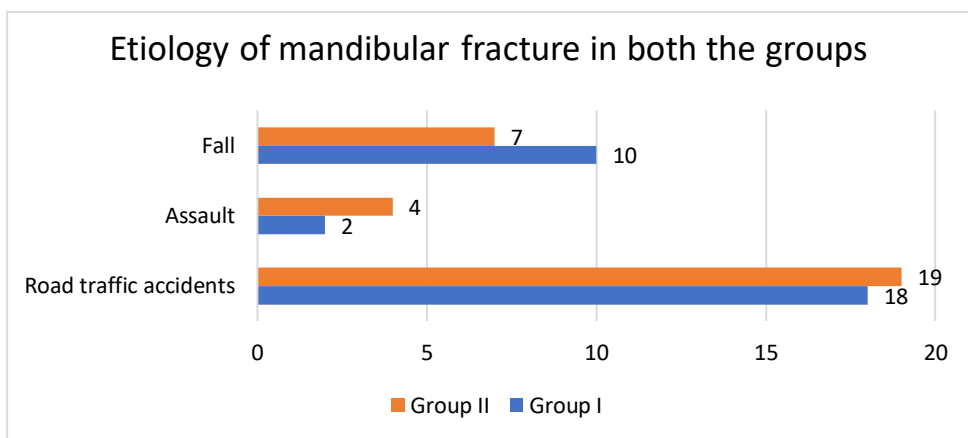
### Irrigation and Closure

After plate fixation, surgical site was copiously irrigated with 5% Povidone iodine and followed by normal saline. Hemostasis was achieved and suturing was done with 3-0 vicryl & 3-0 silk in layers. Pressure pack was applied and patients were prescribed antibiotics and analgesics for 7 days. The intermaxillary fixation was removed and the patient was advised to maintain the oral hygiene and to perform oral rinses with betadine. Patient was also

advised soft diet for the first week. The patient was followed up on weekly interval for a month and then at 3 months and 6 months.

**Observation and Results**

Both the groups were having 30 patients each. 26 males and 4 females in group I whereas 28 males and 2 females in group II. A total of 54/60 patients were male and 6 females. Out of the 60 patients in the study 37/60(61.66%) were because of fractures, 17/60(28.33) because of road traffic accident whereas 6/60(10%) were because of assault. The distribution of which in each group is as in Graph 1.



**Graph 1:** Etiology of mandibular fracture in both the study groups

Distribution of patients in both the groups according to the site of the fracture is as shown in Table 1

**Table 1:** Distribution of patients in study groups according to the fracture site.

Site	Group I	Group II	Total
Symphysis	2	4	6(10%)
Parasymphysis	13	11	24(40%)
Body	6	10	16(27%)
Angle	9	5	14(23%)

Comparison of various parameters in both the study groups with mean and standard deviation and test of significance using student t test is as shown in Table 2 and 3.

**Table 2:** Comparative evaluation of working time, post-operative occlusion, post-operative infection at 1 week and 1 month and post operative mobility of fracture segments

Groups	Working Time in minutes	Post-Operative Occlusion		Post Operative Infection at 1 <sup>st</sup> Week		Post operative Infection at 4 <sup>th</sup> Week		Post operative mobility of fracture segments	
		No Disturbance	Disturbance	Infection	No Infection	Infection	No Infection	No mobility	Mobility
Group I	48.83±4.48	27	03	26	4	29	01	28	02
Group II	47.17±4.48	21	09	20	10	26	04	22	08
Test of significance	T test -1.43	Mann Whitney Value-357		Mann Whitney Value-360		Mann Whitney Value-405		Mann Whitney Value-355	
P value	0.15	0.03		0.0689		0.1666		0.0382	
Comparative evaluation	Not Significant	Significant		Not Significant		Not Significant		Significant	

Pain was recorded based on the visual analogue scale for patients preoperatively and post operatively on day of surgery (Day 1), at 1 week and at 1 month post-operatively as in Table 3.

**Table 3:** Mean post-operative pain score based on visual analog scale with standard deviation and comparison of same in both the study groups.

	Pain at 24 Hrs	Pain at 1 week	Pain at 1 month
Group I	2.50±0.57	0.33±0.49	0.06±0.25
Group II	2.06±0.73	0.86±0.73	0.10±0.30
Mann Whitney test	314.50	282	435
P value	0.0139	0.029	0.647
Comparative evaluation	Significant	Significant	Not Significant

Iatrogenic damage caused by the screws was evaluated on radiographs and graded as minor and major contact. Minor contact was seen in 1 case of Group II and 0 case of Group I. None of the Group showed the incidence of Major contact.

1/30(3.33%) patients in group I and 4/30(13.33%) patients in group II showed plate failure due to chronic infection and loosening of hardware. No patient in any of the groups showed plate failure due to fracture of the plate.

In group I, 3/30(10%) patients showed temporary paresthesia preoperatively, 4/30(13.33%) patients at 1 week and 1/30(3.33%) patient at 4 weeks whereas in group II, 2/30(6.66%) patients showed temporary paresthesia preoperatively, 2/30(6.66%) patients at 1 week and 1/30(3.33%) patient at 4 weeks.

## Discussion

The only permanent thing in this world is change. Over the years the methods to treat mandibular fractures have undergone many refinements. The strategic position of the mandible on the facial skeleton and its unique role in Mastication, Deglutition, Phonation and Esthetics compels the clinician to give immediate attention whenever it is fractured.

The male dominance as observed in our study was also reported by Haug et al<sup>7</sup> who did a 5 years retrospective review of facial fractures. This may be justified by the fact that the males are generally more prone to situations in which there is higher risk of trauma.

Road traffic accident was the cause of mandibular fractures in 37 cases (61.66%), fall in 17 cases (28.33%) and in 6 cases (10%) it was interpersonal violence. This distribution could be compared favorably with the results obtained by Schuchardt et al<sup>8</sup> who found road traffic accidents to be the cause in 35.6% cases, fist fights in 31.8% and work related accidents and sports accidents in 11.6% and 3.3% cases respectively. Higher incidence of Road traffic accident can be explained by the fact that there are no comprehensive rules for traffic safety in our country.

In this study parasymphysis was the most common site of fracture (40%) followed by body (27%), angle (23%) and symphysis (10%). This result was contradictory to the findings of Huag et al<sup>7</sup> who found body of mandible to be the most common site (29.5%) and Schuchardt et al<sup>8</sup> who had condylar fractures (25%) having the highest frequency. This difference could be explained on the basis of the selection criteria's of this study which excluded grossly displaced fractures of the mandible.

In the present study, 27 patients of 2.0mm locking plate osteosynthesis (90%) had normal pre-morbid occlusion postoperatively. Only 3/30(10%) patients had postoperative occlusal discrepancy which was treated successfully by employing intermaxillary fixation for a period of 7 days in 1 patient and selective occlusal grinding in 2 patients. Sauerbier S, Kuenz J and Hauptmann S<sup>9</sup> reported 6% incidence of minor occlusal discrepancy postoperatively in 53 mandibular fractures treated with locking plates and this finding is consistent with our study. Ayman C et al<sup>10</sup> assessed 2.0 mm locking Miniplate screw system in the treatment of mandibular fractures with a 1 week period of maxillomandibular fixation.

On the other hand, 21 patients (70%) of Champy's miniplate osteosynthesis had normal postoperative occlusion. Of the remaining 9 patients (30%) with occlusal discrepancy, 7 patients had to undergo intermaxillary fixation for 1 week along with selective occlusal grinding and 2 patients were put on intermaxillary fixation for 2 weeks. In the prospective study by Cawood<sup>11</sup> 5.7% of mandibular fractures, treated by miniplates osteosynthesis had malocclusion detected on review. The higher percentage of malocclusion (30%) in group II in our study could be because all patients with postoperative occlusal discrepancy were patients with displaced fractures.

This incidence of occlusal discrepancy was compared and showed statistically significant difference with significantly less occlusal disturbances postoperatively with 2.0 mm locking plates. The first biomechanical comparison of locking plates to appear in the maxillofacial surgical literature was made by Gutwald<sup>12</sup> He concluded that a higher stability was achieved with the locking plates.

Mandibular fractures are often contaminated by oral bacteria.<sup>13</sup> The propensity of infection is increased with the natural reluctance of patient to swallow or move his tongue freely so that stasis develops with consequent accumulation of debris in the region of fracture. This encourages multiplication of bacteria and the greater delay in obtaining reduction and immobilization; the more likely it is that infections will result.<sup>14</sup> Iizuka T and Lindquist C have shown that post reduction infection at the fractured site is not only the result of contamination, but is also related to reduced stability of fracture i.e. mobility of fractured segments.<sup>15</sup> Zachariades N et al stated that stability is considered as the best protection against infection, as movement in the presence of foreign bodies (i.e. loose screws) usually leads to infection and pseudoarthrosis. Infection rate is also shown to be less with intra oral

approach.<sup>16</sup> Avascularity is shown to be one of the primary risk factor and so is the presence of teeth in fracture line.<sup>17</sup>

Patients were evaluated preoperatively, and postoperatively at 1 week, 1 month and 6 months after surgery for the signs of infection. Swelling, local rise in temperature, local inflammation and pus discharge were considered indicators for the presence of infection. The rate of infection was compared between the two groups at 1 week and at 1 month interval by using Mann Whitney test. There was no significant difference between the two groups, however the infection was reported to be higher in group II.

The incidence of infection for Group I was 13% at 1 week and 3% at 1 month. The incidence of infection for Group II was 32% at 1 week and 13% at 1 month. Edward Ellis III<sup>18</sup> has shown that with the use of open reduction and internal fixation, the reported incidence of infection ranged from 3% to 32%. Sauerbier et al<sup>9</sup> treated 56 mandibular fractures with locking plates in 53 patients and reported 7.5% patients with minor complications like infection and dehiscence. Ellis and Graham,<sup>19</sup> a total of 80 fractures in 59 patients were treated with the 2.0 mm locking plate/screw system, 6 (9%) patients developed postsurgical Infections. The data in our study was in accordance with the above studies.

Mobility at the fracture site was examined in Group I and Group II patients preoperatively and during various follow up stages. Preoperatively 3 out of 30 patients of Group I had no mobility, 18 patients had mobility in one plane and 9 patients had mobility in two plane. In Group II, 1 patient showed no mobility, 19 patients showed mobility in one plane and 10 patients showed mobility in two planes. In the present study, it was observed that at 1 week, 2(7%) out of 30 patients in group I had postoperative mobility present at the fracture site and in group II, 8(27%) out of 30 patients had postoperative mobility present at the fracture site.

Out of those 10 patients reported with mobility, 7 patients were put on intermaxillary fixation for 1 week, 3 patients for 2 weeks and then selective occlusal grinding was done if necessary. After 4 weeks, functional occlusion was restored in all patients. Mann Whitney test was applied to study the association between the mode of treatment and postoperative mobility. The results however showed statistically significant differences between the 2 groups, Group II having higher postoperative mobility between fractured segments.

Saikrishna D et al<sup>20</sup> in their study compared 2.0mm standard miniplates with locking miniplates and concluded that Locking plate/screw system proved to be more rigid than conventional plate/screw system. Favoring the other similar studies, group I patients in our study showed increased stability after fracture reduction and fixation obviating the need for IMF. Rigidity of fractured segments produces a stable foundation for better vascularity and soft tissue growth, thus allowing better healing of wound.

Pain associated with the procedure was recorded for Group I and Group II patients preoperatively and during various follow up stages based on a visual analogue scale.

(Table 3) Group I procedure was associated with significantly higher pain scores on the day of surgery but the pain was reported to be significantly higher in Group II at 1 week. However there was no significant difference between the pain scores of the two groups 1 month postoperatively, though the pain was still higher in group II.

The higher pain scores on day 1 for Group I patients was perhaps due to the wide surgical exposure and soft tissue retraction required for the placement of perpendicular screws and on 1 week for Group II was due to higher incidence of infection and mobility at the fracture segments.

One of the rare but most important complications associated with semi rigid fixation osteosynthesis is iatrogenic tooth damage. Post-operative OPG was evaluated to determine the incidence of tooth contact. The contacts were classified as major contact and minor contact. In present study, 1/30(3%) and first patient operated under Group II reported with minor contact. The damage occurred due to oblique placement of the screw to avoid screw insertion in the fracture line. The injured tooth was examined postoperatively for tooth vitality. Vitality testing was done by thermal tests using hot guttapercha points and ethyl chloride spray. Endodontic treatment was carried out for the management of injured tooth. No incidence of tooth injury was reported in Group I patients.

Postoperatively, complication like plate failure was evaluated in follow up period for both the Groups. In Group I, 1 (3%) out the 30 patients and in Group II, 4 (13%) out the 30 patients reported with infection at the fracture site.

2 patients in group II had a draining sinus tract postoperatively at 3 months. On radiographic examination it was revealed that the infection was due to loosening of the hardware and inter-fragmentary movement. Plate removal was done under higher antibiotic coverage in all of the patients reported with recurrent infection.

Hayter and Cawood<sup>21</sup> showed mental paresthesia in 8% of cases of mandibular fractures treated by Miniplate osteosynthesis while in another study by Gabrielli<sup>22</sup> postoperative paresthesia was found to be 31.52%. In our present study temporary paresthesia was noted to be present in 3(10%) patients preoperatively and 5(17%) patients postoperatively in group I and 2(7%) patients preoperatively and 3(10%) patients postoperatively in group II. In each one of the groups, 1 patient sustained the sensory disturbance for more than 4 weeks and they were managed conservatively. Although there was no significant difference between the postoperative sensory disturbances in both the groups, higher incidence of sensory disturbances in group I can be attributed to need for more tissue retraction for placement of perpendicular screws.

We could see the following advantages of 2.0 mm miniplates in that it was unnecessary for the plate to have intimate contact with the underlying bone in all areas and also decreases necrosis of fracture segments and produces less stress shielding due to non-compression. Locking bone plate/screw systems is that the screws are unlikely to loosen from the bone plate with greater amount of stability across the fracture gap. The study suggest that fixation of

mandibular fracture with locking plates provides extra stability and carries low morbidity and infection rates. The only probable limitations of these plates may be the slight technical sensitivity and the cost which is marginally higher in locking plates.

### Conclusion

During the course of present study the 2.0mm locking miniplate was found to be standard in profile, strong yet malleable, facilitating reduction and stabilization giving additional stability at fracture site. The use of 2.0mm locking plate system with its advantages of improved handling characteristics, increased stability, less occlusive discrepancy, low infection rate, less mobility between fractured segments, less pain and preservation of bony perfusion appear to be an effective and reliable alternative to Champy's miniplates in mandibular fractures.

The small sample size and limited follow-up could be considered as the limitations of this study. It is recommended to have a multi-centric study with large number of patients and correlation among these studies to authenticate our claims.

### Source of funding

None.

### Conflict of interest

None.

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**How to cite the article:** Agrawal A, Agrawal D. Comparative evaluation of 2.0mm miniplates over Champy's miniplates in mandibular fractures in rural population of Chhattisgarh. *J Dent Specialities* 2019;7(2):66-71.



## Evaluating the effects of smoking and smoking cessation on alveolar bone in young adults: An interventional prospective study

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### Abstract

**Introduction:** Preponderance of evidence suggests that smoking is one of the most significant risk factors in the development and progression of periodontal diseases. Smoke contains thousands of different compounds like Nicotine, Tar. Lack of education of dentists and hygienists to promote smoking quitting activities is a significant barrier for Motivational Interviewing for smokers.

**Aim:** To evaluate the effect of smoking on alveolar bone in young adults and motivating patients to quit through the Motivational Interviewing.

**Materials and Methods:** Sixty subjects were categorized into three groups. Group 1: smokers, Group 2: non-smokers, Group 3: smokers but willing to quit smoking. For alveolar bone height measurement Image Digitization was done. Smoking cessation was carried out for Group 3. Motivational Interviewing was used to convince the patients for smoking cessations. After six months, Nicoscreen® was used to know whether they quit smoking or not.

**Results:** Group 1 had statistically significant bone loss in comparison to Group 2 & Group 3 after six months which is attributed to effect of smoking on alveolar bone.

**Conclusion:** Periodontal health is compromised by chronic smoking by an increase in alveolar bone loss. Nicoscreen® can be used as a prompt screening tool for smoking cessation.

**Keywords:** Smoking, Motivational interviewing, Smoking cessation.

### Introduction

Periodontitis is the most prevalent form of periodontal diseases which is multifactorial in nature but bacterial infection being the main culprit. In addition, there are several risk factors i.e. smoking, diabetes (systemic diseases), stress etc. that may increase the probability and severity of periodontitis.<sup>1</sup>

Preponderance of evidence suggests that smoking is one of the most significant risk factors in the development and progression of periodontal diseases.<sup>2</sup> The postulated mechanisms of increased periodontal disease progression in smokers include alterations in the host response, such as reductions in serum IgG<sub>2</sub> levels and impairment of various neutrophil functions, such as phagocytosis and aerobic antimicrobial functions.<sup>3</sup> Other reported effects of smoking on the periodontium are suppression of fibroblast and osteoblast functions, alterations in gingival blood flow, and reductions in the GCF flow.<sup>4</sup> It has been well documented that smoking adversely affects bone by reducing bone mineral content.<sup>5</sup>

The association between cigarette smoking and periodontal diseases represents a significant oral health problem. Smoke contains thousands of different compounds like Nicotine, "Tar" (composed of many chemicals), Benzene, Benzo pyrene, Cotinine, a metabolite of nicotine, can be measured in the serum/plasma, urine and saliva, and is a better measure of cigarette smoke exposure as it has a longer half-life than nicotine (18 hrs compared with 1–2 hrs). Smokers would be expected to have serum cotinine levels of over 14 ng/ml, and this could be as high as 1000 ng/ml. Resting plasma nicotine levels are much lower (5–50

ng/ml), and are maintained by the individual to satisfy their craving for nicotine.

Lack of education of dentists and hygienists in terms of being able to select effective treatments available to promote quitting activities is a significant barrier for Motivational Interviewing (MI) for smokers. Various oral symptoms and dental treatments relevant to smoking may be applicable to motivate patients in dental clinics. The theoretical model for intervention with respect to behavioural approaches involves stage-based interventions.<sup>6</sup> This model separates smokers into five different stages: pre-contemplation, contemplation, preparation, action, and maintenance. Progression through these stages is sequential, although relapse to an earlier stage could occur.

Several types of tobacco dependence treatments involving counselling, behavioural therapy, and pharmacotherapy should be employed in all smokers who attempt quitting.

The aim of this study was to evaluate the effect of smoking on alveolar bone in young adults with a few years of smoking and motivating patients to quit and promoting for smoking cessation through the Motivational Interviewing (MI). The objectives of the study were to compare effect of smoking with clinical parameters, to compare crestal bone loss in smokers, non-smokers and smoking cessation groups, to evaluate the role of smoking cessation by Motivational Interviewing (MI) and to evaluate Nicoscreen® as a screening tool for smoking cessation.

## Methodology

It was an interventional, prospective and comparative study, carried out on patients selected from the outpatient Department of Periodontics & Oral Implantology, Ahmedabad Dental College and Hospital for evaluation of the effect of smoking and smoking cessation on alveolar bone.

Patients were randomly selected based on following criteria. The subjects included only males aged 18-26 years. Subjects having all premolars, molars and lower central incisors without mal alignment/ malocclusion were included. Subjects considered not having periodontitis as identified by clinical examination by following criteria: 1) No more than one tooth with inter proximal attachment loss  $\geq 2$ mm. 2) Site should not have probing depth more than 3mm. 3) Subjects should not have attachment loss associated with recession.

The subjects having any systemic condition that affect periodontal condition i.e. diabetes, individual who have received periodontal therapy before 12 months from baseline of study, antibiotics or NSAID within 6 months prior to study, subjects who have undergone orthodontic treatment and patient with diastema were excluded from study.

The subjects once selected, underwent routine periodontal examination. Cigarette smoking status was obtained from a written questionnaire completed by each subject, which was reported to be a valid method for estimating smoking prevalence. Subjects were considered smokers if they had been smoking  $>5$  cigarettes per day since last 2 years.<sup>7</sup>

A total number of sixty patients participated in this study. They were categorized into three Groups. Group 1 (n=20) consisted of smokers, Group 2 (n=20) consisted of non-smokers and Group 3 (n=16) consisted of patients who were smokers but willing to quit smoking. Former smokers were not included in the study.

A parallel-arm prospective design for the study was used. After enrollment in the study, all individuals were evaluated clinically and radiographically (baseline evaluation). Then, with the purpose of obtaining a uniform periodontal status, all subjects underwent a rigorous dental hygiene programme (DHP). The DHP consisted of approximately two sessions per week, for 3 weeks, of oral hygiene instructions (brushing and flossing), scaling (quadrant by quadrant at 1-week intervals and using selected hand instruments), and polishing with rotary instruments. The endpoint of the mechanical treatment included removal of supragingival and subgingival calculus and stain to achieve a smooth surface. Fifteen days later, a second clinical evaluation was performed to assess the effect of the DHP on baseline periodontal status. After this, each subject continued throughout the study with a personal oral hygiene routine (as instructed during the DHP) and with no professional periodontal maintenance. At the end of the study, periodontal therapy was performed as needed. A reported change in smoking habits (reviewed at each

session). After six months clinical and radiographic parameters were re-measured.

For the radiographic measurements, RVG were taken by using standardised parallel device. Only one dental x-ray equipment Gomax<sup>®</sup> was used, with the exposure parameters fixed at 60 kV(p), 15 mA, and 1 second. For each subject, three RVG were taken: left & right from the molar-premolar region and one at mandibular anterior region between two central incisors.

Image Digitization was done by transferring the RVG to Sopro<sup>®</sup> software for analysis and measurement. After transferring the image, brightness was adjusted to identify CEJ. Digitized images were analyzed with a software program using a magnification in a 15-inch non-interlaced high-resolution monitor with a display resolution of 800 × 600 pixels. All image evaluations were performed by a single operator, seated 50 cm far from the screen in a room with soft light without prior knowledge of the experimental group to which each image belonged.

For bone height measurement, the distance from the cemento-enamel junction (CEJ) to the alveolar bone crest (ABC) was measured in millimetres at three proximal sites per image: one molar-molar site referred to distal surfaces of first molars, one molar-premolar site referred to mesial surfaces of first molars, and one premolar-premolar site referred to mesial surfaces of second premolars. Because two (left/right) radiographs were taken from the molar-premolar region, a total of six posterior proximal sites (Fig. 1) and one in lower anterior between two central incisors (Fig. 2) per subject were measured at each evaluation point over the six months of period. The observer performing the analysis identified and marked the CEJ and then identified and marked the ABC as the most coronal position where the periodontal ligament space was uniform in thickness.

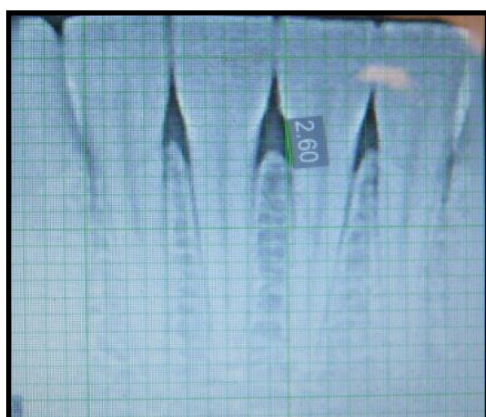
Smoking cessation was carried out after baseline clinical and radiographic measurement for Group 3. Motivational Interviewing (MI) was used to convince the patients for smoking cessations. After six months special cessation kit Nicoscreen<sup>®</sup> (Fig. 3) was used to know actual status of patients whether they had quit smoking or not.

Nicoscreen<sup>®</sup> is based on the principle of the highly specific immunochemical reactions between antigens and antibodies, which are used for the analysis of specific substances in urine. The drops of urine are placed onto a cassette and the assay reacts within 5 minutes providing preliminary evidence of nicotine use by appearance of line that indicate positive or negative result.

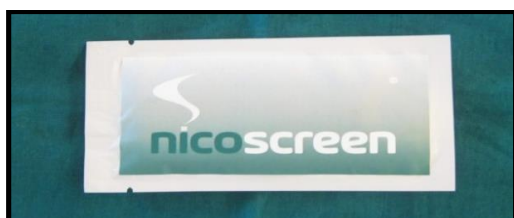
Interpretation of results (Fig. 4,5): Negative: Two Colour Bands: The appearance of two purple bands within the result window indicates a negative test result. Positive: One Colour Band: The appearance of only the control line, 'C', within the result window indicates the result is positive, i.e. the specimen contains COT at a concentration above the cut-off level. Invalid: No Band- A distinct control line, 'C', should always appear in the result window. The test is invalid if no control line forms in the result window.



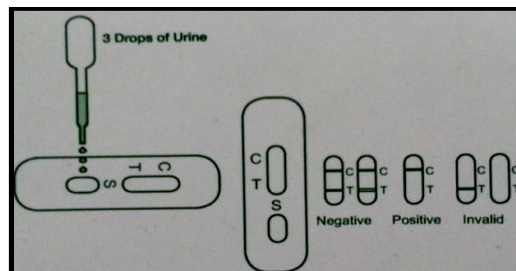
**Fig. 1:** Measurement of crestal bone loss at lower right posterior region



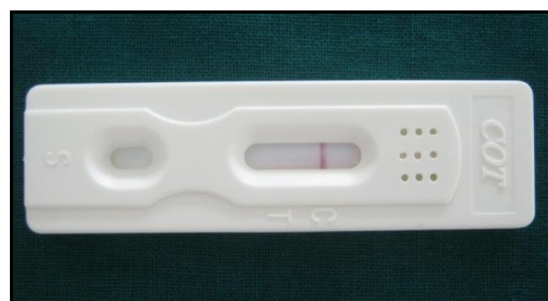
**Fig. 2:** Measurement of crestal bone loss at mesial surface of mandibular right central incisor



**Fig. 3:** Nicoscreen® (Kit for smoking cessation)



**Fig. 4:** Nicoscreen® reaction



**Fig. 5:** Nicoscreen® shows positive result

**Results**

All the data were transferred to SPSS v17 for the statistical analysis. The Student's *t*-test for paired comparisons was used to determine the significance of the difference between initial and re-evaluation clinical parameters and measurement of bone loss for the study subjects. Analysis of variance (ANOVA) was used to compare multiple groups for a measurement of bone loss and clinical parameter (i.e. PI and GI) among all the groups. Multiple comparisons were done between the group forms using the Tukey's test for measurement of bone loss and clinical parameter (i.e. PI and GI). (Table 1-3)

**Table 1:** Inter-group comparison of site specific mean crestal bone loss

Site		Groups			F value	p value
		Group 1	Group 2	Group 3		
Right side distal surface of 1 <sup>st</sup> molar	Baseline	1.98 ± 0.55	1.55 ± 0.40	2.36 ± 0.42	12.64	<0.001**
	At 6 months	2.26 ± 0.60	1.57 ± 0.41	2.38 ± 0.41	14.38	<0.001**
Right side mesial surface of 1 <sup>st</sup> molar	Baseline	2.00 ± 0.81	1.59 ± 0.42	2.28 ± 0.41	5.85	0.005
	At 6 months	2.33 ± 0.83	1.62 ± 0.43	2.30 ± 0.42	8.06	0.001
Right side mesial surface of 2 <sup>nd</sup> pre-molar	Baseline	2.10 ± 0.65	1.73 ± 0.45	2.29 ± 0.42	5.06	0.01
	At 6 months	2.48 ± 0.59	1.71 ± 0.47	2.31 ± 0.41	12.39	<0.001**
Left side distal surface of 1 <sup>st</sup> molar	Baseline	2.04 ± 0.56	1.66 ± 0.30	2.27 ± 0.34	9.04	<0.001**
	At 6 months	2.28 ± 0.50	1.68 ± 0.30	2.29 ± 0.34	14.4	<0.001**
Left side mesial surface of 1 <sup>st</sup> molar	Baseline	1.92 ± 0.63	1.77 ± 0.33	2.34 ± 0.34	6.09	0.004
	At 6 months	2.30 ± 0.70	1.79 ± 0.33	2.35 ± 0.35	6.77	0.002
Left side mesial surface of 2 <sup>nd</sup> pre-molar	Baseline	2.27 ± 0.62	1.79 ± 0.53	2.37 ± 0.28	6.37	0.003
	At 6 months	2.53 ± 0.61	1.81 ± 0.53	2.34 ± 0.28	10.36	<0.001**
Mesial surface of right mandibular central incisor	Baseline	2.87 ± 0.96	2.04 ± 0.71	2.80 ± 0.29	12.58	<0.001**
	At 6 months	3.23 ± 0.95	2.07 ± 0.71	2.82 ± 0.29	9.04	<0.001**

**Table 2:** Inter-comparison of mean PI between groups at baseline and at follow up

Groups	Baseline		Follow up at 6 months	
	Mean difference	p value	Mean difference	p value
Group 1 VS Group 2	0.085	0.49	0.405	<0.001**
Group 2 VS Group 3	0.083	0.57	0.015	0.97
Group 1 VS Group 3	0.001	1.00	0.390	<0.001**

**Table 3:** Inter-comparison of mean GI between groups at baseline and at follow up

Groups	Baseline		Follow up at 6 months	
	Mean difference	p value	Mean difference	p value
Group 1 VS Group 2	0.01	0.98	0.02	0.91
Group 2 VS Group 3	0.00	0.98	0.07	0.34
Group 1 VS Group 3	0.00	1.00	0.09	0.91

## Discussion

Tobacco smoking, mostly in the form of cigarette smoking, is recognized as the most important environmental risk factor in periodontal diseases. This habit has proven to be an important risk factor involved in the initiation, maintenance, and aggravation of periodontal diseases in adults. (Offenbacher S et al.)<sup>1</sup> These studies were mainly concerned with adult populations, generally heavy smokers with many years of cigarette consumption in whom other risk factors, such as age or systemic diseases, may co exist. The main findings of this prospective study were that smoking was associated with poorer periodontal condition as assessed clinically, and it had a negative effect on alveolar bone as assessed radiographically in a group of well-motivated young adults without periodontitis. Bergstrom et al.<sup>8</sup> investigated the long-term (10 years) influence of smoking on periodontal bone height and demonstrated a reduction in bone height that was 2.7 times greater in adult smokers.

The effect of nicotine was studied in an animal model of periodontal disease by Fiore MC et al.<sup>9</sup> The components of tobacco and nicotine metabolites may act directly as local irritants on the gingiva and alveolar bone or systemically (Offenbacher et al.)<sup>1</sup> Nicotine can suppress the proliferation of cultured osteoblasts while stimulating osteoblast alkaline phosphatase activity. Slots J<sup>10</sup> reported that nicotine increased the secretion of interleukin-6 (IL-6) and tumor necrosis factor alpha (TNF- $\alpha$ ) in osteoblasts. Nicotine also seems to stimulate bone matrix turnover by increasing the production of tissue-type plasminogen activator and matrix metalloproteinases (MMPs), thereby tipping the balance between bone matrix formation and resorption toward the latter process, as reported by Katonoet al.<sup>11</sup> Nicotine and lipopolysaccharide stimulated the formation of osteoclast-like cells via an increase in macrophage colony-stimulating factor and prostaglandin E<sub>2</sub> (PGE<sub>2</sub>) production. Receptor activator of nuclear factor-kappa B ligand (RANKL) and osteoprotegerin (OPG) are members of the tumor necrosis factor super family. RANKL promotes osteoclastic differentiation and activates bone resorption. In contrast, OPG inhibits osteoclast genesis and suppresses bone resorption by inhibition of RANKL.<sup>12</sup>

Smoking cessation intervention is an important category in the dental practice. The dentist can assist the patient by offering medication and providing or referring for counselling or additional treatment, and arrange for follow-up contacts to prevent relapse (Tanaka et al.)<sup>13</sup> Therefore, the provision of information about effective smoking cessation aids is an essential component of intervention for patients who are willing to quit.

The present study was designed to evaluate the effect of smoking and smoking cessation on alveolar bone in young adults and the Motivational Interviewing (MI) for the cessation of smoking. A total number of sixty patients having mean age of 23.4 years were participated in this study. They were categorized into three groups as described earlier. All patients from Group 1 and Group 2 successfully completed the study without any drop out, while six patients were dropped out from Group 3 at six months re-evaluation, as they refused to quit smoking.

The accumulation of dental plaque was higher for smokers than the other two groups. Inter-comparison of PI between groups at baseline and follow up showed that comparison between Group 1 and Group 2 showed statistically insignificant difference at baseline ( $p=0.49$ ), however at follow up it was found to be a statistically significant difference ( $p<0.001$ ). Comparison of PI at baseline and at follow up among all groups showed statistically insignificant at baseline, whereas it was found to be statistically highly significant at follow up. Similar results were reported by Al-Wahadni and Linden<sup>14</sup> in a case control study of young Jordanians smokers.

Clinical gingival inflammation was almost the same in all three groups at baseline. After six months of follow up, a reduction in clinical gingival inflammation was observed in all groups, but Group 3 showed statistically highly significant result ( $p<0.001$ ). Studies have found greater (Gunsolley J C et al.)<sup>15</sup> and equal (Jin Q et al.)<sup>16</sup> levels of gingival inflammation in smokers compared to non-smokers. Al-Wahadni and Linden<sup>14</sup> also found increased signs of gingival inflammation in young smokers.

The 6- to 12-month re-entry procedure has been the gold standard for the evaluation of changes in alveolar bone in most clinical regenerative studies during the last decades (Toback GA et al.)<sup>17</sup> Despite the limitations of radiographic

analysis, (Bragger U, Hausmann E)<sup>18,19</sup> it remains the only non-invasive method for bone evaluation in young subjects with no periodontal destruction. Sopro<sup>®</sup> software was used for better identification of CEJ and measurements of alveolar bone loss along with RVG.

Alveolar bone height was measured in proximal sites of standardized, mandibular posteriors and mandibular anterior digital radiographs with a RVG. Group 1 had a decreased bone height at all stages of the study, and bone loss was noted in these subjects after six months of follow-up which is attributed to effect of smoking on alveolar bone, while Group 2 & Group 3 had a constant alveolar bone height or slight decreased bone height at follow up except in group two right side distal to 1<sup>st</sup> molar and mesial to 2<sup>nd</sup> pre-molar which showed statistically insignificant result. The mean crestal bone loss of all seven surfaces was measured at baseline and at follow up. Statistically significant difference among Group 1, Group 2 & Group 3 was found at right side mesial surface of 1<sup>st</sup> molar ( $p=0.001$ ) & left side mesial surface of 1<sup>st</sup> molar ( $p=0.002$ ) at follow up. Statistically highly significant difference among Group 1, Group 2 & Group 3 ( $p<0.001$ ) was found at right side distal surface of 1<sup>st</sup> molar, right side mesial surface of 2<sup>nd</sup> pre-molar, left side distal surface of 1<sup>st</sup> molar, left side mesial surface of 2<sup>nd</sup> pre-molar & mesial surface of right mandibular central incisor at follow up. The statistical analysis disclosed that the duration of smoking had a negative effect on the alveolar bone height measured. These findings are in agreement with the literature (Haber J et al.),<sup>2</sup> data from cross-sectional studies published by Feldman et al.<sup>20</sup> Bergstrom et al.<sup>8</sup> and data from longitudinal studies published by Machtei et al.<sup>21</sup> and Bergstrom et al.<sup>22</sup> All of these studies were conducted in an older population (mean age >39) with a longer duration of smoking (mean >10 years). The current population under study was different because subjects were younger, and total smoking frequency was lower. Our results confirm previous reports about young smokers in cross sectional (Gunsolley JC et al.)<sup>15</sup> longitudinal clinical studies by Muller HP et al.<sup>23</sup> and Levin L et al.<sup>24</sup>

The 5A approach provides a structure for identifying all smokers and offering support to help them quit (Mihir Shah et al. 2006).<sup>25</sup> This model consists of five components for effective smoking cessation intervention: Ask about tobacco use; Advise about quitting; Assess willingness to make a quit attempt; Assist in the quit attempt; and Arrange follow-up.

In present study, MI was used for smoking cessation and at the end of six months; six patients were dropped out because they refused to quit the smoking. Very few studies demonstrate a dose-response relationship between risk reduction of periodontal disease and smoking cessation. Findings of the NHANES III (National Health and Nutrition Examination Survey) revealed that the odds of periodontitis for former smokers who quit  $\geq 11$  years previously were indistinguishable from the odds for non-smokers (Tomar & Asma).<sup>26</sup>

Smoking cessation was confirmed by the special screening kit (for cotinine) named Nicoscreen<sup>®</sup>. It is a

prompt screening tool used to detect cotinine in body fluids up to three days after the body has absorbed the substance. Although the subjects who participated in this study were all dental students, they correspond to a homogenous subset with regard to oral hygiene knowledge, periodontal health status, and social class. Smoking may impact alveolar bone negatively even in a well-motivated young population. The patterns of change on bone parameters evaluated over six months of follow-up might indicate that smoking is already damaging the alveolar bone in these subjects, who were clinically diagnosed to be free from destructive periodontal disease. Hashim R et al.<sup>27</sup> reported that smoking in adolescence was a strong predictor of loss of periodontal attachment occurring by the mid-twenties. Despite public information campaigns, a substantial proportion of the population continues to smoke.

### Conclusion

Periodontal health is compromised by chronic smoking by an increase alveolar bone loss, whereas in non-smokers the periodontal health condition remained unaltered. The association between smoking and clinical morbidity tend to be dose-dependent. Importantly, the conditions in former smokers remained stable, very similar to those of non-smokers. To conclude with, this study reveals that in smokers, more plaque score and reduced gingival inflammation is observed than non-smokers and smoking cessation group. It has negative impact on alveolar bone than non-smokers. Smoking cessation group and non-smokers has better clinical parameter than smokers in terms of bone height. Smoking cessation is effective in preventing not only oral diseases but also the progression of periodontal tissue breakdown. Intervention may be integrated in existing procedures of dental treatment because improvement of outcome of the treatment is expected by smoking cessation. Nicoscreen<sup>®</sup> can be used as a prompt screening tool for smoking cessation.

### Source of funding

None.

### Conflict of interest

None.

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**How to cite the article:** Parikh HA, Shah MN, Shah SB, Shah PS, Patel RR. Evaluating the effects of smoking and smoking cessation on alveolar bone in young adults: An interventional prospective study. *J Dent Specialities* 2019;7(2):72-7.

## A randomized split mouth study for comparison of clinical success rate of GIOMER based sealant and conventional fluoride releasing pit and fissure sealant in first permanent molars

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### Abstract

**Objective:** To compare and assess the application time, retention, marginal staining, development of carious lesion and plaque accumulation of GIOMER based pit and fissure sealants with conventional fluoride releasing pit and fissure sealant in first permanent molars.

**Study Design:** Fifty children in the age range of 6-9 years, following acceptable home dental care, had participated in the study. A randomized split-mouth design was used in which two fissure sealants (Helioseal F and Beautisealant) were randomly placed in 50 harmonizing contralateral duo of permanent first molars. Sealants were gauged by a single skilled and calibrated examiner using mouth mirrors and probes following the USPHS criteria at 3-, 6- and 12-months follow up.

**Results:** Mean application time for Beautisealant was significantly less i.e. 155.39 seconds than that of Helioseal F i.e. 260.91 seconds. The retention rates at 3, 6 and 12 months for Helioseal F was 80.4%, 76.1% and 60.9% and for Beautisealant was 71.7%, 65.2% and 47.8% respectively.

**Conclusion:** Application time of Beautisealant was significantly less than Helioseal F, but Helioseal F demonstrates better retention rate, while both material displayed similar results for marginal staining, development of carious lesion and plaque accumulation.

**Keywords:** Pit and fissure sealants, Retention, Giomer.

### Introduction

Dental caries is an infectious disease of the tooth caused by the micro-organisms attacking the susceptible host tooth in collaboration with substrate that results in confined dissolution and ruination of calcified tissue with time. Pit and fissures of first permanent molars, due to its extended eruption phase have highest prevalence of dental caries as they provide excellent instinctive shelter for the growth of microbes. Preventive measures such as control of bacterial plaque and topical fluoride application have its effect on such surfaces but sealing the pits and fissures just after tooth eruption may be one of the most important method in providing resistance to caries.<sup>1</sup>

Dental sealants form a smooth layer avoiding sticking of food and thus providing hindrance to bacterial survival in pits and fissures.<sup>2,3</sup>

Resin-based fluoride releasing conventional sealants are preferred choice, however use of phosphoric acid demineralizes the enamel layer and have elongated treatment time and is more technique sensitive.<sup>4</sup>

Newer GIOMER based pit and fissure sealant using self-etch primer eliminates phosphoric acid etch and rinse, self-etch adhesive combine etching, priming and bonding into single step, thus conserving the enamel and reducing chair side time especially in uncooperative children. However, retention of self-etch adhesive as compared to conventional sealants is questionable.<sup>5</sup>

Hence, a study was conducted to evaluate the clinical performance of GIOMER based sealant (Shofu Beautisealant) in comparison to conventional fluoride

releasing pit and fissure sealant (Vivadent Ivoclar Helioseal F) in first permanent molars.

### Material and Methods

Fifty children in the age of six to nine years were selected from the Out-patient Department of Pedodontics and Preventive Dentistry, I.T.S Centre for Dental Studies and Research, Muradnagar.

Study was approved by the ethical committee of the institution. Consent form was signed by each patient's parents/guardians before enrolling them in the study.

Sample size was evaluated using the formula:  $N=2(Z_{\alpha}+Z_{\beta})^2 / (d)^2$  where,  $\alpha$ =First type of error;  $\beta$ =Second type of error;  $d$ =Allowable difference.

A split-mouth design was used in which the two fissure sealants (Helioseal F and Beautisealant) were randomly placed in fifty harmonizing contralateral duo of permanent first molars. Group 1 (Helioseal F) and Group 2 (Beautisealant)

Software (Stat Trek random number generator) based random numbers were generated to randomly allocate the sealants for placement on either side of the arch in all the patients.<sup>6</sup> Both teeth were sealed during the same appointment starting with the right side and followed by the left side.

Children included in the study were having both left and right first permanent molars indicated for sealant application from either arch. Teeth with no sign of occlusal caries and patient following acceptable home dental care measures.



Uncooperative patient and unerupted/ partially erupted teeth on the contralateral side and patients having any chronic medical diseases or receiving long term medication were excluded.

### Procedure

The tooth was cleaned with wet bristle brush at low speed and then rinsed and dried. Isolation was carried out using cotton rolls and assisted suctioning to maintain a dry operating field.

**Helioseal F sealant (Group 1):** 37% phosphoric acid etchant was applied on the occlusal surface directly with the syringe for 30 seconds. A white frosted appearance on the enamel confirmed adequate etching. Helioseal F sealant was then applied to the pits and fissures according to the manufacturer's instructions. The sealant was cured for 20 seconds using LED light curing unit. Occlusion was checked using articulating paper and extra material was reduced with slow speed finishing burs.

**Beautisealant (Group 2):** Adequate amount of primer was first dispensed onto V-DISH, which was available in the company kit after following the same procedure as above for cleaning and drying the teeth. A fine micro-brush was used to apply the primer on the enamel surface of pits and fissures. It was left undisturbed for at least 10 seconds, followed by gentle air drying to avoid dispersion of primer.

The sealant was then applied directly from the syringe into the pit and fissures slowly and steadily and light cured for 20 seconds as per manufacturer's instructions. Occlusion was checked and reduced as per the patient comfort.

### Clinical evaluation

#### a) Application time

Time in seconds for each sealant application was recorded by the operator, using the digital stopwatch, beginning from the placement of first cotton roll for isolation till the end of the curing cycle.

#### b) Retention, marginal staining and development of carious lesion

All the margins were inspected and explored to check for any marginal discoloration and seal. Patients were then recalled at 3-, 6- and 12- month intervals to check for retention, marginal Staining and development of carious lesion according to the Modified United States Public Health Services (USPHS) criteria.<sup>7</sup>

#### c) Plaque disclosing procedure

Two toned plaque disclosing agent was used to check for plaque accumulation. The agent was applied on sealed dried tooth for 60 seconds and rinsed once with water. Blue color displayed accumulation of plaque. Absence and presence of plaque was recorded on follow up at each interval accordingly.

#### d) Blinding

Follow up examination for pit and fissure sealant was done by trained and calibrated evaluator, specialists in pediatric dentistry. The operator could not be blinded for application of materials and recording the time for application because different type of procedures were required for both the

materials according to the manufacturer's instructions. The evaluator was blinded regarding all the clinical recordings to be scored for the two sealant materials.

### Statistical analysis

The data was compiled and analyzed using SPSS version 20. Student t-test was used to compare the application time. Pearson Chi-Square test was used to compare the other parameters of clinical evaluation.

### Results

In the present *in vivo* study, fifty children with mean age  $7.8 \pm 1.13$ . The sealants were evaluated for the clinical performance including retention, marginal staining, development of carious lesion and plaque accumulation at 3, 6 and 12 month intervals.

56% samples were male i.e.  $n = 28$  as compared to 46% females i.e.  $n = 22$ .

Two patients were dropped out from the study as they did not turn up for recalls. 92 teeth were evaluated for the study.

Application time at zero day was compared using Student t-test. Mean time for Group 1 (Helioseal F) was  $260.91 \pm 58.52$  seconds and Group 2 (Beautisealant) was  $155.39 \pm 46.62$  seconds. Results showed that mean time of application for group 2 was significantly lower than that of group 1. ( $P = 0.0001$ ). (Table 1)

Overall retention of sealants at each recall is shown in Table 2, 3, 4. The frequency of retention of a sealant fell gradually from 76.05% after 3 months to 54.35% after 12 months. The total loss of Beautisealant (26.1%, 30.4% and 41.3% at 3, 6 and 12 months, respectively) was significantly more than the total loss of Helioseal F (8.7%, 10.9%, 13%, respectively). ( $p = 0.032, 0.036, 0.006$ ).

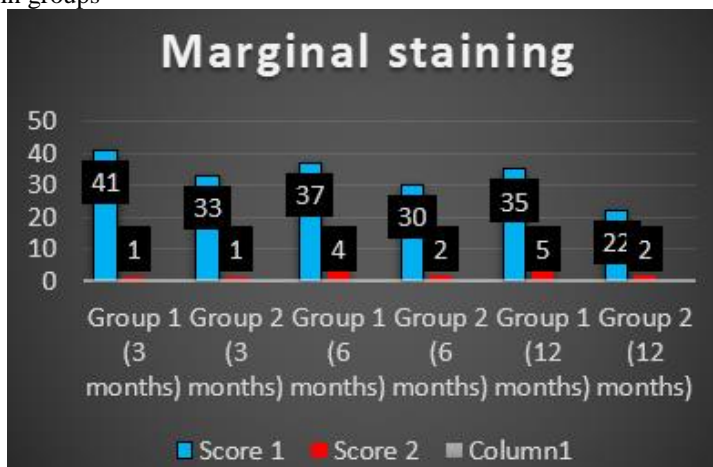
Graph 1 shows marginal staining at 3, 6 and 12 months was absent in 97.6%, 90.2% and 87.5% in group 1 and 97.1%, 93.8% and 92.6% in group 2, respectively ( $p = 0.879, 0.588, 0.504$ ).

There was no development of carious lesion at 3 and 6 months. Only 1 tooth in each group showed development of carious lesion at 12 months (Table 5). ( $p = 1.000$ ).

Plaque accumulation was present in 2.4%, 2.4% and 2.5% in group 1 and 8.6%, 6.1% and 14.3% in group 2 at 3, 6 and 12 months (Table 6). There was no statistical difference between two groups ( $p = 0.223, 0.432$  and  $0.067$ ).



**Graph 1: Marginal staining in groups**



**Table 1: Comparison of time calculated for application at zero day in both groups**

	Group	N	Mean (seconds)	Std. Deviation	P value
Time	1	46	260.91	58.520	0.0001**
	2	46	155.39	46.620	

NS = not significant, \*significant = P < 0.05, \*\*highly significant = P < 0.01

**Table 2: Comparison of retention at 3 months in both groups**

		Retention at 3 months			Total	P Value
		Score 1 N (%)	Score 2 N (%)	Score 3 N (%)		
Group	1	37 (80.4%)	5 (10.9%)	4 (8.7%)	46 100.0%	0.032*
	2	33 (71.7%)	1 (2.2%)	12 (26.1%)	46 100.0%	

NS = not significant, \*significant = P < 0.05, \*\*highly significant = P < 0.01

**Table 3: Comparison of retention at 6 months in both groups**

		Retention at 6 months			Total	P Value
		Score 1 N (%)	Score 2 N (%)	Score 3 N (%)		
Group	1	35 (76.1%)	6 (13.0%)	5 (10.9%)	46 100.0%	0.036*
	2	30 (65.2%)	2 (4.3%)	14 (30.4%)	46 100.0%	

NS = not significant, \*significant = P < 0.05, \*\*highly significant = P < 0.01

**Table 4: Comparison of retention at 12 months in both groups**

		Retention at 12 months			Total	P Value
		Score 1 N (%)	Score 2 N (%)	Score 3 N (%)		
Group	1	28 (60.9%)	12 (26.1%)	6 (13.0%)	46 100.0%	0.006**
	2	22 (47.8%)	5 (10.9%)	19 (41.3%)	46 100.0%	

NS = not significant, \*significant = P < 0.05, \*\*highly significant = P < 0.01

**Table 5:** Comparison of development of carious lesion at 12 months in both groups

		Development of Carious Lesion at 12 months		Total	P Value
		Score 1 N (%)	Score 2 N (%)		
Group	1	1	45	46	1.000 <sup>NS</sup>
		(2.2%)	(97.8%)	100.0%	
Group	2	1	45	46	100.0%
		(2.2%)	(97.8%)	100.0%	

<sup>NS</sup> = not significant, \*significant = P < 0.05, \*\*highly significant = P < 0.01

**Table 6:** Comparison of plaque accumulation at 12 months in both groups

		Plaque Accumulation at 12 months		Total	P Value
		Score 1 N (%)	Score 2 N (%)		
Group	1	1	39	40	0.067 <sup>NS</sup>
		(2.5%)	(97.5%)	100.0%	
Group	2	4	24	28	100.0%
		(14.3%)	(85.7%)	100.0%	

<sup>NS</sup> = not significant, \*significant = P < 0.05, \*\*highly significant = P < 0.01

## Discussion

Dental caries is one of the most prevalent and important dental problem affecting most of the children in India.<sup>8</sup> Dietary patterns which include more of carbohydrates and sugars are the predominant cause for the high prevalence of dental caries which affect the newly erupted first permanent molars.<sup>9</sup> Caries occurrence in the pits and fissures of the occlusal surface of the molars is responsible for about 67–90% of caries in children within age of 5 to 17 years.<sup>10</sup> Karunakaran R et al., conducted a study to evaluate the prevalence of dental caries among school going children in sub-urban area of south India and reported an overall prevalence of 65.9%.<sup>11</sup> Dental sealants (also termed pit and fissure sealants, or simply fissure sealants) form an important part of School Dental Health Programs conducted by various Dental Institutes in India.<sup>12</sup>

Helioseal F is a conventional phosphoric acid etch and rinse light-curing, white-shaded fissure sealant featuring fluoride release. Fluoride is known to increase enamel resistance via the promotion of remineralization and inhibition of demineralization; reduce plaque growth and plaque activity; have a bacteriotoxic effect.<sup>13</sup> Clinical studies for Helioseal F have shown to have better retention than other fissure sealants.<sup>14</sup> And an *in vitro* SEM analysis of surface morphology after Helioseal F placement has revealed least voids, cracks and microporosities.<sup>15</sup> Therefore, considering all the qualities, Helioseal F was the material of choice as a control.

Beautisealant is a fluoride releasing pit and fissure sealant that seals deep grooves and fissures while providing all round protection especially during the caries-prone years through the sustained release and recharge of fluoride and inhibits plaque accumulation.<sup>16</sup>

Conventional sealants require phosphoric acid etching which can dehydrate and demineralizes healthy tooth structure. Beautisealant self-etch primer contains dual adhesive monomers have higher pH that thoroughly penetrate into deep pits and fissures to prime the tooth surface for an effective chemical bond to the sealant while

minimizing any damage to enamel by partially dissolving hydroxyapatite for filling it by resin.<sup>17</sup>

Clinical performance of both the sealants was evaluated using the Modified United States Public Health Service (USPHS), Ryge Criteria for Direct Clinical Evaluation of Restoration.<sup>18</sup> The reason for opting for this criterion was its simplicity, easy to record the data in a presentable form and easy communication.

Recording of presence and absence of plaque accumulation was done to check for plaque inhibiting property of Beautisealant as no clinical study according to literature has been done for the same.

Time of application is an important consideration when all the four molars require sealant application. Increased time of application by conventional phosphoric acid etch and rinse hampers isolation and thus retention. In the self-etch approach, the etching and priming steps are combined into a single step procedure, without the need for washing. This reduces the chair side time and technique sensitivity, especially for uncooperative children.<sup>19</sup>

In our study the application time for the self-etch primer system was significantly less than that of phosphoric acid etch and rinse.

## Retention

The efficacy of sealants in preventing caries has been associated with the duration and degree of sealant retention. Mechanical retention of sealants is the direct result of resin penetration into pits and fissures and porous micromechanical tags.<sup>20</sup> Ledger *et al* reposted that etching of enamel surface with 37% phosphoric acid solution for 60 seconds result in 27.1 µm etching depth.<sup>21</sup>

In the present study, in both the groups, there was loss of retention with time but comparison of retention in Group 1 (Helioseal F) and Group 2 (Beautisealant), retention of Helioseal F was significantly more than that of Beautisealant at 3, 6 and 12 months follow up.

In a similar study, Rajashekar Reddy *et al* (2015) evaluated two pit and fissure sealants for 12 months,

Helioseal F showed 53.57% complete retention, 37.50% partial retention.<sup>22</sup> Güçyetmez T *et al* (2017), Beautisealant showed poor retention rate at 15 months follow up. Only 24.2% showed complete retention and 43.3% showed partial retention.<sup>23</sup>

Marginal Staining is an important parameter in the evaluation of the clinical success of sealant material, mainly at the sealant margin. Etching procedures might increase adhesion to enamel of sealant materials, allowing better marginal adaptation.<sup>24</sup> The presence of a marginal gap can lead to marginal staining, which can be considered the first sign of sealant failure.

In the present study, both Group 1 (Helioseal F) and Group 2 (Beautisealant) showed marginal staining after 12 months evaluation. Only teeth containing pit and fissure sealants were recorded. Beautisealant showed slightly better response against marginal staining but the difference was not statistically significant. Ninawe N *et al* (2012) evaluated and compared marginal staining of two fluoride releasing pit and fissure sealants. Both the materials showed similar results with respect to marginal staining and in Helioseal F, 86.7% teeth showed no marginal discoloration.<sup>2,5</sup>

### Development of carious lesion

Pit and fissure sealants have shown to have better preventive property than any other tooth dentifrice education because of its better compliance. In the present study, there was no development of carious lesion in both the groups at 3 and 6 months, only 1 tooth in each group showed initial caries development at 12 month follow up. Su HR *et al* concluded that the clinical anticariogenic effect of one-step etching adhesives and phosphoric acid etching sealant was similar.<sup>25</sup>

Plaque accumulation: In the present study, plaque accumulation was evaluated at 3, 6 and 12 months interval to check for plaque inhibition property of Beautisealant. Both the sealant showed plaque inhibition. On evaluation, only negligible number of teeth in both the groups showed plaque deposition but there was no statistically significant difference in 3, 6 and 12 months follow up.

### Limitations

1. The present *in-vivo* study needs a long term clinical follow-up to strengthen the efficacy of pit and fissure sealants.
2. Comparison of fluoride release property of both the sealants.
3. Measurement of fluoride recharging property of Beautisealant.
4. Small sample size

### Conclusion

The application of pit & fissure sealant is highly effective in preventing caries in young population & reduction of caries development is more related to the quality of sealant retention, instead of to the content of the material. Successful retention & cost effectiveness of Helioseal F is more critical than the self-etching primer system, just to

eliminate the phosphoric acid etching for ease of treatment & saving time.

### Source of funding

None.

### Conflict of interest

None.

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**How to cite the article:** Sharma S, Chopra R, Jhingan P, Sachdev V. A randomized split mouth study for comparison of clinical success rate of GIOMER based sealant and conventional fluoride releasing pit and fissure sealant in first permanent molars: *J Dent Specialities* 2019;7(2):78-83.

## A comparative analysis of survival rate and shear bond strength of bondable molar tubes with two different mesh designs

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### Abstract

**Objective:** To evaluate and compare the shear bond strength (in vitro) and survival rate (in vivo) of molar tubes with conventional and modified mesh base designs.

**Materials and Methods:** Molar tubes of two different base design ie conventional (American Orthodontics) and modified base design (Ortho Organizers) were evaluated and compared for shear bond strength and survival. 20 molar tubes of each type were bonded on freshly extracted first permanent molars. Shear bond strength was tested using a Universal testing machine. 20 patients requiring fixed orthodontic treatment were selected. Molar tubes with two different base designs were placed on alternate sides in the four quadrants so that each arch had molar tubes of both types. Survival of the bonded tubes was evaluated monthly for a period of six months.

**Results:** Molar tubes having conventional mesh base design showed greater shear bond strength (10.49 Mpa) as compared to modified mesh base design (10.41 Mpa). The difference was found to be statistically significant ( $p=0.004$ ). However, tubes with a modified mesh base (OO) showed a greater survival rate (95%) compared to those with conventional mesh base (85%).

**Conclusion:** Molar tubes with conventional mesh base design bonded with Transbond XT showed greater shear bond strength than molar tubes with modified mesh base design. Molar tubes with modified mesh base design showed a greater survival rate than molar tubes with conventional mesh base design.

**Keywords:** Shear bond strength, Molar tubes, Universal testing machine.

### Introduction

In recent years, the orthodontic specialty has almost totally switched to the bonding appliance considering the advantages like aesthetics, hygiene, comfort and ease of application it provides over the banded appliances.<sup>1-2</sup>

Bonding of attachments to molars rather than banding is a less frequently adopted practice. Molar tubes bonded with either a chemically cured or light-cured resin adhesive have exhibited failure rates over 21%. Also, brackets bonded to molars have a lower bond strength and a high clinical failure rate than brackets bonded to teeth located more anteriorly in the arch.<sup>3</sup> High bond failure rates reported may be from orthodontic and masticatory forces or from moisture contamination during the bonding process due to isolation difficulties. Manufacturers have sought to address bond failure on molars through improvements in adhesive technology and attachment designs. Improvements include increased base dimensions and changes in the base design.<sup>4</sup>

So the present study evaluated bond strength and survival rate of bondable molar tubes with two different mesh designs. The null hypothesis stated that there was no difference in the survival rate and shear bond strength of bondable molar tubes with two different mesh designs.

### Materials and Methods

This study was carried out in the Department of Orthodontics and Dentofacial Orthopaedics and Centre for Advanced Research, I.T.S Centre for Dental Studies and Research, Muradnagar.

The study was divided into two parts- survival rate (assessed in vivo) and shear bond strength (assessed in

vitro). For evaluation of shear bond strength, molar tubes from two different manufacturers were obtained: Group 1- IFIT TUBES (American Orthodontics) with conventional mesh base design and Group 2- Maestro series (Ortho Organiser) with modified mesh base design. To elaborate on the differences in the mesh base design, a microscopic analysis of the mesh bases was carried out using a Stereomicroscope Olympus (SZX7) and Magnus Pro Software at 40X magnification. The mesh space, also known as aperture area and the thickness of the mesh wire were calculated for each tube type. The mesh wire thickness was measured in three different locations and an average reading was taken in microns. The aperture area was calculated by taking the average length and breadth of the aperture base, each measured at three locations. Two specimens of each type of tube were measured and the average was taken.

40 freshly extracted permanent first molar teeth were mounted in self-cure acrylic. The blocks were divided into 2 groups with 20 samples in each group for bonding molar tubes of two different mesh base designs. The teeth were cleaned and rinsed with pumice slurry to ensure the removal of plaque and the organic pellicle. Moisture control was maintained after the rinse to provide a dry working field. The teeth were etched for 30 seconds. After the etching period the etchant was rinsed off the teeth. The teeth were dried thoroughly with a moisture and oil free air spray. A thin layer of bonding agent was painted over the etched enamel surface. The coating was thinned by a gentle air burst for 1 to 2 seconds. Molar tube placement was started immediately after all etched surfaces were coated. A thin layer of adhesive was applied on the base of the tube and

placed on the tooth with proper alignment and position with the help of a bracket placement gauge. The excess of adhesive material was removed from the surface of the tooth using an explorer tip. Curing was done using LED curing light with a wavelength of 340-400 nm for 10 seconds at each corner of the molar tube.

**Bond strength test**

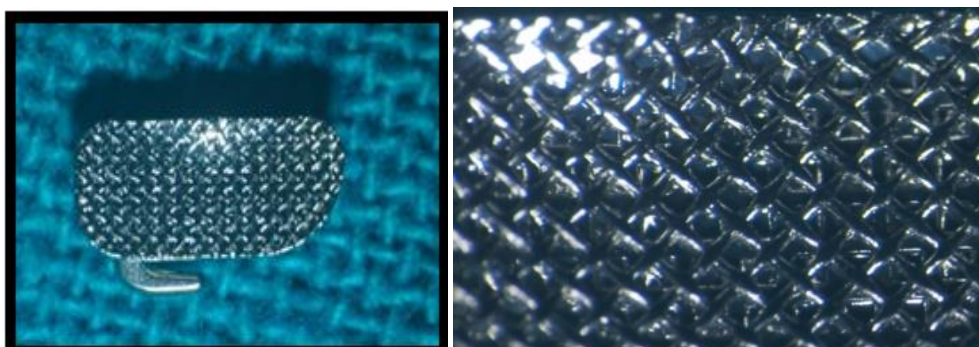
After bonding, all the specimens were stored in distilled water at 37°C for 24 hours before testing for bond strength. The shear bond strength was measured using Universal testing machine. A mounted jig i.e a steel rod with a flattened end was attached to the crosshead of universal testing machine and an occluso-gingival load was applied to the molar tube parallel to the buccal surface of the teeth.

The force required to shear off the molar tube was recorded in Newtons at a crosshead speed of 0.5 mm/minute.

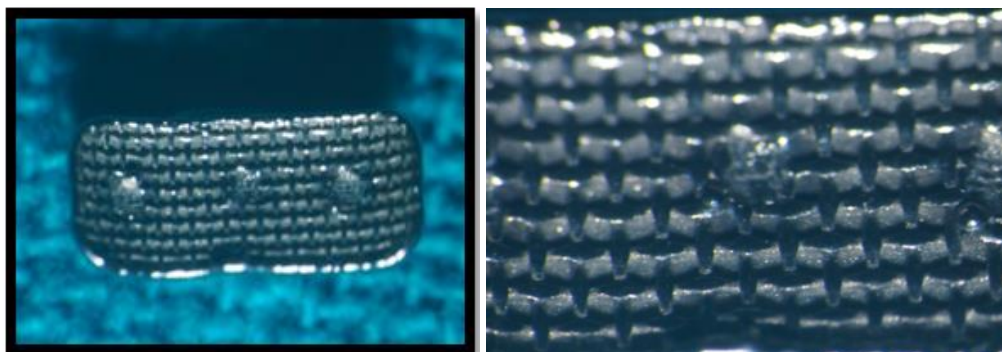
**Adhesive remnant index**

The mode of bond failure was assessed according to the amount of adhesive left on the molar tube surface utilizing the adhesive remnant index (ARI) under stereomicroscope (OLYMPUS, Japan, Model no –SZ2-ILST) at 10X zoom. The ARI ranges from:

- 0 - no adhesive remained on the tooth
- 1 – less than half of the enamel bonding site covered with adhesive
- 2 – more than half of enamel bonding site covered with adhesive
- 3 - the enamel bonding site covered entirely with adhesive



**Fig. 1:** Molar tube with conventional mesh base (American Orthodontics) at 10 x and 40 x magnification



**Fig. 2:** Molar tube with Modified mesh base (Ortho Organizer) at 10x and 40 x magnification



**Fig. 3:** (a) Showing the placement of molar tube on 1<sup>st</sup> molar of upper right quadrant (AO) and lower right quadrant (OO) and (b): Showing the placement of molar tube on 1<sup>st</sup> molar of upper left quadrant(OO)lower left quadrant (AO)

**For the survival analysis**

20 patients (age>12 years) requiring fixed orthodontic treatment and with no previous history of orthodontic treatment were included in the study. Patients with cleft lip and palate, craniofacial syndromes, absence of or planned extraction of first permanent molar, 1<sup>st</sup> permanent molar with evidence of demineralization or hypoplastic enamel or congenital defects, patients requiring orthognathic surgery, extra-oral or intra-oral anchorage reinforcement were excluded. Molar tubes with two different base designs were placed on alternate sides in the four quadrants so that each arch had molar tubes of both the types. The patients were evaluated every 4 weeks in order to assess loss of molar tubes for a total period of 6 months. All bond failures were noted on each patient’s record taking into account the side (right and left), arch (maxilla and mandible), date (day/month/year) and position (tooth). The loose molar tube was replaced by new molar tubes and rebonded using direct bonding technique.

**Statistical analysis**

The data was subjected to statistical analysis using SPSS (Statistical Package for Social Sciences) version 20.0 statistical analysis software. The means and standard deviations of shear bond strength of the molar tubes were calculated. The student t test for two independent groups was used to test difference in bond strength. The chi square

test was used to compare bond failure rate in vivo. The level of significance and confidence intervals were 5% and 95% respectively.

**Results**

In the present study, the shear bond strength ranged from 9.5- 10.9 Mpa in tubes of Group 1 and 9.8-11 MPa in Group 2 (Table 1). Reynolds suggested that the bond strength of 5.9 -7.8 Mpa is clinically acceptable. The bond strength of tubes in both the groups was higher than this range. However, molar tubes in Group 1 had a greater bond strength (mean 10.49 Mpa) compared with Group 2 (mean 10.41 Mpa) and the difference was statistically significant (p=0.04) with a mean difference in shear bond strength of 0.37 MPa.

Table 2 shows the number of breakages of molar tubes recorded every 30 days for a period of 6 months. There was a failure of a total of 8 tubes in Group 1 and 5 tubes in Group 2. Group 2 showed a greater success rate of 95 % as compared to Group 1. Group 1 showed a greater failure rate of 15% compared to Group 2 which showed a success rate of only 85%. Survival of both the types of tubes was compared using Chi Square test (Table 3). Although the Group 2 molar tubes showed a higher success rate, the difference was not statistically significant (p value .263).

**Table 1:** Shear bond strength of molar tubes in MPa

Group	N	Mean	Std. Deviation	Std. Error Mean
1	20	10.490	.3837	.0858
2	20	10.118	.3787	.0847

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	T	df	P value	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
SBS	.068	.796	3.086	38	.004	.3720	.1206	.1279	.6161

**Table 2:** No. of breakages over a period of 6 months

Group	T1	T2	T3	T4	T5	T6	Total
1	1 (Q1)	2(Q2,Q3)	1(Q2)	4(Q1,Q1, Q4,Q4)	0	0	8
2	1(Q2)	1(Q3)	3(Q1,Q2,Q1)	0	0	0	5

**Table 3:** Six months survival analysis

Group * Result Cross tabulation					
			Result		Total
			Failure	Success	
Group	1	Count	6	34	40
		% within group	15.0%	85.0%	100.0%
	2	Count	2	38	40
		% within group	5.0%	95.0%	100.0%
Total		Count	8	72	80
		% within group	10.0%	90.0%	100.0%



Chi-Square Tests					
	Value	df	Asymp. Sig. (2-sided)	P value	Exact Sig. (1-sided)
Pearson Chi-Square	2.222 <sup>a</sup>	1	.136		
Continuity Correction <sup>b</sup>	1.250	1	.264		
Likelihood Ratio	2.315	1	.128		
Fisher's Exact Test				.263	.132
Linear-by-Linear Association	2.194	1	.139		
McNemar Test <sup>b</sup>				. <sup>c</sup>	
N of Valid Cases	80				
a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 4.00.					
b. Computed only for a 2x2 table					
c. Both variables must have identical values of categories.					

**Discussion**

High bond failure rates of molar tubes have been reported; these may result from orthodontic and masticatory forces or from moisture contamination during the bonding process due to isolation difficulties.<sup>4</sup> It has been shown that molar bonding is associated with survival times almost half that of cemented bands. Forces up to 360 Newtons have been registered in molar region in young adolescents.<sup>5</sup> The variables associated with the shear bond strength are the size, design and the surface treatment of the adhesive contact surface of the bracket base.<sup>5</sup> To improve bond strength the bracket adhesive pads has been a focus of development. Improved adhesive systems and the refinement of bracket base design have enabled manufactures to decrease the size of bracket base without sacrificing bond strength.<sup>6</sup> There are various bracket base designs all in attempt to optimize the mechanical bond between the bracket and the adhesive. The design of the bracket base adhesive pad has been found to be a significant factor in shear bond strength.<sup>5</sup> Therefore, this study was conducted with the purpose of comparing survival rate (in vivo) and shear bond strength (in vitro) of 1<sup>st</sup> molar tubes with two different mesh designs: Group 1- IFIT TUBES (American Orthodontics) with conventional mesh base design and Group 2-Maestro series (Ortho Organiser) with modified mesh base design.

The results indicated that the bond strength did not depend on the base area of the bonding pad. The tubes in Group 1 had a surface area of 9.81mm<sup>2</sup> which was smaller than the surface area of 13.24 mm<sup>2</sup> of tubes in Group 2. This is in agreement with the result of Talpur et al<sup>4</sup> who also did not find a statistically significant relationship between bond strength and base surface area. Several other studies by Banks,<sup>7</sup> Cucu,<sup>8</sup> Purmal<sup>9</sup> have also suggested that there is no relationship between bond success and base surface area.

Hudson et al<sup>5</sup> suggested that variables other than size could affect the bond strength such as: the contact surface design, any treatment applied to the base of the bracket or the adhesive system. Therefore the wire diameter and the size of the aperture between mesh strands are variable and may affect shear bond strength. In our study, the aperture

area (length x breath) μm<sup>2</sup> of Group 1 tubes (American Orthodontics) was 5060 mm<sup>2</sup> and that of tubes in Group 2 (Ortho Organizers) was 2370 mm<sup>2</sup>. The average thickness of mesh strand in Group 1 tubes was 373.60μm and that in Group 2 was 333.5 μm. So the Group 1 tubes had a larger aperture area but a smaller thickness of mesh strand compared with Group 2. These two factors may have contributed to the higher shear bond strength of tubes in Group 1. Similar to this result, Hudson et al<sup>5</sup> found in their study that the tubes with the lowest bond strength (Ormco) had a base average aperture area less than half the size of average aperture areas of the tubes with the highest bond strength (3M), but the largest mesh strand diameter (126.5μm).<sup>5</sup>

The other factors that may explain the difference in bond strength of the two types of tubes are the surface treatment, mesh gauge and design. Both types of tubes had a similar single 80 mesh gauge, but the Group 1 tubes had a photo-etched mesh base with the mesh criss-crossing diagonally from corner to corner and a glossy finish. In contrast, the Group 2 tubes had a mesh made separately of stainless steel with micro etched bondable pad to maximize bond adhesion and a compound contoured base design. The surface of the mesh had a step ladder appearance with a mat finish.

In the present study, the adhesive used for bonding was Transbond XT for both the groups because previous studies have shown this adhesive to generate the highest bond strength which is in agreement with the study done by Chapman.<sup>10</sup>

Because of the intrinsic limitations of in vitro studies and the inability to fully reproduce clinical conditions, prospective clinical trials are required to determine whether certain bonding materials or conditions provide more clinically acceptable than others.<sup>1</sup> Hence the second part of this study was designed as a clinical trial to test whether the difference of bond strength found in-vitro translated to a clinical advantage. The survival rate of the two types of molar tubes was evaluated over a six-month period using a split mouth design.

In our study the overall failure rate of bondable molar tubes ranged from 15% in Group 1 to 5% in Group 2. Group



2 showed a greater success rate of 95% as compared to Group 1. Although the Group 2 molar tubes showed a higher success rate of survival, the difference was not statistically significant (p value .263). Several other studies have evaluated survival of bondable molar tubes in-vivo, but the difference in variables tested make a direct comparison difficult.

Geiger et al<sup>11</sup> reported a failure rate of 12.4% to 21.1% for bonded maxillary first molar tubes. Another study that used a light-curing adhesive also reported a high failure rate 22% of upper and 20% of lower first molar tubes—even though rapid curing reduces moisture contamination. However, considering that the failure rate of first molar bands varied from 0.56% to 34.6%, bonding on molars can be substituted for bands without increasing the risk of failure.<sup>1</sup> So to conclude, the survival of bondable molar tubes depends not only on the shear bond strength but other factors such as occlusal forces, diet, patient co-operation, bonding conditions such as materials used for bonding, moisture control, etching time, access for bonding, operator's efficiency and surface morphology of the molars may also play a role. The limitations of this study include the short follow-up period which did not cover the entire treatment time. We also did not investigate failure rates according to type of malocclusion in this study. Although some researchers found significant differences in bracket failure rates among different malocclusion types another study reported no significant differences. In addition, the biting forces may vary according to gender which was not evaluated in our study.

## Conclusion

The following conclusions were drawn from the study:

1. The molar tubes with a conventional base design exhibited a significantly greater shear bond strength compared with those having a modified base design.
2. The molar tubes with a modified mesh base showed a greater success rate (95%) compared with tubes having a conventional mesh base (85%); however the difference was not statistically significant.
3. Adhesive Remnant index analysis indicated that the majority of bond failures occurred within the adhesive.

## Source of funding

None.

## Conflict of interest

None.

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**How to cite the article:** Punia K, Shetty D, Sharma P, Kumar P, Raza M, Jain S. A comparative analysis of survival rate and shearbond strength of bondable molar tubes with two different mesh designs. *J Dent Specialities* 2019;7(2):84-8.

## Comparative evaluation of silver nanoparticle gel and chlorhexidine gel as an adjunct to scaling and root planing in management of chronic periodontitis—A clinico-microbiological study

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### Abstract

**Introduction:** Bacteria play an important role in the development of periodontitis and chlorhexidine (CHX) is considered “gold standard” in its treatment. Silver ions being strong antiseptics have been used in dentistry for a long time. Therefore the aim of our study was to compare the efficacy of chlorhexidine gel and megaheal gel containing silver nanoparticles in treatment of patients suffering from chronic periodontitis.

**Materials and Methods:** 20 patients who had chronic periodontitis were selected who were divided randomly and equally into 2 groups- Chlorhexidine gel group and Megaheal gel group. Subgingival plaque samples were taken from selected pocket before and after treatment and the number of colony forming units per millilitre was determined.

**Results:** The CFU count of anaerobic bacteria was found to be lower for Megaheal gel group as compared to Chlorhexidine gel group

**Conclusion:** Thus, Megaheal gel was found to be more effective in reducing count of anaerobic bacteria than Chlorhexidine group.

**Keywords:** Silver nanoparticle gel, Chlorhexidine gel, Chronic periodontitis.

### Introduction

The problems caused by periodontitis have long been identified as a serious health issue in many populations for a long time.<sup>1</sup> Chronic periodontitis has a slow to moderate rate of disease progression, and is often associated with local predisposing factors: dental plaque, subgingival calculus deposits, some iatrogenic factors and systemic diseases, such as diabetes mellitus.<sup>2</sup> The severity and extent of periodontal tissue damage varies from person to person and depends largely on immune responses of the individual to microorganisms.<sup>3</sup>

Chlorhexidine is an effective antimicrobial agent. It is a cationic bisbiguanide with broad antibacterial activity,<sup>4</sup> low mammalian toxicity and possesses strong affinity for binding to skin and mucous membranes.<sup>5</sup> Assessment of a gel formulation as an alternative means of delivering chlorhexidine to the teeth and oral cavity has proven problematic as much depends on the ability of the patient to deliver the gel to the appropriate areas of the mouth. Chlorhexidine gel does not penetrate easily to areas away from its site of application;<sup>6</sup> thus, any assessment of the effects of the gel depends on the amount of gel reaching the appropriate area of the mouth at the appropriate period of time.<sup>7</sup>

Also, silver is a non-toxic, powerful disinfectant, which can significantly reduce bacterial infection.<sup>8</sup> The use of silver as an antiseptic is very frequent nowadays, but it has not been tested sufficiently in the field of periodontics. The effects of silver ions are mostly based on three mechanisms:

1. Interaction with DNA of bacteria
2. The destruction of the cell membrane
3. The blocking of essential enzymes that regulate transport of electrons.<sup>9</sup>

Silver has a long lasting bacteriostatic effect because it is bind to proteins tissue and chlorides.

### Materials and Methods

#### Patient selection criteria

The presented clinical study was performed at the Department of Periodontology and Oral Implantology, I.T.S Centre for Dental Studies & Research, Ghaziabad, India. The research protocol was reviewed and approved by the Ethical Committee of the Institution. All patients were educated about the study and then written consent was taken before enrolment in the study. The study was conducted for a period of three months. A flow diagram for complete methodology is presented in Fig. 1.

Twenty patients of both the sexes participated in the study and were divided into two groups. The first group received Chlorhexidine gel and the second group received megaheal gel after scaling and root planing.

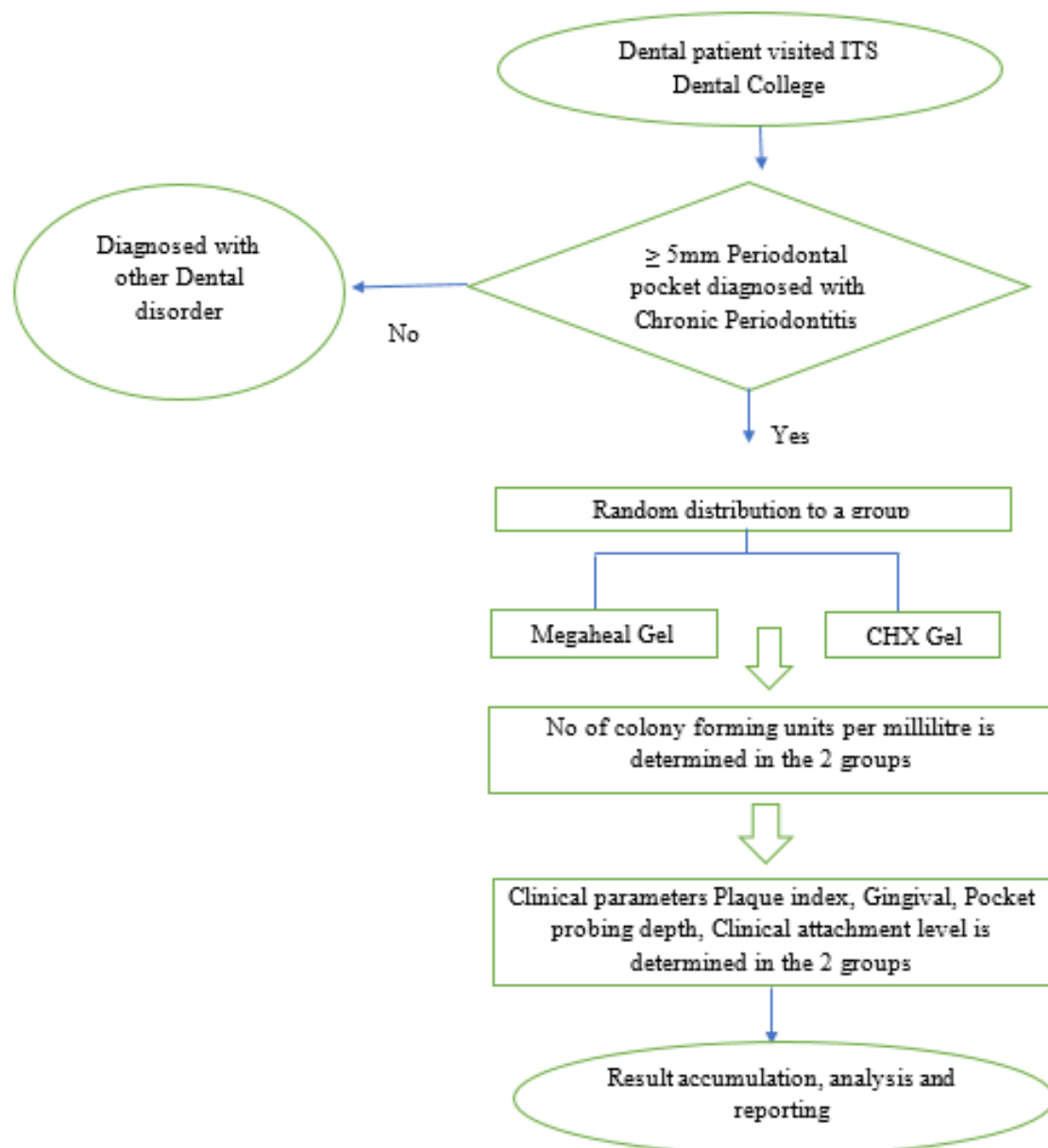
The inclusion criteria of the study was

1. Patients in age range: 18-65 years
2. Patients who were systemically healthy
3. Patients with diagnosis of chronic periodontitis
4. Patients having at least 20 teeth present excluding third molars.
5. Patients with presence of at least 2 teeth, with probing depth  $\geq 5$ mm.
6. Clinical attachment loss of  $\geq 5$ mm, in 2 quadrants.

#### The study excluded

1. The patients whose treatment of periodontitis was conducted more than 12 months ago
2. The presence of systemic diseases that may affect the treatment of periodontal disease

3. The use of antibiotics and anti-inflammatory drugs in the last 6 months,
4. Pregnancy, lactation and the use of contraception drugs as well as systemic infections of the oral cavity.



**Fig. 1:** Study design

#### Patient's allocation and procedure

Patients were assigned equally and randomly to one of the two groups (N=20). Envelopes containing identification for treatment groups were enclosed, mixed, and then numbered. Each participant was randomly allocated to one of the following group.

All teeth were measured (excluding third molars) with a CPITN probe. For the assessment of oral hygiene the following indices were used:

1. Plaque index (PI)<sup>10</sup>, measured on four sides (mesio-vestibular, vestibular, disto-vestibular, oral) and score marked with values 0–3.
2. Gingival index (GI)<sup>10</sup>, measured on the same four sides and score marked with 0–3. The GI score of 2 and 3 indicated bleeding on probing (BOP).

3. Periodontal pocket depth (PPD)<sup>11</sup> in mm – the distance from the free gingiva margin to the bottom of the periodontal pocket.
4. In order to assess the periodontal status, the clinical attachment level (CAL)<sup>11</sup> – the distance from the cemento-enamel junction to the bottom of the periodontal pocket, was measured.
5. Also plaque sample was taken from the periodontal pocket at baseline and after 3 months of application of gel. Microbiological analysis was carried out for the samples collected. The sample was scraped by a Gracey curette from the root surface and placed in phosphate buffer saline (5 ml). Automatic pipette was used during the dilution procedure. The dilution procedure was carried out at -1 and -2. Trypticase soy agar plates were prepared. A bacteriological loop was used to spread the PBS over the plates. The plates were then kept incubated for 48 hours. Anaerobic colonies formed were counted on a colony counter.



**Fig. 2:** Preoperative pic (CHX group)



**Fig. 3:** Pre-operative pic (Megaheal group)



**Fig. 4:** Application of CHX



**Fig. 5:** Application of Megaheal



**Fig. 6:** Post operative pic (CHX group)



**Fig. 7:** Post operative pic (Megaheal group)

Complete statistical analysis of data was done with the help of statistical software package, SPSS Statistics 18. Variables were presented as mean value  $\pm$  standard deviation (SD). One way ANOVA test was used for evaluation of distribution of clinical data. A statistical significance within and between groups was tested by t-test for the paired and independent samples. All the analyses were estimated at  $p < 0.001$  level of statistical significance.

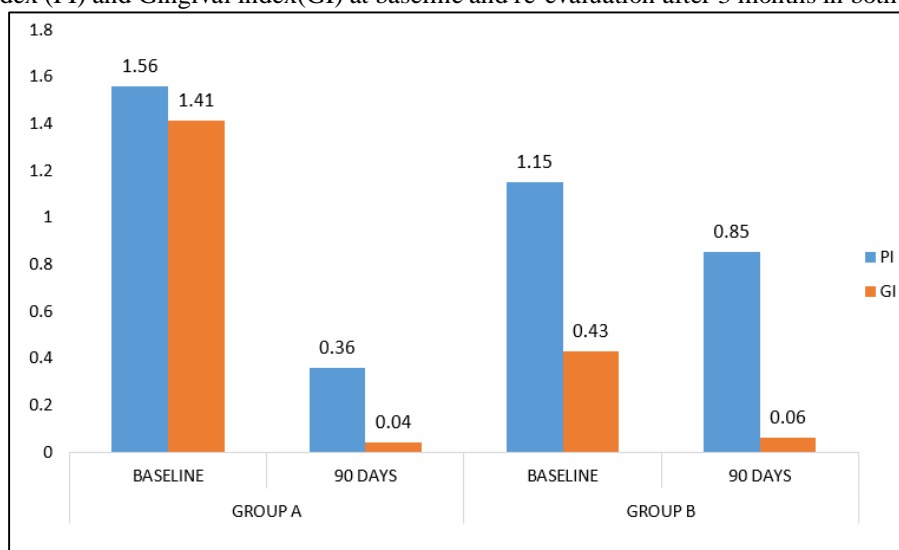
**Results**

The reduction in Plaque Index, Gingival Index, Pocket Probing Depth and Clinical Attachment level was found to be significant from baseline to 3 months between the groups. The microbiological analysis showed a higher reduction in CFU (Colony Forming Units) in Group B as compared to Group A from baseline to 3 months. (Graph 1 -3 , Table 1)

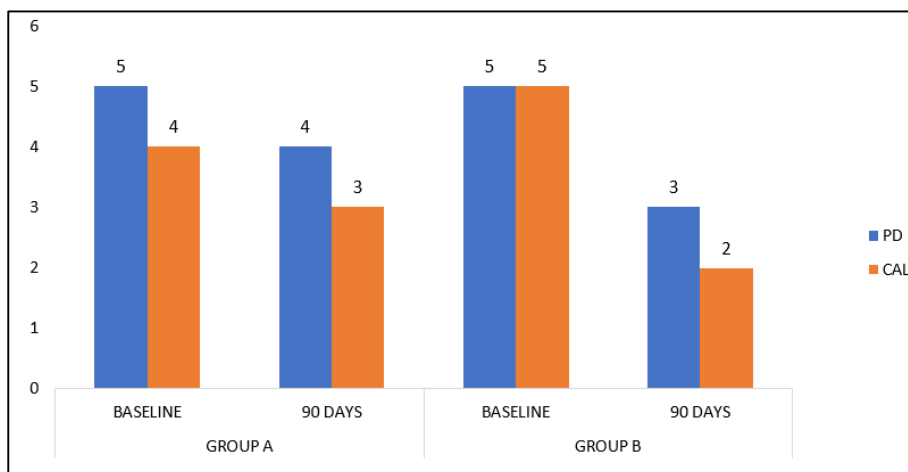
**Table 1:** Mean values of clinical parameters Plaque index (PI), Gingival index (GI), Pocket probing depth (PPD) and Clinical Attachment level (CAL) at baseline and 3 months after treatment

Groups (before/after treatment)	PI mean±SD	GI mean±SD	PPD mean±SD	CAL mean±SD
CHX (n=10)				
Baseline	0.342±0.142	1.36±0.121	5.7±0.483	6.7±0.483
3 months	0.327±0.139	1.343±0.117	4.4±0.516	5.2±0.421
P1	<0.001	<0.001	<0.001	<0.009
Megaheal (n=10)				
Baseline	0.299±0.130	1.37±0.102	5.7±0.823	6.7±0.823
3 Months	0.284±0.132	1.35±0.104	4.4±0.516	5.5±0.527
P2	<0.001	<0.001	<0.001	<0.001

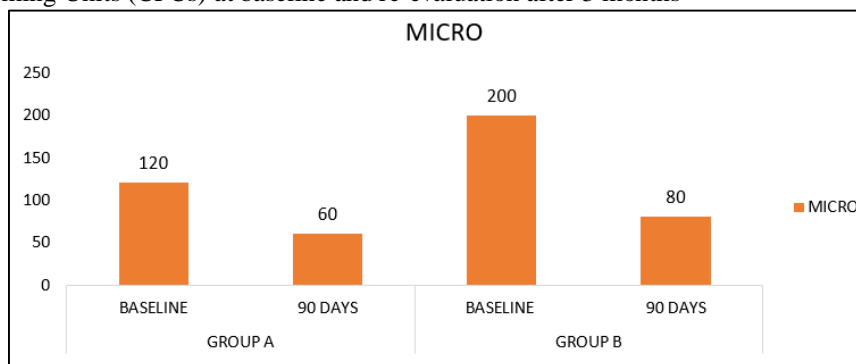
**Graph 1:** Plaque index (PI) and Gingival index(GI) at baseline and re-evaluation after 3 months in both groups.



**Graph 2:** Pocket probing depth (PPD) and Clinical Attachment level (CAL) at baseline and re-evaluation after 3 months in both the groups





**Graph 3:** Colony Forming Units (CFUs) at baseline and re-evaluation after 3 months

### Discussion

Our results showed that the CHX and megaheal have an equal, statistically significant effect on all studied clinical parameters PI, GI, PPD, CAL in the patients with a chronic form of periodontal disease. In the study, we demonstrated that megaheal gel led to a reduction in PPD significantly because of its successful antibacterial efficacy. This efficacy against periodontal pathogenic species was also shown in other studies.<sup>12</sup> The compounds that contain silver are attractive because of their strong antimicrobial activity, high stability and wide-spread antibacterial spectrum.<sup>13</sup> For the assessment of oral hygiene, PI was used, which was statistically significantly reduced after the treatment in both of the tested groups ( $p = 0.001$ ). We can explain these results by the fact that silver ions prevent adhesion of bacteria and thus influence the prevention of biofilm formation which precedes creation of plaque on dental hard structure. Nowadays the emphasis on the testing of silver activity against periodontal pathogens from the biofilm has been increased recently. The study by Lu et al. also focused on the antibacterial effect of silver nano-particles of various sizes on anaerobic bacteria, the results of the study showed that the smallest tested nano-particles (5 nm) showed greater antimicrobial effects compared to larger particles (15–55 nm).<sup>14</sup> There are positive antibacterial effects of different sizes of silver nanoparticles on anaerobic bacteria; the assumption is that this effect stems from silver astringent potential associated with the direct or even indirect antibacterial effects of silver ions.<sup>15</sup> Passing through the bacterial cell wall, silver ions prevent the replication of the DNA molecule. In this way, the interactive inactivation of bacterial proteins occurs and as a result of the catalytic activity of silver, oxygen radicals are released, which cause structural damage inside the bacteria.<sup>16</sup> This phenomenon leads to damage or even the death of bacteria.

### Conclusion

The use of adjuvant antiseptics within the SRP for patients with chronic forms of periodontal disease has been justified. In our study, the tests showed that CHX gel and megaheal gel as adjuvant antiseptics and as part of SRP, have practically the same statistically significant effect on all studied clinical parameters. In the Megaheal group, 3

months after therapy, a significant reduction of GI and PI was obtained compared to CHX group. This is of great importance, because megaheal was not used as the adjuvant antiseptic in this category of patients and, as the CHX was accepted as a "gold standard" of this type, it seems that silver ions should be re-evaluated for adjuvant treatment within the causal therapy of patients with chronic periodontal disease.

### Source of funding

None.

### Conflict of interest

None.

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**How to cite the article:** Kalita U, Tyagi VK, Gupta SJ, Vaish S, Sharma N. Comparative evaluation of silver nanoparticle gel and chlorhexidine gel as an adjunct to scaling and root planing in management of chronic periodontitis—A clinico-microbiological study. *J Dent Specialities* 2019;7(2):89-94.

# Comparative evaluation of effects of subgingival application of ozonated olive oil versus chlorhexidine in patients with chronic periodontitis: A clinico- microbiological randomised trial

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## Abstract

**Introduction:** Chronic periodontitis is an infectious disease resulting in inflammation within the supporting tissues of the teeth, progressive attachment loss and bone loss. Non-surgical periodontal treatment of chronic periodontitis poses a great challenge. Conventional treatment includes Scaling and Root Planing (SRP) and mechanical debridement. Studies have suggested use of ozonated olive oil for management of periodontal infection.

**Objective:** The aim of this study was to evaluate the effect of using Ozonated olive oil along with SRP, compared to subgingival chlorhexidine with SRP for treatment of chronic periodontitis.

**Materials and Methods:** In this split-mouth design, twenty untreated chronic periodontitis patients who met the criteria of having periodontal pocket with depth  $\geq 4$ mm and bleeding on probing (BOP) in at least two different quadrants were included. Group 1 (control) subgingival chlorhexidine application was done and in group 2 (test) ozonated olive oil application with SRP was done. Clinical parameters were evaluated at baseline, 7 days, 14 days and 21 days post treatment and plaque samples at baseline and 21 days. Microbiological analysis was done to assess the change in level of *P. gingivalis*.

**Result:** Both the groups (test & control) showed improvement in all the recorded parameters (PI, GI, PPD& microbiological analysis) while the test group showed statistically significant reduction in all the clinical parameters compared to control group ( $p < 0.05$ ) except the microbiological analysis.

**Conclusion:** A single subgingival irrigation with ozonated oil can be effectively used as an adjunct to SRP in non-surgical management of chronic periodontitis.

**Keywords:** Chronic periodontitis, scaling, Root planing, Subgingival irrigation, Ozonated oil, Chlorhexidine, Non-surgical therapy.

## Introduction

Periodontitis is a chronic infection involving destruction of the tooth-supporting apparatus, including the periodontal ligament and alveolar socket support of the teeth. Periodontal disease initiation is by a local accumulation of bacteria and their metabolic products leading to apical migration of the junctional epithelium along the root surface, deepening the gingival crevice to produce periodontal pockets and associated attachment loss, which is the hallmark lesion of periodontal disease.<sup>1</sup>

The microbiology of periodontal infections is complicated for which numerous bacterial agents have been implicated in their etiology.<sup>2,3</sup> *P. gingivalis* has been known as a major etiologic agent in the development of adult periodontitis. *P. gingivalis* is a highly adapted pathogen that is armed with a number of putative virulence factors that enable this organism to cause disease. Among such putative virulence factors are fimbriae and lectin-type adhesins, a polysaccharide capsule, lipopolysaccharide, hemagglutination and hemolysing activities, toxic products of metabolism, outer membrane vesicles, and numerous enzymes.<sup>4</sup>

Primary goal of therapy is to arrest disease progression and to resolve inflammation for patients with chronic periodontitis. The aim of the therapy is reducing etiologic factors below the threshold capable of producing breakdown, allowing repair of the affected region at a diseased site. Regeneration of destroyed periodontal structures can be

enhanced by specific procedures either through nonsurgical periodontal therapy (scaling and root planning (SRP) and the adjunctive use of chemotherapeutic agent) or surgical therapy.<sup>5</sup> Unfortunately, in some instances, the complex anatomy of the root and the contours of the lesion may hamper the treatment and prevent sufficient reduction of the bacterial load to make the tooth surface biologically acceptable.<sup>6</sup> This could be related to the persistence of pathogens in the pocket after treatment or to the production of specific virulence factors by the bacteria interfering with the host defense. In this context, it is evident that antimicrobial agents are of great interest and may be valuable as adjuncts to mechanical therapy. These adjunctive therapies are classified by their route of administration to systemic or local drug delivery.<sup>5</sup>

For local administration of antimicrobial agent one of the methods is subgingival irrigation which is intentional irrigation of a gingival crevice or pocket at the point of delivery directed below the gingival margin. It can be done by various antimicrobial agents such as Chlorhexidine, hydrogen peroxide, stannous fluoride, Boric acid and Tetracycline. Even though they show promising results, these existing antiseptic agents have several shortcomings.

Currently, ozone therapy is widely being used as a modern non-invasive method of treatment. It is a powerful oxidizing agent having a high antimicrobial power against oral pathogens, without resistance development has been



reported not only for gaseous ozone,<sup>7,8</sup> but also for ozone in aqueous.<sup>9</sup>

The word ozone derived from Greek 'ozein' (odorant) was first used by Schonbein in 1840 (10) when he subjected oxygen to electrical discharges and noted the odor of electrical matter. It was first used in medicine in 1870 by Landler and as a disinfectant by Dr E. Fisch, a Swiss dentist in 1932 in the form of gas or ozonated water.<sup>11</sup> Ozone has been shown to possess unique properties and has potential applications to the clinical practice of dentistry. There are numerous known actions of ozone such as antimicrobial, immunostimulating, acceleration of the wound healing rate. The three basic forms of application are ozonated water, ozonated olive oil and gaseous ozone, of which the ozonated olive oil being ideal delivery system as it entraps and releases ozone in a sustained manner.

Ozonated olive oil is pure olive oil that has undergone ozonation using a steady flow of ozone- oxygen mixture in the ratio of 5:95% until olive oil transforms from the greenish-colored liquid status to the whitish gel status.<sup>12</sup> Numerous studies have found their effectiveness against both Gram-positive and Gram-negative bacteria, viruses and fungi.<sup>13</sup> In the field of periodontology, it has mainly been used for gingivitis, periodontitis, peri-implantitis, wound healing and prophylaxis.

Chlorhexidine is considered to be the "gold standard" agent for chemical plaque control methods, because it is a broad spectrum antiseptic. However, use of chlorhexidine is discouraged because of its unpleasant taste and undesirable side effects such as tooth staining.<sup>14</sup>

The aim of this study was to assess the clinical and microbiological activity of ozonated oil therapy versus 0.12% chlorhexidine for the treatment of chronic periodontitis.

## Materials and Methods

Twenty patients attending the OPD of the Department of Periodontics, I.T.S CDSR, Muradnagar were screened for this split-mouth randomized controlled clinical trial. The patients (age group 22–65 years) diagnosed with chronic periodontitis having periodontal probing depth  $\geq 4$ mm, bleeding on probing (BOP) and minimum one periodontal pocket in at least two different quadrants were selected. Inclusion criteria was patients having no history of systemic disease that may affect periodontium, were non-smokers with at least 20 natural teeth; and had not undergone any periodontal treatment in the last 6 months. Exclusion criteria included pregnant women and those with a history of systemic antibiotic administration within 3 months prior to the study. Patients meeting the inclusion criteria were considered for the treatment and follow-up. Patients who agreed for the treatment were enrolled in the study and signed informed consent form was obtained. Ethical approval was obtained from the institutional ethical committee. The history was taken and complete periodontal examination was performed at baseline. Acrylic stent was prepared. Group 1 (control) SRP + subgingival chlorhexidine application was done and in group 2 (test)

ozonated olive oil (DENTOZONE INDIA) [Fig 1.] application with SRP was done. Clinical parameters like Plaque index (PI), Gingival index (GI) and Pocket probing depth (PPD) (using a UNC 15 probe) were evaluated at baseline. Plaque samples collection and microbiological analysis was done to assess the change in level of *P. gingivalis* at baseline. SRP was done using ultrasonic scalers (Suprasson Newtron) and Gracey curettes (Hu–Friedy) until the root surfaces felt smooth and hard to tactile exploration. In the end of the treatment, the periodontal pocket was irrigated by a blunt-tipped sterile plastic syringe containing 0.12 % chlorhexidine (in the control group) [Fig. 3-5] and ozonated oil (in the test group) using disposable 10 ml plastic syringe.[Fig. 6-8] The selected teeth were isolated with cotton rolls and thoroughly dried and the oil was applied carefully subgingivally until excess oil was observed from the gingival margin. This procedure was repeated for all teeth to be treated. Excess oil was removed with a cotton roll. Periodontal pack was given and patients were instructed not to eat, drink, or rinse for at least 30 mins and were also instructed to refrain from chewing hard or sticky foods, brushing near the treated site or using interdental aids. Instructions with supragingival brushing at the site of application were given. Oral hygiene instructions were given to all patients. After 21 days, patients were reviewed, clinical parameters were again recorded and plaque samples were collected.

Prior to the scaling and root planing and oil application, at baseline subgingival plaque sample was taken from the deepest periodontal pocket for microbiological analysis. The sampling site was isolated with cotton rolls before taking the sample. The supragingival plaque was removed with a sterile curette and cotton gauze. Subsequently, a subgingival plaque sample was obtained using gracey curette.

Sample were kept in the Transport medium (RTF) [Fig 2] which were first vortexed then inoculated in the culture medium according to the requirement in Enriched and selective medium. For, Pg, Blood Agar as an enriched medium, Brucella agar with hemin and vit K and (BA) was used. Incubation was done at 37 °C for 3-4 days in anaerobic jar (strictly anaerobe). Kanamycin Blood Agar as anaerobic selective medium was used. Its same as blood agar only Kanamycin is added which makes it selective medium. Then after completion of incubation the plates were removed and the colony characters of the required organism and also the colony count was done for quantification. Then performed for Grams staining – seen for Gram Negative Coccobacilli. These organisms were confirmed by grams staining and key biochemicals- Glucose, sucrose, cellibiose and arabinose.



Fig. 1: Ozonated oil (Dentozone India)



**Fig. 2:** Plaque sample collection with a curette in a Transport medium



**Fig. 5:** Measurement of pocket depth after 21 days



**Fig. 3:** Pre-operative pocket probing depth measurement in chlorhexidine group



**Fig. 6:** Pre-operative pocket probing depth in ozonated oil group



**Fig 4:** Chlorhexidine irrigation



**Fig.7:** Ozonated oil application



Fig. 8: Measurement of pocket depth after 21 days



Fig. 9: Kanamycin Blood Agar showing *P. gingivalis*

**Statistical analysis**

The Statistical Analysis was performed using Software (SPSS version 16) for data processing and analysis. The differences in means of the parameters at the baseline and at 21 days between test and control groups were evaluated using an independent t-test. The changes in parameters over time were evaluated using a paired t-test for each group separately,  $p < 0.05$  was considered statistically significant.

**Result**

In this study, both the groups (test & control) showed improvement in all the recorded parameters (PI, GI, PPD). No adverse effect were reported by the patients following periodontal therapy. In control group PI, GI & PPD significantly reduced after 21 days follow-up compared to baseline (Table 1). Similarly, PI, GI & PPD significantly reduced in Test group also after 21 days follow-up compared to baseline (Table 2). On inter group comparison between test & control group, there was no statistically significant difference amongst the clinical parameters (PI, GI, PPD) at baseline. However, after 21 days follow-up the test group showed statistically significant improvement in recorded parameters compared to control group (Table 3) (Graph 1.).

For *P. gingivalis*, baseline data shows no significant differences between the two treatment groups. On inter group comparison between test & control group, there was no statistically significant difference amongst the microbiological count. On intragroup comparison there was significant reduction in *P. Gingivalis* count from baseline to 21 days.

**Table 1:** Intra Group Comparison of Clinical and Microbiological Parameters (Test Group)

Paired Sample Statistics					
		N	Mean±std. Deviation	Std. Error Mean	p value
	PI Baseline	10	2.0750±.624	.197	.296
	PI 21 days	10	.3500±.293	.092	.795
	GI Baseline	10	1.2750±.248	.078	.060
	GI 21 days	10	.1000±.129	.040	.108
	PPD Baseline	10	5.60±.699	.221	1.000
	PPD 21 days	10	3.20±.632	.200	.442
	<i>P. gingivalis</i> count at baseline	10	2.0579±.153	.048	.511
	<i>P. gingivalis</i> count at 21 days	4	1.6990±.000	.000	.044

**Table 2:** Intra group comparison of clinical and microbiological parameters (Control Group)

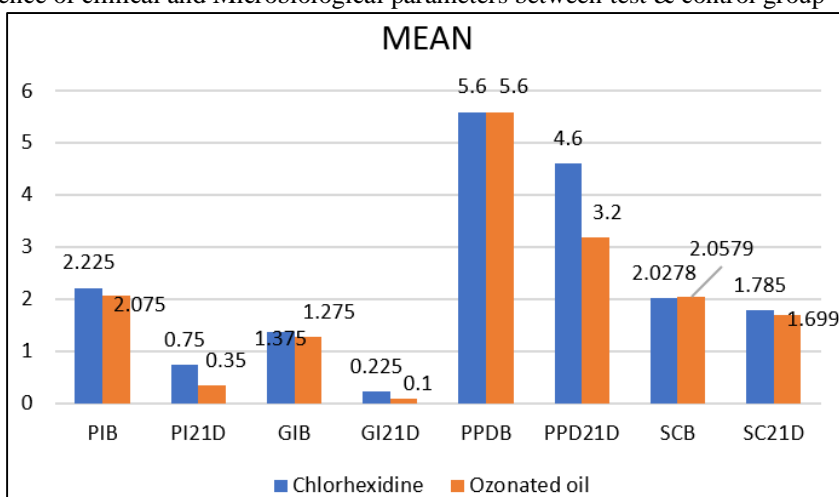
Paired Sample Statistics					
		N	Mean±std. Deviation	Std. Error Mean	p value
	PI Baseline	10	2.2250±.55840	.176	.296
	PI 21 days	10	.7500±.26352	.083	.795
	GI Baseline	10	1.3750±.37731	.119	.060
	GI 21 days	10	.2250±.21890	.069	.108
	PPD Baseline	10	5.60±.699	.221	1.000
	PPD 21 days	10	4.60±.699	.221	.442
	<i>P. gingivalis</i> count at baseline	10	2.0278±.19106	.060	.511
	<i>P. gingivalis</i> count at 21 days	7	1.7850±.14689	.055	.044



**Table 3:** Inter group comparison of clinical and Microbiological parameters between test & control group

	Group	N	Mean±std. Deviation		Mean Difference	P value
PI Baseline	Chlorhexidine	10	2.2250	±.558	.150	.578
	Ozonated oil	10	2.0750	±.624		
PI 21 days	Chlorhexidine	10	1.3750	±.377	.100	.493
	Ozonated oil	10	1.2750	±.248		
GI Baseline	Chlorhexidine	10	5.60	±.699	.000	1.00
	Ozonated oil	10	5.60	±.699		
GI 21 days	Chlorhexidine	10	.7500	±.263	.400	.005
	Ozonated oil	10	.3500	±.293		
PPD Baseline	Chlorhexidine	10	.2250	±.218	.125	.137
	Ozonated oil	10	.1000	±.129		
PPD 21 days	Chlorhexidine	10	4.60	±.699	1.400	.000
	Ozonated oil	10	3.20	±.632		
<i>P. gingivalis</i> count at baseline	Chlorhexidine	10	2.0278	±.191	.077	.702
	Ozonated oil	10	2.0579	±.153		
<i>P. gingivalis</i> count at 21 days	Chlorhexidine	7	1.7850	±.146	.075	.282
	Ozonated oil	4	1.6990	±.000		

**Graph 1:** Mean Difference of clinical and Microbiological parameters between test & control group



**Discussion**

Periodontal disease is a multifactorial disease process in the mouth. The role of microorganisms, host response, in the cause of periodontal disease is well established. The initiation and progression of periodontitis in the subgingival pockets is because of different bacterial accumulations. The mechanical therapy may help in elimination of the subgingival micro-flora. However its effectiveness is limited by many factors such as concave tooth surfaces, margins of restorations and inaccessibility of periodontal pockets, so mechanical method can also be enhanced by antimicrobial agent.<sup>15</sup>

The periotherapy include, prevention for the non established periodontitis, surgical or the non-surgical remedy for the established periodontitis.<sup>16</sup> The surgical therapy include excision of the infected tissues and modifying the environment to achieve the best condition for rehabilitating process with meticulous maintenance follow

up.<sup>17</sup> The non-surgical periotherapy is based upon the bacteriological findings and on the susceptibility of the causative microorganisms to the antimicrobial drugs given.<sup>18</sup>

Chlorhexidine has gained popularity as an important oral antiseptic agent and is used as an adjunct to periodontal therapy. It is a broad spectrum antiseptic having antimicrobial effects on Gram-positive as well as Gram-negative bacteria, some viruses, and fungi.<sup>19</sup> However, because of the undesirable effects such as brownish discoloration of teeth, some restorative materials, the dorsum of tongue and taste disturbance, after prolonged use, several alternatives to chlorhexidine have been investigated.<sup>20</sup>

Ozonated oils are obtained from the chemical reaction between ozone and unsaturated fatty acids of vegetable oils.<sup>21,22</sup> Due to its excellent curative results, simple

application, long-term effects, and nontoxic nature they are widely being used.

The aim of the study was to investigate the antimicrobial effectiveness of a commercially available ozonated olive oil (DENTOZONE INDIA) against *P. gingivalis* as a causative organisms in treatment of chronic periodontitis.

There are different ways of delivering ozone, by dissolving in water, it becomes highly unstable and rapidly decomposes through a complex series of chain reactions, so it cannot be stored.<sup>23</sup> In contrast, when it is dissolved in an oil base, we can measure its life span in years. It chemically reacts with oil, and forms long complex molecules. Hence for this study ozonated olive oil gel was chosen over ozonated water because the application of gels stays for longer in the oral cavity, has satisfactory drug penetration, high efficacy and acceptability, this is in addition to the action of omega 3 in olive oil which have potential benefits as a host modulatory agent in the adjunctive management of periodontitis.<sup>24</sup>

Results of the present study revealed that both groups showed improvement in all clinical parameters up to 21 days for PI, GI & PPD parameters. From the bacteriological point of view results revealed statistically significant reduction of the mean Pg at 21 days for both the groups. There was found to be no significant difference between groups at 21 days for Pg count.

Results of our study was in agreement with an in vitro study by Muller et al. (2007)<sup>25</sup> reported that there is no additional success in reducing the microbiota on applying ozone. Al Habashneh, et al.<sup>26</sup> showed that subgingival irrigation with ozonated water as an adjunctive therapy to SRP for chronic periodontitis patients produces no statistically significant difference compared with SRP plus distilled water irrigation.

Study done by Sorokina & Lukinych (1997)<sup>27</sup> using subgingival irrigation with ozonized water in combination with professional measures of oral hygiene, plaque formation was found to be reduced due to marked anti-inflammatory effects on the periodontium after using irrigation of periodontal pockets with ozone. Kshitish and Laxman (2010)<sup>28</sup> demonstrated, higher percentage of plaque index (12%), gingival index (29%) and bleeding index (26%) reduction using ozone irrigation. On contrary, Patel et al. (2012)<sup>29</sup> showed that, the adjunctive use of the Ozonated olive oil gel (OZO) with SRP in treatment of chronic periodontitis resulted in a substantial improvement (P <0.001) of clinical parameters as well as microbiological parameters over the time and in comparison to the control groups.

The recolonization of periodontal pocket occurs due to translocation from non-periodontal site by periodontal pathogen that frequently colonizes oral mucosa, tongue dorsum and other oral niches. Also, Hosagi and Duncan<sup>30</sup> showed that *P. gingivalis* shows protective mechanism to oxidative stress generated by toxic reactive oxygen species (ROS) through up-regulation of anti-oxidant genes resulting in the detoxification of ROS and peroxides. The robustness

of this bacterium is not only due to the strong oxidative stress mechanisms that protect its DNA, proteins and lipid layer from oxidative damage, but also because of its superior DNA repair process that accomplishes an efficient and precise removal of deleterious lesions.

The persistence of deep pocket favored recolonization of the putative periodontal pathogens. Accordingly, for assessment of microbial ecological niches surgical management for the pockets is necessary. A more meaningful method is to compare the comprehensive surgical technique comparing the use of ozonated olive oil versus antibiotics in the treatment of deep pocket in chronic periodontitis.

It is worth mentioning that in spite of recolonization of the bacteria in both groups at 21 days, there was a maintained PI, GI & PPD reduction. The subpopulation of *P. gingivalis*, with both high and low levels of pathogenicity has been suggested to exist among periodontal pathogens harbored by individuals with negligible slight or even severe periodontal destruction. Therefore, there was a lack of association between *P. gingivalis* count in sub gingival plaque samples and severity of clinical signs of the disease.

## Conclusion

Within the limitations of the present study it can be concluded that irrigation with ozonated oil was effective in reducing inflammation and pocket depth in chronic periodontitis patients and can be effectively used as an adjunct to SRP in routine non-surgical periodontal therapy. Ozonated oil as an adjunct is painless and non-invasive and may still find application as an anti-septic in the nonsurgical treatment of periodontal diseases. However, only small to moderate non-significant microbiological improvement of these diseases was found for its adjunctive use in this study; more well-designed studies will be needed to provide insight on the optimal concentration of ozone, duration and frequency of application irrespective of the method of delivery before it can be considered a routine treatment. Ozone is being considered as a promising treatment modality for various dental problems in the near future. But, it has to be kept in mind that presently ozone is used as an adjunct to other conventional treatment modalities so should be used in combination until future research shows benefits in independent usage.

## Source of funding

None.

## Conflict of interest

None.

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**How to cite the article:** Khare M, Jain KS, Sharma N. Comparative evaluation of effects of subgingival application of ozonated olive oil gel versus chlorhexidine in patients with chronic periodontitis: A clinico-microbiological randomised trial. *J Dent Specialities* 2019;7(2):95-101.

## Micronucleus assay using DNA specific and non specific stains in exfoliated oral epithelial cells as a biomarker to assess cytogenetic damage in petrol station attendants

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### Abstract

**Introduction:** Micronuclei are intracytoplasmic chromatin bodies seen as a result of cytogenetic damage or mitotic abnormality. Assessment of micronuclei in exfoliated oral epithelial cells is a marker for genotoxic damage due to various reasons such as lifestyle factors such as alcohol, tobacco and areca nut, occupational exposure to chemical carcinogens and radiation.

**Aim and objectives:** The aim of the study was to assess the micronuclei count in oral cytospreads of petrol station attendants chronically exposed to petroleum vapors using DNA specific and non specific stains.

**Materials and Methods:** 40 subjects in the study group working in petrol pump stations for more than 5 years and 40 healthy subjects in the control group without any history of past occupational exposure to petroleum products were included in the study. Percentage micronuclei count and micronuclei index were calculated after observing 1000 cells in oral cytospreads prepared from buccal mucosa of each subject and stained with Papanicolaou (PAP- non DNA specific stain) and Acridine orange stain(DNA specific stain).

**Results:** Percentage micronuclei count and micronuclei index were increased in study group as compared to the control group. The results were statistically significant. The values were lower in smears stained with DNA specific stain (acridine orange) as compared to non DNA specific stain(PAP).

**Conclusion:** Micronuclei assay is useful tool to assess and monitor cytogenetic damage due to occupational exposure to petroleum vapors in petrol station attendants. DNA specific stains are better as compared to non DNA specific stains in evaluation of micronuclei.

**Keywords:** Biomarker, Cytogenetic damage, Exfoliative cytology, Micronuclei.

### Introduction

Markers of cellular and molecular changes, respectively, which are associated with the process of carcinogenesis, but which occur even before a malignant transformation takes place, are called biomarkers.<sup>1</sup> Genomic damage in human cells is the prerequisite for disease development, including cancer. It may be produced by multiple agents such as environmental genotoxins, radiation, chemicals, lifestyle factors such as alcohol, smoking, drugs, stress and genetic factors. Assessment of this genomic damage can be utilized as an effective tool for diagnosis and monitoring with therapeutic value.<sup>2</sup>

Cytogenetic markers like chromosomal aberrations, sister chromatid exchanges, and micronuclei (MN) are sensitive indicators of genetic damage. Micronuclei (MN) are small chromatin bodies that appear in the cytoplasm by the condensation of acrocentric chromosomal fragments or by whole chromosomes, lagging behind the cell division or the loss of chromatin in the main nucleus due to a mutagenic exposition.<sup>3-5</sup> Thus, it is the only biomarker that allows the simultaneous evaluation of both clastogenic and aneugenic effects in a wide range of cells, which are easily detected in interphase cells.<sup>4,6</sup> Buccal cells form the first barrier for the inhalation or ingestion route and are capable of metabolizing proximate carcinogens to reactive products. Therefore, it could be argued that oral epithelial cells represent a preferred target site for early genotoxic events induced by carcinogenic agents entering the body via inhalation and ingestion.<sup>2</sup> The buccal mucosal cells are the first targets due to inhalation of such vapours.<sup>7</sup> Buccal

mucosal cells can be easily collected and studied as they are exfoliated in the process of physiological maturation and desquamation.<sup>8</sup> The cytological details can be studied through either DNA specific stains(example acridine orange, feulgen stain) or non specific stains(example giemsa stain, PAP stain).<sup>9</sup>

Exposure to gasoline vapours is classified by the International Agency for Research on Cancer (IARC) as possibly carcinogenic to humans, mainly on the basis of the well-established carcinogenicity of some components such as benzene (IARC, 1989). Petrol station attendants who are occupationally exposed to such gasoline vapours are exposed to increased genotoxic risk as compared to other individuals.<sup>7</sup> The purpose of this study was to assess the effect of genotoxic damage produced by gasoline vapours in petrol pump attendants through micronucleus assay in exfoliated buccal mucosal cells and to ascertain its role as a potential biomarker to determine the genotoxic damage in these individuals.

### Materials and Methods

The study comprised of 40 subjects in the study group who were working in petrol pump stations for more than 5 years and 40 healthy subjects in the control group without any history of past occupational exposure to petroleum products. Written informed consent was obtained from all the subjects. Inclusion criteria was those subjects with more than 5 years history of occupational exposure at petrol pumps were included in the study. Exclusion criteria was those subjects who worked in any other chemical industry in



the past and those who did not give consent to be a part of the study. Each subject was asked to rinse their mouth with saline and oral cytosmears were prepared from the buccal mucosa of each subject by scraping with wooden spatula, smeared onto a clean glass slide, air dried and fixed immediately with a spray fixative containing 95% alcohol. The slides were then stained with Papanicolaou (PAP) stain and acridine orange (AO) stain and mounted with DPX.

**Micronuclei assessment**

The smears were then viewed under research microscope (Olympus, BX 53) under high magnification (X400 and X1000) and micronuclei were observed in exfoliated oral epithelial cells according to the criteria defined by Tolbert et al.(1992).[3] 1000 epithelial cells in each smear were observed and the presence of micronucleated cells(MNC) and micronuclei frequency(MF). Percentage of micronuclei (number of micronuclei per 100 cells) and Micronuclei index (MNI= Micronuclei frequency/Total number of Micronucleated cells) were calculated and compared to the controls. The micronuclei observations were also correlated to the occupational history of the study group.

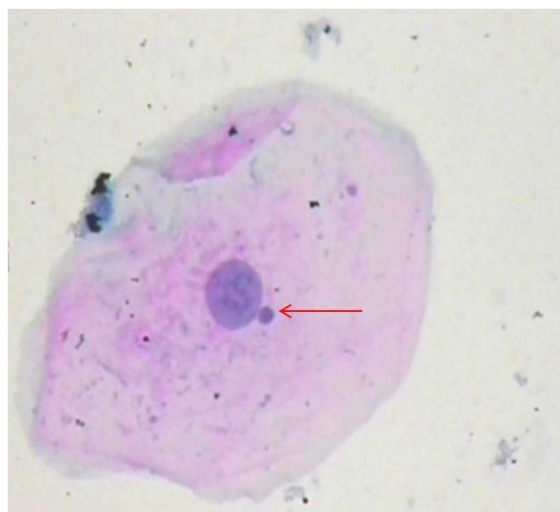
**Statistical analysis**

The results were analyzed statistically using SPSS v.17 software using paired T test and ANOVA test. p values less than 0.05 were considered statistically significant with 95% confidence interval.

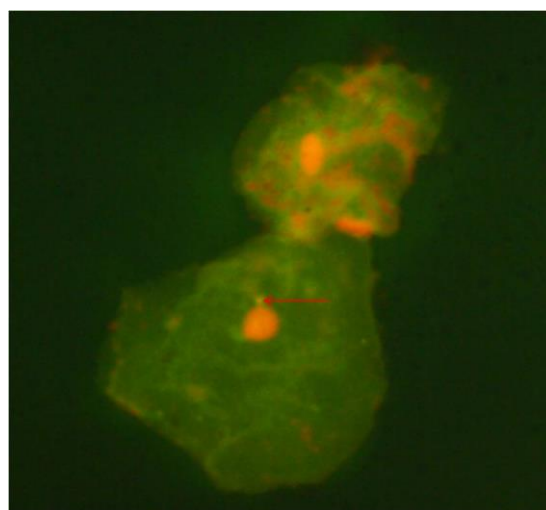
**Results**

The mean age of the subjects in study group was 39.15±5.08 years and in control group was 33.35±7.39 years. The mean occupational history of the subjects in the study group was 9.25±3.32 years (Table 1). The percentage micronuclei count was higher in the study group (1.34±0.61 with acridine orange stain and 1.95±0.72 with PAP stain) as compared to the control group (0.175±0.16 with acridine orange stain and 0.185±0.13 with PAP stain). The results were statistically significant (p<0.001) (Table 2). The micronuclei index was also higher in the study group (1.74±0.37 with acridine orange stain and 1.82±0.42 with PAP stain) as compared to the control group (1±0.28 with acridine orange stain and 1.01±0.69 with PAP stain). The results were statistically non-significant (p>0.05)(Table 3). Additionally, the exfoliated cells showed other nuclear abnormalities such as hyperchromatism, altered nucleo-cytoplasmic ratio, karyorhexis and binucleation. The percentage micronuclei

count and micronuclei index were observed to be increasing with increasing occupational exposure to petroleum vapours (Table 4). Micronuclei observed are shown in Fig. 1 (PAP stain) and Fig. 2 (Acridine orange stain).



**Fig. 1:** Micronuclei observed in exfoliated oral epithelial cells (PAP stain, 100x magnification)



**Fig. 2:** Micronuclei observed in exfoliated oral epithelial cells (Acridine orange stain, 100x magnification)

**Table 1:** Age and duration of occupational history in control and study groups

		N	Mean age (in years)	SD
Age	Study Group	40	39.15	5.082
	Control	40	33.35	7.392
Occupational History	Study Group	40	9.25	3.319
	Control	40	0	0

**Table 2:** Percentage Micronuclei count in Control and study group using Acridine orange and PAP stain

	Percentage Micronuclei count		
	Study Group	Control	p value
<b>AO</b>	1.34±0.61	0.175±0.16	0.000
<b>PAP</b>	1.95±0.72	0.185±0.13	0.000
<b>p value</b>	0.000	0.675	
Student T test, p value ≤0.05 statistically significant			

**Table 3:** Micronuclei index in Control and study group using Acridine orange and PAP stain

	Micronuclei index		
	Study Group	Control	p value
<b>AO</b>	1.74±0.37	1±0.28	0.000
<b>PAP</b>	1.82±0.42	1.61±0.69	0.162
<b>p value</b>	0.208	0.002	
Student T test, p value ≤0.05 statistically significant			

**Table 4:** Correlation of percentage micronuclei and Micronuclei index to duration of occupational history

Duration of Occupational history	N	Acridine orange stain		PAP stain	
		Percentage micronuclei count	Micronuclei index	Percentage micronuclei count	Micronuclei index
<b>0-5 Yrs.</b>	46	0.26	1.23	0.34	1.73
<b>6-10 Yrs.</b>	21	1.07	1.70	1.69	1.77
<b>11-16 Yrs.</b>	13	2.03	1.68	2.66	1.78
<b>Total</b>	80	0.76	1.49	1.07	1.76
<b>p value(ANOVA)</b>		0.000	0.001	0.000	0.942

ANOVA test, p value ≤0.05 statistically significant

## Discussion

Micronuclei represent small, additional nuclei formed by the exclusion of chromosome fragments or whole chromosomes lagging at mitosis caused by genotoxins/carcinogens.<sup>7,10</sup> Micronuclei assay is a simple, non invasive and inexpensive tool to assess genotoxic damage in an individual. Circulating lymphocytes have been investigated previously for micronuclei assessment in head and neck cancer cases.<sup>11,12</sup>

Oral exfoliative cytology is based on the principle that oral squamous cells have physiological propensity to exfoliate in the process of cell turn over following cell maturation. Evaluation of oral exfoliated cells for micronucleated cells and micronuclei frequency forms a promising means to evaluate genotoxic damage. Ease of accessibility and procurement of smears adds to the advantages of oral exfoliated cells as an excellent methodology to study genomic damage.

Micronuclei count in exfoliated oral epithelial cells have been observed to be significantly associated with oral hygiene and dental factors,<sup>5</sup> systemic disorders such as diabetes mellitus,<sup>13</sup> environmental and occupational exposure,<sup>7</sup> tobacco related habits such as smoking, gutkha and paan/areca nut chewing,<sup>4</sup> oral potentially malignant disorders and oral cancer.<sup>14,15</sup>

Petrochemical products and its products, principally benzene have been classified as known carcinogens. Exposure to benzene has been associated with acute myeloid leukemia and Hodgkin's lymphoma.<sup>16</sup> Exposure to these products can be environmental (as vehicle pollutants

and cigarette smoke) or occupational (workers in petrochemical industries and refineries). Petrol pump station attendants are exposed to organic chemicals such as benzene vapors during refilling and handling of petrol. Therefore, they are at a higher risk of acquiring genotoxic damage due to occupational exposure from inhalation of the volatile components of petroleum.<sup>7</sup>

The results of our study show significantly increased levels of micronucleated cells and micronuclei frequency in petrol pump station attendants, which could be attributed to occupational exposure to petrochemical products and its vapors. However, Hadnagy et al.<sup>17</sup> have stated that these workers are not only exposed to petrochemical vapors directly, but also those through vehicular emissions and environmental pollution.<sup>7</sup> This could also contribute to the increased cytotoxic damage in these subjects.

Our results are in accordance with a previous study by Celik et al.<sup>7</sup> who have also shown increased MN frequencies in exfoliated buccal cells between exposed workers (1.34 ± 0.80) and control subjects (0.47 ± 0.03). Bukvic et al.<sup>18</sup> also observed significant difference in MN count in peripheral lymphocytes of petrol station attendants. However, there are studies with divergent results indicating no correlation of exposure to petroleum vapors to cytogenetic damage. Surralles et al.<sup>19</sup> reported no significant difference in the frequency of cytogenetic damage between benzene exposed workers and controls in the buccal cells and lymphocytes. Bukvic et al.,<sup>18</sup> Carere et al.<sup>20</sup> and Pitarque et al.<sup>21</sup> showed that there was no significant difference between controls

and experimental subjects in evaluation of SCE frequencies in petrol station attendants.

Celik et al.<sup>7</sup> have shown that the urinary phenol levels to be elevated in individuals exposed to petroleum products. However, estimation of urinary phenol has a limitation of requirement of high exposure to benzene and being affected by other factors such as diet and drugs. Qu et al.<sup>22</sup> have recommended analysis of other urinary biomarkers such as trans, trans-muconic acid and S-phenylmercapturic acid for bimonitoring of low level benzene exposure.

Our study showed lower MN count and frequency with acridine orange stain (DNA specific stain) as compared to PAP stain (non DNA specific stain). It is difficult to differentiate intracellular structures from micronuclei when non DNA specific stains are used, therefore often leading to over estimation of MN count. These intra cellular structures are not detected with the DNA-specific stain which specifically stains the nucleic acid component, therefore being more specific.<sup>9</sup> Therefore, DNA specific stains are more precise in identifying the micronuclei as non DNA specific stains provide false high values for micronucleated cells and frequency.

### Conclusion

Micronuclei (MN) assay has a definite advantage in terms of simplicity, less ease technique sensitive, economical and minimum time consuming procedure. MN assay can be used as a simple chairside or mass screening method to assess and identify patients with early genomic damage. The present study ascertains the role of micronuclei assay and oral exfoliative cytology in biomonitoring the genotoxic changes in oral epithelial cells in subjects with occupational exposure to petroleum vapors in petrol pump station attendants. Application of DNA specific stains can increase the sensitivity of the assay in detecting micronuclei in exfoliated buccal cells.

### Source of funding

None.

### Conflict of interest

None.

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**How to cite the article:** Gupta P, Khan A, Juneja S, Jain A, Gulati N. Micronucleus assay using DNA specific and non specific stains in exfoliated oral epithelial cells as a biomarker to assess cytogenetic damage in petrol station attendants. *J Dent Specialities* 2019;7(2):102-6.

## Taboos: A curse to oral health: Socio-cultural beliefs among adult population of Muradnagar, Ghaziabad- A cross-sectional study

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### Abstract

**Introduction:** People have a strong belief in the myths and taboos related to oral health which has a huge effect in the prevention and treatment of oral diseases. Thus the objective of this study was to find the cultural beliefs and association between the taboos in dentistry and adult oral health behaviour in the population of Muradnagar, Ghaziabad.

**Materials and Methods:** Adult study subjects who visited the OPD above the age of 18 years were included. Demographic details like age, gender, occupation was recorded. A 11-item pre-tested questionnaire was interviewer administered to assess the cultural beliefs, taboos and myths regarding oral health.

**Result:** A total of 50 adults with a mean age of 39.56±16.41 years were included in the study. Majority (84%) of the respondent believed that teething causes fever. There was no significant correlation between the genders and the myths and taboos regarding oral health. Significantly higher unemployed (50%) and daily-wage workers (23.7%) believed that tooth cleaning causes sensitivity of teeth when compared to salaried (10.5%) and businessman (15.8%). ( $p \leq 0.05$ ).

**Conclusion:** The present study depicted high prevalence of myths and taboos regarding oral health. It is common not only among the unemployed but also among elite and working class. If community is educated for proper prevention and cure, the myths relating dental concepts will vanish from the society and over all dental health status of the community will improve.

**Keywords:** Taboos, Myths, Cultural beliefs, Oral health.

### Introduction

India is a very diverse country with different religion, culture and beliefs. It varies according to region and people staying in rural and urban areas. In India majority of population resides in rural areas, therefore people have their own beliefs and practices concerning health and disease, which equally affects oral diseases and treatments.

Culture is defined as a learned behaviour which is socially acquired. It is transferred from one group to another through learning process.<sup>1</sup> All these customs, cultural morals, habits, beliefs, superstitions and taboos has a huge effect on people's mindset in both rural and urban areas, though due to little more awareness it is seen less in urban areas. And all this hugely affects the oral health of the general public.

Communities with inappropriate exposure to oral health care delivery systems are at higher risk of oral diseases, when socio-cultural determinants such as poor living conditions; low education; lack of traditions, beliefs, culture & myths related to oral health are more prevalent.

A taboo is a strong social prohibition relating to any area of human activity or social custom that is sacred and forbidden based on moral judgment and religious beliefs.<sup>1</sup> Similarly, a myth is commonly a false belief, a misconception, or a fictitious or imaginary understanding of a thing or a person and has no relevance with reality.

Myths can be prevalent in a population due to a variety of reasons such as poor education, cultural beliefs, and social misconceptions. In general, myths are usually passed on from one generation to the next generation. Myths are deep seated in the society, so it is difficult to break the chain. It is important to know about these myths and

misconceptions prevalent in the population as understanding them is essential to provide good care as well as health education to the people.<sup>2</sup>

Oral health is a critical but an overlooked component of overall health and well-being among children and adults. People believe in spiritual treatment and alternative forms of medicine, they prefer visiting a hakim (local traditional practitioner) over a doctor, or a roadside quack for any oral health problems rather than visiting a well qualified doctor.

Thus, aim of the study was to study the cultural beliefs about oral health in adults, to know the existing taboos and myths about dentistry among population, to assess the variation of these taboos and myths across various demographic aspects.

### Materials and Methods

The present cross-sectional study was carried in the Out Patient department, I.T.S Centre for Dental Sciences and Research, Muradnagar, Ghaziabad from March to April 2019. Informed written consents were taken from participants. Ethical clearance was obtained from the Institutional Review Board.

A convenient sample of 50 adult study subjects who visited the OPD and at the camps above the age of 20 years were included. Demographic details like age, gender, occupation was recorded. A 11-item pre-test questionnaire was interviewer administered to assess the cultural beliefs, taboos and myths regarding oral health.

Data were analysed by the SPSSv 19 Statistical Package Software for the Social Sciences (SPSS Inc., Chicago, IL, USA). Descriptive statistics such as mean, median, standard deviation and percentage was used.

Comparison of frequencies was done using Chi-Square test. Any p-value less than 0.05 were considered significant.

## Results

### Demographic details

The study participant aged from 20-60 years with a mean age of 39.56±16.41 years.

Of the 50 study participants, 24(48.0%) were males and 26(52.0%) were females.

Majority (38%) were unemployed, 22% each were salaried and businessman respectively and 18% were daily wage workers. (Table 1)

**Table 1:** Demographic details

Age Group (in years)	Number	Percentage
20-30	18	36%
31-40	17	34%
41-50	5	10%
51-60	10	20%
<b>Gender</b>		
Male	24	48%
Female	26	52%
<b>Occupation</b>		
Unemployed	19	38%
Daily wage workers	9	18%
Salaried	11	22%
Business	11	22%

76% of the respondents believed, that tooth cleaning causes sensitivity of teeth, majority (84%) of the study participants believed that teething causes fever, only 6% had a belief that worms of tooth decay can be removed from ears. (Table 2)

**Table 2:** Questions for assessing cultural beliefs and taboos in dentistry among adult population

Questions	Response Yes (%)	Response No (%)
Q1- Do you think extraction of upper teeth affects eyesight?	33 (66.0)	17 (34.0)
Q2- Do you think cleaning of teeth with fingers is better than brushing?	23 (46.0)	27 (54.0)
Q3- Do you believe use of clove, supari ease tooth pain?	16 (32.0)	34 (68.0)
Q4- Do you think it's better not to brush in case of gingival bleeding?	27 (54.0)	23 (46.0)
Q5- Do you think worms of tooth decay can be removed from ears?	03(6.0)	47(94.0)
Q6- Do you believe that teething causes fever?	42 (84.0)	08 (16.0)
Q7- Do you believe that tooth cleaning (scaling) causes tooth mobility?	26 (52.0)	24 (46.0)
Q8- Do you believe that tooth cleaning causes sensitivity of teeth?	38 (76.0)	12 (4.0)
Q9- Do you think that there is no need to treat the dental problems in milk teeth?	25 (50.0)	25 (50.0)
Q10- Do you think that orthodontic treatment should not be done at younger age?	27 (54.0)	23 (46.0)
Q11- Do you think RPDs are fixed prosthesis?	31 (62.0)	19 (38.0)

Comparison of responses between males and females showed no statically significant difference for all the questions (Table 3)

**Table 3:** Gender wise response of the questionnaire

Questions	Responses	Males N(%)	Females N(%)	Chi-Square	
				p-value	significance
Q1 Do you think extraction of upper teeth affects eyesight?	Yes	14(42.4)	19(57.6)	0.059	NS
	No	12(70.6)	5(29.4)		
Q2 Do you think cleaning of teeth with fingers is better than brushing?	Yes	13(56.5)	10(43.5)	0.555	NS
	No	13(48.1)	14(51.9)		
Q3 Do you believe use of clove, supari ease tooth pain?	Yes	8(50)	8(50)	0.846	NS
	No	18(52.9)	16(47.1)		
Q4 Do you think it's better not to brush in case of gingival bleeding?	Yes	15(55.6)	12(44.4)	0.586	NS
	No	11(47.8)	12(52.2)		
Q5 Do you think worms of tooth decay can be removed from ears?	Yes	2(66.7)	1(33.3)	0.600	NS
	No	24(51.1)	23(48.9)		
Q6 Do you believe that teething causes fever?	Yes	22(52.4)	20(47.6)	0.902	NS
	No	4(50.0)	4(50.0)		
Q7 Do you believe that tooth cleaning (scaling) causes tooth mobility?	Yes	12(46.2)	14(53.8)	0.389	NS
	No	14(58.3)	10(41.7)		
Q8 Do you believe that tooth cleaning causes sensitivity of teeth?	Yes	19(50)	19(50)	0.614	NS
	No	7(58.3)	5(41.7)		
Q9 Do you think that there is no need to treat the dental problems in milk teeth?	Yes	12(48.0)	13(52)	0.571	NS
	No	14(56)	11(44)		

Q10 Do you think that orthodontic treatment should not be done at younger age?	Yes	13(48.1)	14(51.9)	0.555	NS
	No	13(56.5)	10(43.5)		
Q11 Do you think RPDs are fixed prosthesis?	Yes	17(54.8)	14(45.2)	0.608	NS
	No	9(47.4)	10(52.6)		

Significantly higher unemployed (50%) and daily-wage workers (23.7%) believed that tooth cleaning causes sensitivity of teeth when compared to salaried (10.5%) and businessman (15.8%).

Also significantly higher percentages of unemployed and daily-wage workers thought RPDs are fixed prosthesis when compared to respondents who were salaried and the ones involved in business. ( $p \leq 0.05$ ) no significant difference in responses to other questions based on occupation was observed ( $p \geq 0.05$ ) (Table 4)

**Table 4:** occupation wise responses of the questionnaire

Questions	Responses	Unemployed N (%)	Daily Wage N (%)	Salaried N(%)	Business N(%)	Fisher Freeman Halton	
						P-Value	Significance
Q1 Do you think extraction of upper teeth affects eyesight?	Yes	14(42.4)	6(18.2)	6(18.2)	7(21.2)	0.784	NS
	No	5(29.4)	3(17.6)	5(29.4)	4(23.5)		
Q2 Do you think cleaning of teeth with fingers is better than brushing?	Yes	10(43.5)	5(21.7)	3(13)	5(21.7)	0.528	NS
	No	9(33.3)	4(14.8)	8(29.6)	6(22.2)		
Q3 Do you believe use of clove, supari ease tooth pain?	Yes	7(43.8)	2(12.5)	3(18.3)	4(25)	0.847	NS
	No	12(35.3)	7(20.6)	8(23.5)	7(63.6)		
Q4 Do you think it's better not to brush in case of gingival bleeding?	Yes	8(29.6)	7(25.9)	6(22.2)	6(22.2)	0.372	NS
	No	11(47.7)	2(8.7)	5(21.7)	5(21.7)		
Q5 Do you think worms of tooth decay can be removed from ears?	Yes	1(33.3)	1(33.3)	1(33.3)	0(0.00)	0.724	NS
	No	18(38.3)	8(17.0)	10(21.3)	11(23.4)		
Q6 Do you believe that teething causes fever?	Yes	17(40.5)	9(21.4)	7(16.7)	9(21.4)	0.164	NS
	No	2(25)	0(0)	4(50)	2(25)		
Q7 Do you believe that tooth cleaning (scaling) causes tooth mobility?	Yes	13(50)	6(23.1)	3(11.5)	4(15.4)	0.086	NS
	No	6(25)	3(12.5)	8(33.3)	7(29.2)		
Q8 Do you believe that tooth cleaning causes sensitivity of teeth?	Yes	19(50)	9(23.7)	4(10.5)	6(15.8)	0.00	HS
	No	0(0)	0(0)	7(58.3)	5(41.7)		
Q9 Do you think that there is no need to treat the dental problems in milk teeth?	Yes	9(36)	5(20)	4(16)	7(28)	0.615	NS
	No	10(40)	4(16)	7(28)	4(16)		
Q10 Do you think that orthodontic treatment should not be done at younger age?	Yes	11(40.7)	6(22.2)	6(22.2)	4(14.8)	0.557	NS
	No	8(34.8)	3(13)	5(21.7)	7(30.4)		
Q11 Do you think RPDs are fixed prosthesis?	Yes	13(41.9)	9(29)	5(16.1)	4(12.9)	0.017	S
	No	6(31.6)	0(0)	6(31.6)	7(36.8)		

## Discussion

This study was performed to investigate the existence of myths and taboos, to assess the variation of these myths across various demographic aspects and to impart education to the people regarding abolishing the myth as that will be a hindrance towards a healthy life in patients visiting Dental Hospital, India, a developing country faces many challenges in fulfilling oral health needs of the population. And in addition to this, there is a major effect of myths and taboos on health seeking behaviour in the Indian population.

In the present study it was found that 66% of respondent believe that extraction of upper teeth affects the eyesight which is more than that of study done by Khan SA et al<sup>5</sup> (47%), Sharma R et al<sup>3</sup> (64%), Kochhar S et al<sup>7</sup> (49.6%), Pandya P et al<sup>9</sup> (42.7%), Raina SA et al<sup>8</sup> (52.4%),

Rai A et al<sup>6</sup> (19.1%). For example, extractions performed on older patients, leading to weakening of eye sight due to its vicinity in maxilla, are mere coincidental, but still remain a taboo, hence people relate to this. About 46% of the subjects still use finger instead of toothbrush as a cleaning aid, which is slightly less than the study done by

Kochhar S et al<sup>7</sup> (46.6%) and more than the study done by Rai A et al (11.4%),<sup>6</sup> which may be due to poor education. Many people in the countryside use twigs of neem tree as a tooth brush, some use ashes, salt rice husks, tobacco and some charcoal,<sup>10</sup> therefore they believe using finger is better than using brush and 54% believes that brush should be used as a cleaning aid rather than finger & these could be the educated ones and those who have come in contact with urban life use tooth brushes. In this modern progressing times also still 32% of the participants still depend on the cultural beliefs and taboos in curing their dental health problems and believes that use of clove, supari ease tooth pain which is lower than the study done by Sharma R et al<sup>3</sup> (54%), Kochhar S et al<sup>7</sup> (57.8%), Rai A et al<sup>6</sup> (49.4%). It may be attributed to the fact that the products like clove are easily available and relieve pain quickly and are cost effective and available as a household material that are mostly used in developing countries like India. In gum bleeding 54% participants believed that it was better not to brush, which was more than the study done by Nagarajappa R. et al.<sup>4</sup> (16.5%) and less than the study done by Kochhar S



et al<sup>7</sup>(58.4%) and less than the study done by Rai A et al<sup>6</sup> (73.4%), since they believe that it may aggravate the condition. Because of the cultural beliefs 84% of the participants still believe that teething causes fever in a child, which is more than the study done by Rai A et al<sup>6</sup> (50.9%). While eruption of teeth can slightly raise the child's body temperature but if body temperature is above the normal range i.e 36-37°C, then it is a fever and which is because of some other problem and not because teething.

In this study 52% participant believes that cleaning of teeth through scaling cause mobility in teeth, which is lower than the study done by Sharma R et al<sup>3</sup> (59.3%), Kochhar S et al<sup>7</sup> (65.3%) and more than the study done by Raina SA et al<sup>8</sup>(48%), Pandya P et al<sup>9</sup> (46.7%). If poor oral hygiene is there then calculus deposits are obvious and teeth become periodontally weak which leads on to mobility, recession (periodontitis) but because heavy calculus deposits tooth tend to remain stable for some time, because of this just after removing these calculus through scaling the tooth become mobile and patient believe that cleaning of teeth has caused this and held the dentist responsible. Also due to removal of calculus and exposed area lead on to sensitivity for few days but 76% participant believes it is just because of the scaling.

In this study 50% of the participants believed that there was no need to visit the dentist for treatment of milk teeth, until all the permanent teeth of child erupts which was lower than the study done by Kochhar S et al.<sup>7</sup> (73.8%), Khan SA et. al. (72.5%),<sup>5</sup> Sharma R et al<sup>3</sup> (57.8%) and more than the study done by Pandya P et al<sup>9</sup> (38%), Raina SA et al<sup>8</sup> (47.9%). They think that these teeth are going to shed, so treating them as wastage of money and time but people are getting aware regarding this therefore this positive response was there. And also 54% think that orthodontic treatment if done at younger age can affect the child's brain, hence it shouldn't be done at younger age. Only 6% believed that worm of tooth decay can be removed from ear, which is lower than the study done by Rai A et al<sup>6</sup> (14%), this is because in earlier times it was believed tooth decay is caused because of some worm and still it is believed in some rural areas but now people are more aware regarding this.

62% participant believed that the removal denture is the fixed one for replacement of any teeth. This is just because of the quacks who practice wrong dentistry by just sticking the typhodonts and sometimes extracted tooth with some material and also sometimes fixes the typhodonts with the natural tooth in the mouth directly with self-cure acrylic.

## Conclusion

The present study depicted high prevalence of myths and taboos regarding oral health. It is common not only among the unemployed but also among elite and working class. If community is educated for proper prevention and cure, the myths relating dental concepts will vanish from the society and over all dental health status of the community will improve.

## Recommendation

Dental health education awareness campaign is needed to change the mindset of the community. A multi-sectoral approach is required to address this problem, educate the people and work on oral health promotions. Primary health care workers should be trained to provide oral health education to the community. Also, further longitudinal studies with larger sample size can be carried for better generalizability of the data.

## Source of funding

None.

## Conflict of interest

None.

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**How to cite the article:** Barman A, Garg A, Gupta R, Menon I. Taboos; A curse to oral health: socio-cultural beliefs among adult population of Muradnagar, Ghaziabad-A cross-sectional study. *J Dent Specialities* 2019;7(2):107-110.

## Comparative evaluation of oxygen releasing formula (Blue-M Gel®) and chlorhexidine gel as an adjunct with scaling and root planing in the management of patients with chronic periodontitis –A clinico-microbiological study

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### Abstract

**Introduction:** Phase I therapy is the first step in the treatment of periodontal diseases. However, Scaling and root planing (SRP) alone was found to be of limited efficacy especially in certain unapproachable areas, hence use of an adjunct to SRP has been advocated. In past, chlorhexidine has been used as an adjunct to SRP successfully and is considered as gold standard. Recently, use of commercially available BLUE –M® gel (high level oxygen releasing formula) has been advocated in the field of Periodontology.

**Objective:** The objective of the present study was to compare and evaluate the efficacy of Chlorhexidine gel and Blue-m® gel as an adjunct to non-surgical periodontal therapy (SRP) in  $\leq 5$ mm periodontal pockets, with regard to its clinical effectiveness and bactericidal properties.

**Materials and Methods:** A total of 20 Patients of chronic periodontitis with pocket probing depth  $\leq 5$ mm were divided into control group 1: (SRP + chlorhexidine gel) and test group 2 (SRP + blue m® gel). Standardized periodontal parameters including Gingival index (GI), pocket probing depth (PPD), clinical attachment loss (CAL) were measured at baseline & 1 month respectively. Total bacterial count was assessed semi quantitatively at baseline and 1 month.

**Result & Conclusion:** Both the gels, chlorhexidine gel and blue m gel were equally effective and comparable in management of chronic periodontitis.

**Keywords:** Chlorhexidine, Scaling & root planning, Oxygen releasing gel, Periodontitis.

### Introduction

Periodontitis describes a group of related diseases which out-turns in the desolation of the tissues that support the tooth structure. Oral microflora initiates most destructive diseases that lead to periodontal attachment loss.<sup>1</sup>

Till date scaling and root planing (SRP) endures to be the “gold standard” for periodontal diseases compared to other treatment options and is still practised widely. The inflammatory changes in the periodontal tissue is instigated mainly by the microbial plaque and bacterial infection. A highly structured and complex biofilm is formed in the periodontal pocket by the bacteria. As this process continues, the biofilm reaches far subgingivally and it becomes inconvenient for the patient to reach it during oral hygiene practices.<sup>2</sup>

Traditional treatment options for such conditions such as chronic periodontitis include mechanical debridement aimed at disrupting the biofilm. However, as the anatomy of the root is complex the location of the lesion may hamper the treatment and prevent sufficient reduction of the bacterial load. Studies have assessed the value of various locally delivered antimicrobial systems either as monotherapy or as an alternative to the conventional scaling and root planing in management of the patients with chronic periodontitis<sup>3</sup>

Also, after nonsurgical therapy (SRP), thorough debridement is not fully achieved and several deep periodontal pockets are still believed to persist so, in cases like these, the patient has to undergo surgical procedures.<sup>4</sup>

Despite various advantages the systemic antibiotic therapy has various disadvantages too such there is the evolution and maturing of resistant bacteria and administration of higher dosages so as to attain required concentration of gingival crevicular fluid at the target sites led to the discovery of local drug delivery system.<sup>5</sup>

The flora associated to chronic periodontal diseases is dominated by the presence of Gram-negative anaerobic bacteria, such as *A. actinomycetemcomitans* and *P. gingivalis*.<sup>6</sup>

Chlorhexidine gel is an antiseptic that binds very strongly to the surface of teeth, inner cheeks and gums. It also kills the harmful microorganisms that cause swollen gums, tartar, bad odour from mouth, and other mouth infections.<sup>7</sup>

Over the past years, strong evidence has shown to compromise oxidative stress in pathogenesis and etiology of periodontitis as one of the cause. Also, Free radicals and reactive oxygen species (ROS) are very essential to biologic processes occurring normally. These free radicals can stimulate the growth of fibroblasts and epithelial cells at low concentrations, but it may result in tissue injury if subjected to higher concentrations.<sup>8</sup>

ROS encompasses reactive species such as singlet oxygen, hydrogen peroxide etc which are not true radicals but can however, transform to free radicals in both intra- and extra-cellular environments. ROS acts as intra cellular signal transducers resulting in autophagy, which plays a dual role in periodontitis by promoting cell death or blocking apoptosis in infected cell.<sup>9</sup>

Bluem® oral gel is specially recently developed formula by implantologists, oral surgeons and dentists for specific targeted problems in the mouth and is claimed to possess unique properties when compare to convention local drug delivery systems. It improves the healing of the wounds by intensifying the levels of oxygen in periodontal pockets, bleeding gum, wounds which results from traumatic extraction, in implant dentistry, chemotherapy. The use of this unique formula improves oral hygiene of an individual and also, reduces the risk of infections and inflammation.

### Aim

The comparative evaluation of oxygen releasing formula (blue-m gel®) and chlorhexidine gel as an adjunct with scaling along with root planing in the management and treatment of patients with chronic periodontitis

### Materials and Methods

The study was performed selecting thirty subjects who successfully fulfilled the inclusion criteria and those who did not, were excluded out of the study. All probable participants were explained the design of the study. Subjects who agreed to participate and consented by written informed approval were included.

### Inclusion criteria

1. An age group of 20–50 years
2. Both sexes were included
3. Patients with Chronic periodontitis
4. Probing pocket depth less than or equal to 5mm ( $\leq 5$  mm)
5. Gingival index (GI)
6. Plaque index (PI)

### Exclusion criteria

1. Subjects who had priorly taken antibiotics or were on antibiotics during the trial
2. Medication taken by patient that would induce gingival enlargement
3. Pregnant women or lactating mothers.
4. Current Smokers
5. Patients with habit of Tobacco chewing.

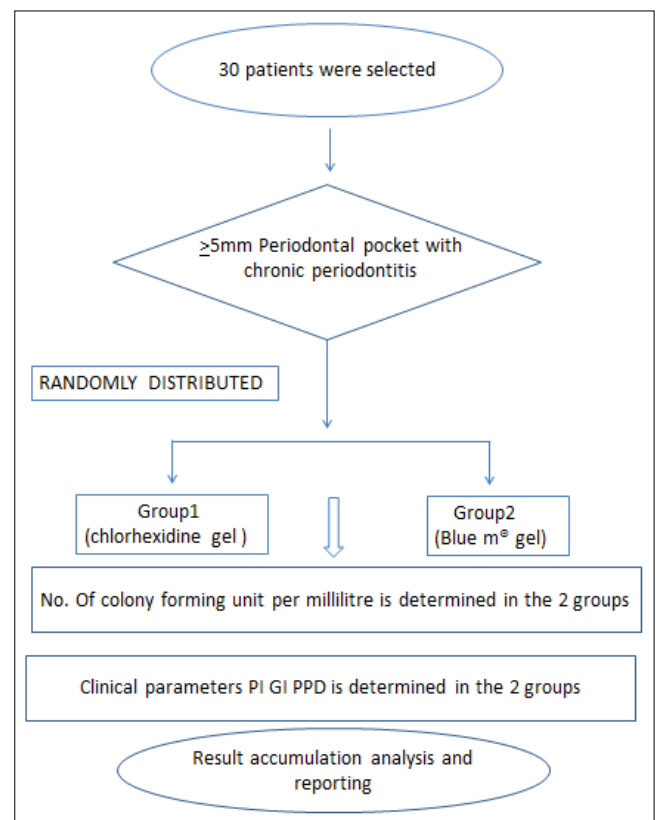
### Methodology

**Clinical examination:** The size of the samples for the present study was procured from the OPD or the outpatient Department of Periodontology and oral implantology ITS Dental College Muradnagar, Ghaziabad. After documenting of case history, proper clinical examinations were performed on a dental chair itself. After clinching inclusion and exclusion criteria patients with presence of localized or generalized chronic periodontitis were chosen for the study. Clinical parameters were taken such as PI, GI and pocket depth measurement were analysed at baseline (0 day) and at 30th day. Plaque samples were further stockpiled and evaluated for determining the colony forming units.

**Study groups:** The chosen thirty samples were arbitrarily divided into two groups using a split mouth design (flowchart 1) which were named as Group I (control) and Group II (experimental group). Left side was allocated for the control group (Group I) and other or the right side was allotted for the experimental group (Group II).

**Group I (control group):** 30 sites on the left side received SRP followed by local administration of chlorhexidine gel (hexigel) in the periodontal pocket with depth less than or equal to 5mm.

**Group II (experimental group):** Thirty sites on the right side were treated by SRP followed by blue m gel placement in the periodontal pocket.



**Flowchart 1:** Study allocation and procedure

**Preparation of test materials:** Chlorhexidine gel (Fig. 1) in Group I (control group) 0.2% chlorhexidine gel (Cervitec Gel, Ivoclar Vivadent, Liechtenstein) was used. It is composed of chlorhexidine gel: with fluoride in conc of 900 ppm in combination with 0.2% chlorhexidinedi gluconate. Ingredients include: Aqua, hydroxyethyl cellulose, Laureth-23, sodium fluoride NaF, aroma, sodium saccharin.

Blue m gel (Fig. 2) in Group II (experimental group):

Blue m gel (15 ml): Composition: Aqua, Alcohol, Glycerin, Silica, Sodium Saccharin, Sodium Perborate, Citric Acid, PEG-32, Sodium Gluconate, Lactoferrin, Xanthan Gum, Cellulose Gum.



Fig. 1: Chlorhexidine gel



Fig. 2: Blue m gel

### Procedure of periodontal therapy

Clinical examinations were carried out carefully and the values for evaluation at baseline were taken precedingly to the procedure and the recordings were made by one calibrated examiner also, values were taken on a standardized form which contained the analytical data of the patient, SRP was performed by ultrasonic scaler. After thorough SRP, the Pocket Probing Depth was re-determined by a probe followed by the local drug delivery of gels in both control and experimental sites.

In Group I, the area of interest was completely dried using air syringe, and then the isolation of the desired site was done with the help of cotton rolls that were made with the intention to prevent contamination from saliva. The local drug delivery consisting of 0.2% chlorhexidine gel (hexigel) was introduced into the periodontal pockets by means of a disposable syringe with a needle attached to it giving it a 90 degree bend so as to properly place the gel in position.

The pocket opening filled with the respective gels was then covered by Coe-Pak to retain the material or the gels in the periodontal pocket, as well as to prevent the ingress of oral fluids of the oral cavity.

With the same approach, in the experimental site (Group II) the local drug delivery system consisting of Blue m gel was put down in the periodontal pocket in similar manner. The pocket opening of the site was covered by Coe-Pak in an alike fashion. Both. The compared sites with there respective gels were then checked for the probing depth after a month that is at 30<sup>th</sup> day. As shown in fig. 3.

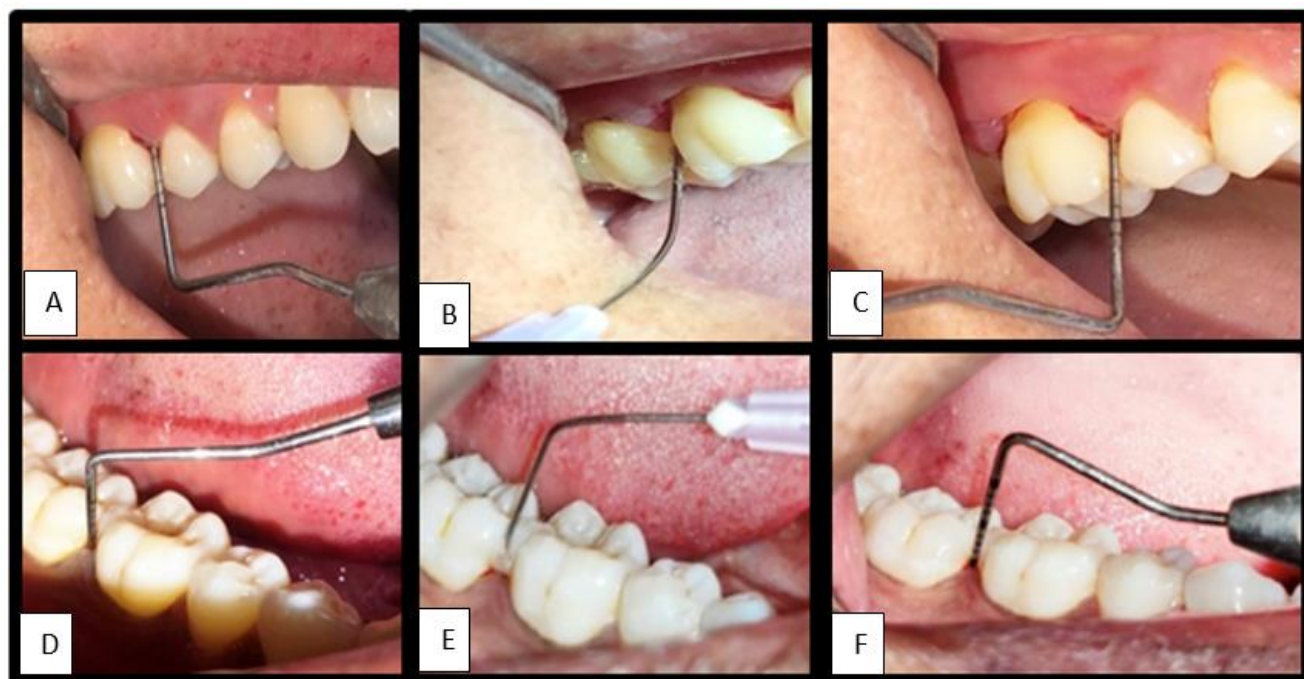


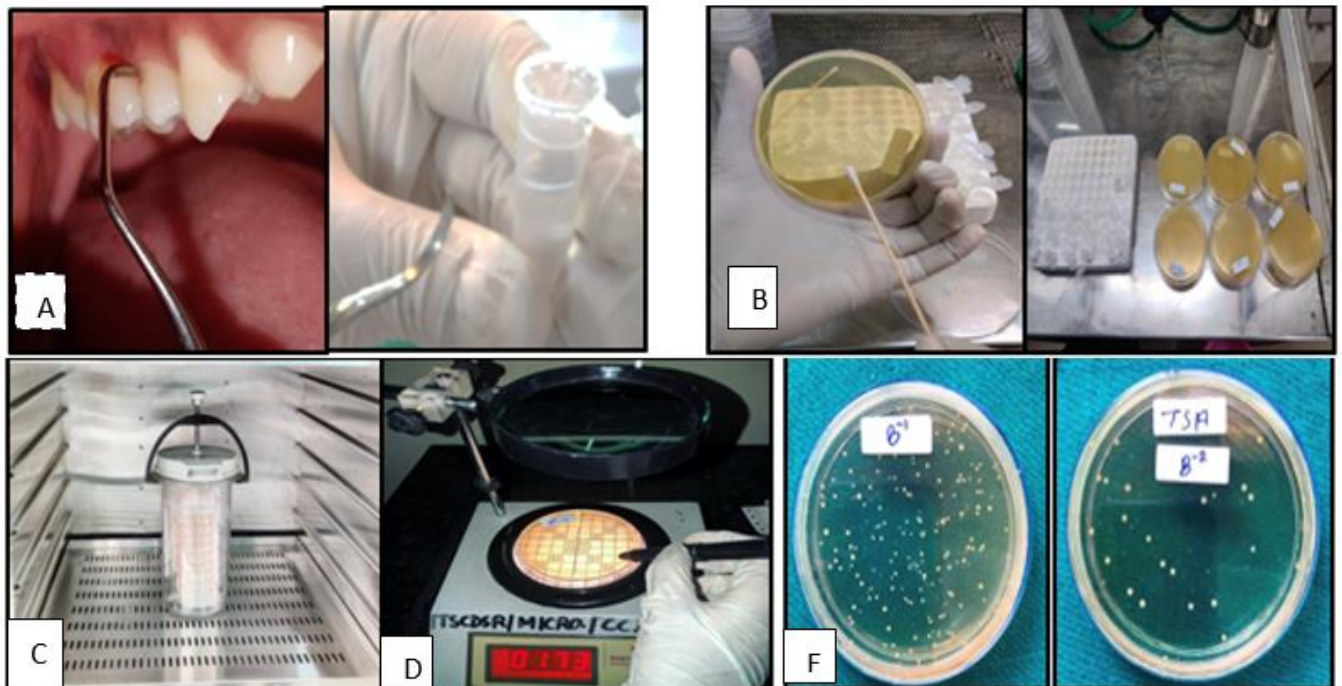
Fig. 3:(A)Initial pocket probing depth at baseline (B) insertion of chlorhexidine gel (C) pocket probing depth at 30 days (D) Initial pocket probing depth at baseline (E) insertion of Blue m gel (F) pocket probing depth at 30 days.



### Microbiological analysis

The collection of plaque sample was performed in the Department of Periodontology, ITS Dental College, and Hospital, Ghaziabad. The collection of subgingival plaque samples was carried out by the same operator to standardize the sampling procedure and to avoid any bias. Before taking the samples, the neighbouring teeth were secluded with cotton rolls. Samples consisting of plaque were collected and scrapped from all the quadrants to achieve sufficient

sample volume and was pooled in “reduced trypticase soy agar” for microbiological analysis. Plaque samples that were contaminated with blood or saliva were repudiated. Immediately after taking out the samples, they were transferred for microbiological analysis of *Aa* and *Pg* which had to be separately vortexed and inoculated or grown in anaerobic jar to meet the requirement for culturing and quantification of anaerobic bacteria, as shown in fig 4 A,B,C,D.



**Fig. 4:** (A) Plaque sample collected in test tubes (3ml) phosphate buffer saline (PBS); (B): Undiluted PBS containing plaque inoculated into trypticase soy agar plates; (C): Plates incubated in incubator with anaerobic gas pack at 37 degrees; (D): Colony counting under microscope; (E): Colonies on trypticase soy agar at baseline and at 30 days.

### Statistical analysis

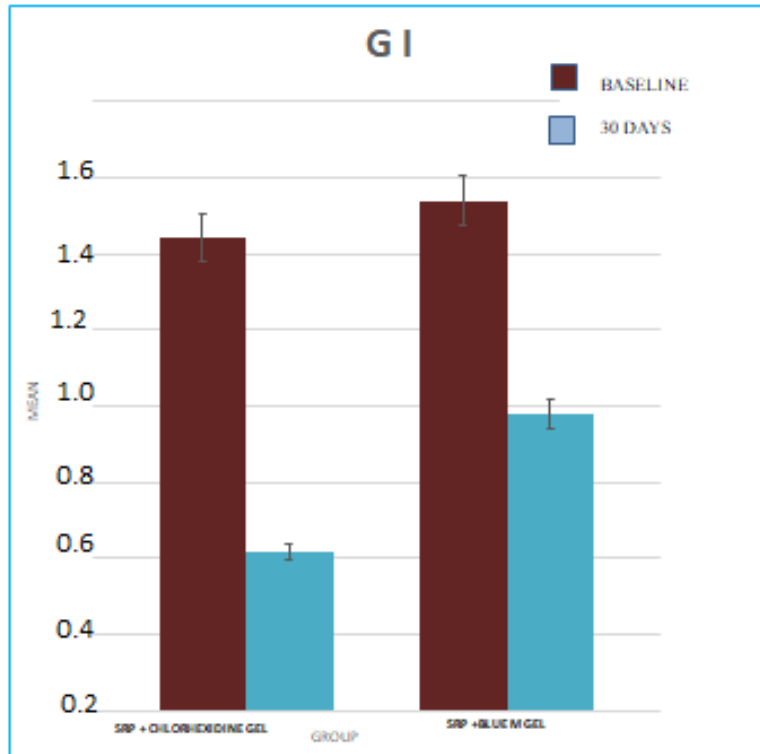
All entries of the data was formulated into a standardized format and examined to assess the efficacy of hexigel (Group I) and blue m gel (Group II) at baseline and at 30 days or 1 month using the statistical package for social sciences (SPSS 16.0 version). The Mean of standard deviation (SD) was calculated. Standardized periodontal parameters including Gingival index (GI), pocket probing depth (PPD), clinical attachment loss (CAL) were measured at baseline & 1 month respectively.

Total bacterial count (CFU) was assessed semi quantitatively at baseline and at 1 month. Statistical analysis was done using the unpaired t-test. Within-group comparison was done using paired t-test.

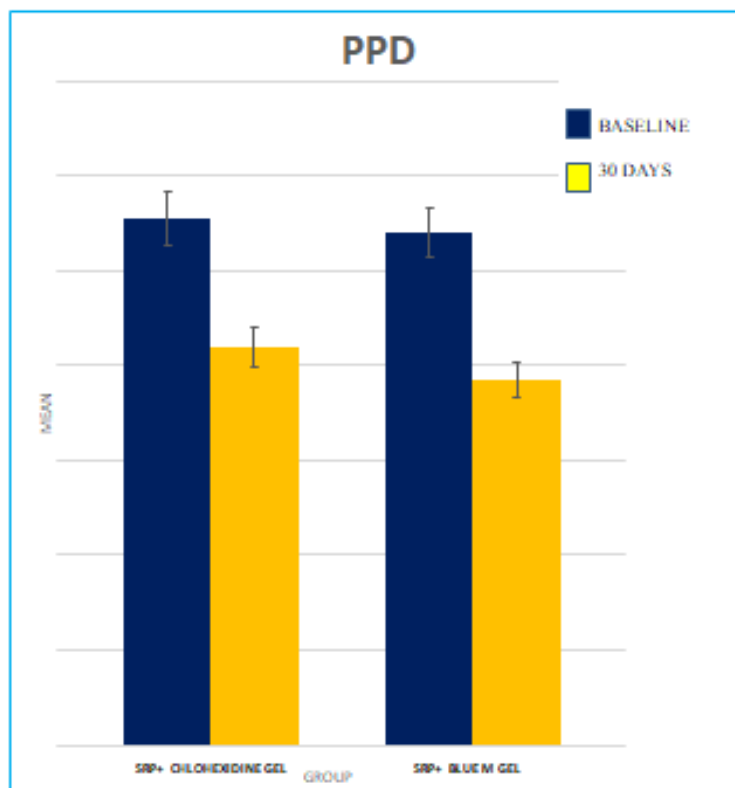
Test of significance i.e the P Value was set at -  $P < 0.05$

### Results

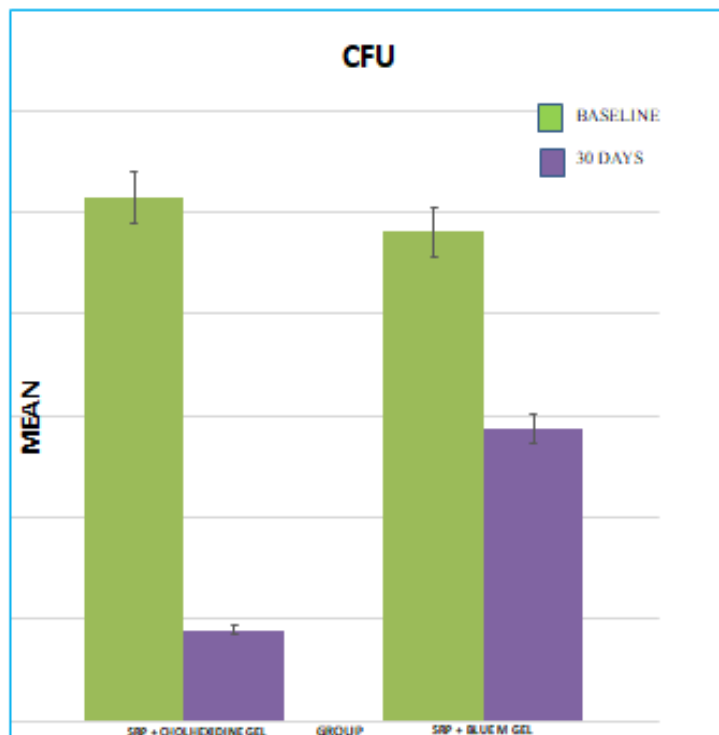
The value of PPD, GI decreased in SRP + Blue m gel from approx 4-5 mm at baseline to approx 2-3mm at 30 days as shown in (graph 1). and in the SRP +chlorhexidine gel from 3-4 mm at baseline to  $\leq 5$ mm at 30 days as shown in (Graph 2). Also at 30 days the bacterial colony count showed significant reduction in number as shown in (Graph 3) and values in (Table1 and Table 2).



Graph 1: Gingival index at baseline and at 30 days



Graph 2: Pocket probing depth (PPD) at baseline at 30 days



**Graph 3:** Colony forming units (CFU’s) at baseline and at 30 days

**Table 1:** Gingival index mean values Inter group comparison

Groups	Group 1 (control)	Group2 (experimental)	values	
Mean GI +SD	50.63+0.67	50.43+0.72	t	0.838
Mean GI +SD	50.73+0.72	4.365	p	0.406

**Table 2:** Gingival index mean values and intra-group comparison of gingival index in Group I and Group II

Groups	Group 1 (control)	Group2 (experimental)	values	
Baseline 0 days	50.63+0.67	50.43+0.72	t	<0.001
At 30 days	40.73+0.72	4.365+0.56	p	<0.001

In the present study Blue m gel is found to be beneficial and encouraging when compared to chlorhexidine gel which is still considered the “Gold standard” to treat periodontal pockets with mild to moderate depth in patients diagnosed with chronic periodontitis, with noteworthy reduction in the indices scores and colony forming units scores compared to baseline values and at 30 days.

**Discussion**

Periodontitis expresses a group of concomitant inflammatory diseases resulting in the shattering of the tissues that provides support and strength to the tooth. Periodontitis is known to have composite etiology with the primary etiologic factor being pathogenic bacteria that is said to inhabit in the subgingival area.<sup>10</sup>

Based on the obtainable documentation, the introduction of local drug delivery into the periodontal pocket can enhance and improve the periodontal health, condition and status. However, these drugs sometimes fail

to completely replace the conventional scaling and root planing procedure.<sup>11</sup>

Delivery of antimicrobial agents locally has been inquired into for defeating the restraints of conventional or traditional SRP therapy. Lately, the employing of sustained release formulations eg tetracycline fibers and metronidazole, gel chlorhexidine chip to deliver antimicrobial agents directly to the site with presence of infections within the periodontal pockets has become victorious therapy and many clinicians are widely accepting and using it.<sup>12</sup>

Chlorhexidine, as yet is said to be the most popular anti plaque agent and is considered as a ‘gold standard’ because of its potent antiplaque action, against which potency and benefit of other anti plaque and anti -gingivitis agents is appraised.

Its efficacy can be attributed to its potent bacteriostatic as well as bactericidal properties and its very well-known property of slow release i.e. substantivity within the oral cavity.<sup>13</sup> It has exclusively and extensively been known as



an effective antimicrobial agent,<sup>14</sup> however the use of chlorhexidine in any form for a prolonged period is limited by altered taste perception and staining of tooth.<sup>15</sup>

Bluem® oral gel formula is developed by a man on mission namely Peter Blijdrop for specific problems in the mouth with the following ingredients :Aqua, Alcohol, Glycerin, Silica, Sodium Saccharin, Sodium Perborate, Citric Acid, PEG-32, Sodium Gluconate, Lactoferrin, Xanthan Gum, Cellulose Gum with their specific functions.

The greater consequential abatement of Gingival index score in the experimental sites (Blue m gel) in our study could be owing to significant improvement in gingival inflammation, the high concentration of active oxygen, as it works fast and effective!

Significant reduction in pocket depth in sites treated with Blue M gel is because of release of more active oxygen of Blue m gel. This causes fast and progressive healing. The reduction in colony forming units was because of the fact that blue m gel is said to normalise and controls detrimental bacteria and thus, is analogous to chlorhexidine gel. Also, there were no complications or risks associated with performing the study with the Blue m gel.

However, Within the Limitation of the study: the substantivity of Blue m gel is not clear also the sample size and duration was less.

## Conclusion

To summarise with, two of the gels i.e chlorhexidine gel and Blue m gel can be used as an reliable option or alternative to SRP, in the present study Blue m gel gel has shown to be fairly and coequally effective when compared to the chlorhexidine gel in treating periodontal pockets with mild to moderate depths

## Source of funding

Nil.

## Conflict of interest

None.

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**How to cite the article:** Koul A, Kabra R, Chopra R, Sharma N, Sekhar V. Comparative evaluation of oxygen releasing formula (Blue-M Gel®) and chlorhexidine gel as an adjunct with scaling and root planing in the management of patients with chronic periodontitis –A clinico-microbiological study. *J Dent Specialities* 2019;7(2):111-7.

## Sialolithiasis in a 19 year old male: A case report

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### Abstract

Sialolithiasis is a condition characterized by the obstruction of a salivary gland or its excretory duct due to the formation of calcareous concretions, resulting in salivary ectasia and subsequent dilatation of the salivary gland. This disease is mostly seen in adults or young adults, and seldom develops in children with submandibular gland duct being the most common site. This case report describes a 19 year old patient presenting with pain and swelling in right side of floor of mouth. Sialolithiasis of right submandibular gland was diagnosed based on clinical and radiographic examination. The sialolith was removed under local anesthesia.

**Keywords:** Sialolithiasis, Submandibular gland, Intraductal, Intraglandular, Sialo-MRI, Lithotripsy.

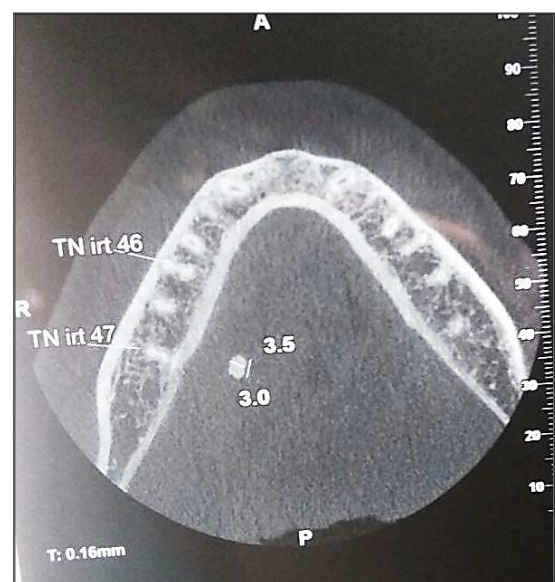
### Introduction

The most frequent benign non neoplastic salivary disorder representing about 50% of all major salivary gland disorders is sialolithiasis.<sup>1</sup> Prevalence rate is as low as 1% of the population with symptomatic sialolithiasis occurring at a rate of 0.45%.<sup>2</sup> Submandibular gland or its duct has highest tendency for sialolithiasis and cause chronic infection. It accounts for 80% of cases followed-by 19% in the parotid and 1% in the sublingual glands. Male predilection is 2:1 and occurs between 2<sup>nd</sup> and 6<sup>th</sup> decade of life. It is rare in children and accounts for 3% of all sialolithiasis.<sup>3</sup> Obstruction of salivary secretion by a calculus is the prime characteristic and it is associated with swelling, pain, pus discharge and inflammation in certain cases. Symptoms are usually unilateral in nature and it has a multifactorial etiology. Salivary calculi is formed from the deposition of calcium salts within the ductal system of salivary glands usually originating from desquamated epithelial cells, foreign bodies, microorganisms and/or mucous plugs. Obstruction, xerostomia, dehydration, increase in salivary pH associated with oropharyngeal sepsis and impaired crystalloid solubility, certain medications such as psychiatric drugs, anti hypertensive drugs and anticholinergic drugs are traditional etiopathogenetic factors. Physiologically, microliths may be detected following precipitation within redundant secretory vesicles which become symptomatic and act as a nidus.<sup>4</sup>

### Case Report

A 19 year old male patient came to the Department of Oral Medicine, Diagnosis and Radiology, Institute of Dental Education and Advance Studies, Gwalior, Madhya Pradesh with chief complaint of pain and swelling in the right back jaw region since 3 months. Pain was dull and intermittent in nature with history of recurrent swelling during meals and subsided on its own after meals. Extra-oral examination was non contributory at the time of examination. Intra-oral examination revealed a large, firm and tender swelling in the right posterior floor of mouth with no associated

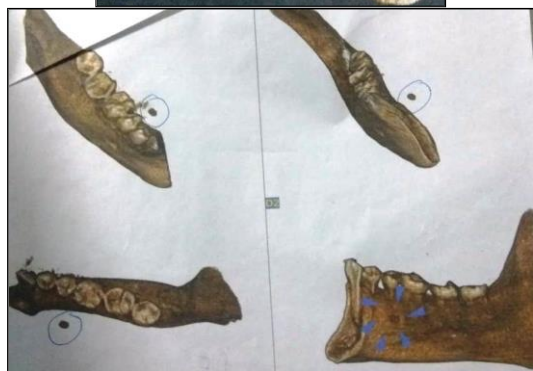
discharge or bleeding reported from the site. When the gland was palpated, saliva could be seen at the duct orifice and the gland was tender. Occlusal radiographic examination revealed faint solitary small ovoid radiopaque fleck on the right side. A cone beam computed tomography scan (CBCT) was taken, which confirmed the presence of calculi {Fig. 1, 2, 3 (a), 3(b)}. Based on these findings the patient was diagnosed with a sialolith in the submandibular gland duct. Surgical removal of the sialolith was planned and performed under local anesthesia (Fig. 4). With antibiotic coverage under local anesthesia, incision was placed longitudinally along the margins and was placed at the ductal orifice and calculi was exposed and retrieved. The calculus was removed in total and was followed by a satisfactory healing process. The sialolith was of size 3x 3.5 mm (Fig. 5).



**Fig. 1:** Axial view of CBCT depicting small ovoid shaped radiopacity in right floor of mouth



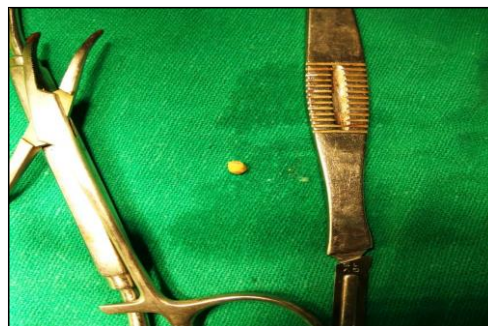
**Fig. 2:** Sagittal view of CBCT depicting small ovoid shaped radiopacity in right floor of mouth



**Fig 3 (a), (b)** 3D reconstruction



**Fig. 4:** Surgical procedure



**Fig. 5:** Excised specimen

### Discussion

Wharton's duct has highest predisposition to sialolithiasis owing to the fact that the excretory duct is tortuous and much longer as compared to other ducts. Also saliva in the submandibular gland flows against gravity, the gland has an alkaline secretion and it contains a higher quantity of mucin proteins, calcium and phosphate. Intraductal calculi are comparatively more common than intra-glandular calculi. When calculus is of smaller size in hilum they are asymptomatic. Symptoms commence when calculi become very large in size and round and elongated in shape.<sup>5</sup> Understanding of its clinical features by diagnostician leads to easy diagnosis. Radiographs act as essential diagnostic aids. Radiopaque calculi are best seen in occlusal radiographs. For radiolucent calculi sialography is a useful tool in diagnosis. Contraindications for sialography include acute infection or patients allergic to contrast material.<sup>6</sup> Gold standard in diagnosis is ultrasonography with about 99% accuracy though its use is limited to operator dependency.<sup>7</sup> With the invention of newer techniques such as scintigraphy, computed tomography, digital subtraction sialography and sialoendoscopy the diagnostic aspect of sialolithiasis have revolutionized.<sup>8</sup> However, computed tomography use has become limited in modern radiology due to radiation exposure.<sup>9</sup> X-ray sialography remains the standard investigation tool due to its higher spatial resolution.<sup>10</sup> Magnetic resonance sialography is now being considered as a better alternative due to the non-invasive nature and level of comfort with no risk of radiation exposure.<sup>11</sup> It is utilized by using special magnetic resonance sequences such as 3D CISS and RARE where x-ray sialography cannot be performed.<sup>12</sup> The size of calculi in salivary gland varies to a great extent. On the basis of a review of literature, most of the sialoliths are usually of 5 mm in maximum diameter and all the stones over 10 mm should be reported as a sialolith of unusual size.<sup>13</sup> The average size of the salivary calculi lies between 3 and 18 mm.<sup>14</sup> According to Lutschmann et al, sialoliths measuring <10 mm account for 78.8% of cases, while those measuring 10–15 and >15 mm account for 13.6 and 7.65% of cases, respectively.<sup>15,16</sup> In the present case, the sialolith was 3.5 mm in size. The management of sialolith is based on its location, size, mobility in ductal system and the symptoms associated with it. Those calculi which are peripherally situated and are small in size can be removed via massage,

widening of the orifice with a lacrimal probe, moist warm heat application along with administration of sialogogues. It is generally expelled out as a single piece or in fragments.<sup>17</sup> Most calculi will respond to antibiotics, combined with simple sialolithotomy. Surgical management includes transcervical sialadenectomy. Despite being invasive it is widely used for perihilar and intraglandular obstructive salivary diseases. Demerits of procedure include functional, neurologic, and aesthetic sequelae.<sup>18</sup> Sialoliths within gland requires submandibular sialoadenectomy or partial parotidectomy. Temporary or permanent injury to marginal branch of facial nerve, scar formation, alteration of sensation and functional incapitance such as reduction in saliva are few risks associated with this procedure.<sup>19</sup> Once the sialolith has been located, the orifice of the salivary duct has to be surgically enlarged with a long incision under local anesthesia and expulsion of sialolith will occur by exerting small pressure at the level of the distal ligature through the incision. Risks of this procedure include infection, bleeding, numbness to floor of mouth and duct scarring resulting in recurrent gland swelling.<sup>20</sup> Conservatively gland-preserving techniques for managing salivary gland obstructions have become possible because of improved radiologic imaging, better optical systems and endoscopic devices and the introduction of minimally invasive therapeutic options. These include extracorporeal shock wave lithotripsy, operative sialoendoscopy, video-assisted transoral and transcervical stone removal, and ductal rehabilitation through interventional radiology and sialoendoscopy.<sup>21</sup> Piezoelectric and electromagnetic are two main energy sources in extracorporeal lithotripsy aiming at fragmentation of stones. Prior fragmentation is necessary using an external lithotripter or laser in cases of bigger calculi. Untoward effects can be reduced by continuous ultrasonographic monitoring. Requirement of multiple sessions and residual stone fragments inside the duct system are major limitations. Metallic dilators are treatment modality in case of stenoses. Balloon catheters under endoscopic control are preferred in case sialolith is peripherally localized. Surgical management may include salivary lithotripsy, basket retrieval and sialendoscopy.<sup>22</sup> The patient in the present case presented with typical symptoms and the findings of clinical and radiographic examination were also typical. The diagnosis was made by clinical and radiographic examination and calculi retrieval by intraoral approach was selected as the treatment method due to the location of the stone.<sup>23</sup> The presented case illustrates the necessity for proper diagnosis and importance of selecting the treatment of choice in cases of salivary gland disease. Postoperative follow-up is essential to ensure the patient is symptom free in the long-term.

### Conclusion

Diagnosis of salivary calculi is mainly based on clinical symptoms and imaging. Management is by surgical means and has to be performed only after managing any infection or inflammation. Even though, surgical treatment is the

mainstay treatment modality at present, minimally invasive techniques like lithotripsy will gain attention in the future.

### Source of funding

None.

### Conflict of interest

None.

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**How to cite the article:** Wadhawan R, Mohan V, Gupta S, Lau H. Sialolithiasis in a 19 year old male: A case report. *J Dent Specialities* 2019;7(2):118-21.



## Full mouth rehabilitation of a patient with mutilated dentition

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### Abstract

Excessive occlusal wear of dentition can result in pulpal injury, occlusal disharmony, impaired function and esthetic deformity. Wear of teeth can be in the form of attrition, abrasion, erosion, abfraction etc. Severe loss of anterior teeth results in loss of anterior guidance this compromise's the posterior teeth during excursive movement. Such excessive wear and abnormalities of teeth often impairs patients basic activities like mastication, speech and esthetics affecting patients life style. Therefore reconstruction of the mutilated dentition is necessary. Full mouth rehabilitation combines esthetics with the science of restorative dentistry to improve the health and function of the patient. This clinical case report describes the use of hobo twin-stage procedure for rehabilitation of a patient with severe tooth wear and reduced vertical dimension of occlusion.

**Keywords:** Hobo twin-stage, Mutilated, Splint, Myofacial pain dysfunction.

### Introduction

Full mouth rehabilitation is achieving balance between esthetics and function and hence is a challenging procedure. This may get difficult if the restorative space required is limited as in the case of a mutilated dentition. Efforts should be made for meticulous treatment planning with a multidisciplinary approach for successful outcomes. The most critical aspect in successful full mouth rehabilitation is a combination of stable occlusion and orthopedically stable temporomandibular joints. Occlusal surface wear of the teeth in an individual is a gradual process during the lifetime. It leads to loss of vertical dimension in an individual with functional and esthetic discomfort in everyday life. So the prosthetic treatment should be performed with extreme care to achieve a good prognosis for the patient.<sup>1</sup>

This clinical case report highlights the use of hobo twin-stage procedure for rehabilitation of patient with severe tooth wear and reduced vertical dimension of occlusion.

### Case Report

A 48-year-old male reported to Department of Prosthodontics, D Y Patil University- School of Dentistry, Navi Mumbai, with a chief complaint of replacement of missing teeth and difficulty in chewing. The patient gave no significant medical history and no signs of temporomandibular joint disorder or myofacial pain dysfunction.

Patient gave a history of fixed partial denture in maxillary and mandibular anteriors which had fractured 8 years ago.

### Clinical Findings

Extraoral examination revealed no facial asymmetry or muscle tenderness.

Intraoral examination revealed severe attrition and abrasion with 14 16 36 37 46 47 missing in upper and lower arch. Draining abscess was seen in relation to 38. Drifting of maxillary and mandibular anterior teeth was seen due to

open contacts. Porcelain fused to metal bridge on 25 26 27 was present. 15 was supraerupted and 24 was rotated mesially (Fig. 1 and 2). Orthopantomogram (OPG) of patient further confirmed excessive wear with pulpal exposure in relation to maximum teeth present in the mouth. There was root resorption seen in 31 32 41. Periapical radiolucency was seen in relation to 38 (Fig. 3).

No gross abnormalities were noted in the overall soft tissues of the lips, cheeks, tongue, oral mucosa, and pharynx.

Approximately 3mm of loss in Vertical Dimension was established. According to Turner and Missirlian classification category 1 shows excessive wear with loss of vertical dimension. The closet speaking space is more than 1mm and interocclusal space is more than 4mm and has some of facial contour that includes drooping of the corners of mouth. Patient was a class 1 category according to Turner and Missirlian classification. Full mouth rehabilitation with restoration of 3mm vertical dimension using hobo twin stage technique was planned to rehabilitate the worn out dentition in functional harmony while providing group function occlusion during eccentric movements.<sup>2</sup>



**Fig. 1:** Intraoral view of maxillary arch



Fig. 2: Intraoral view of mandibular arch



Fig. 6: Wax-up in protrusive



Fig. 3: Preoperative OPG view



Fig. 7: Tooth preparation for maxillary arch



Fig. 4: Diagnostic mounting



Fig. 8: Tooth preparation for mandibular arch



Fig. 5: Wax-up in centric



Fig. 9: Temporaries in centric occlusion





**Fig. 10:** Temporaries in protrusion with posterior disocclusion



**Fig. 11:** Maxillary and Mandibular final models with maxillary anterior segment separated



**Fig. 12:** Metal copings for upper and lower left side



**Fig. 13:** Posterior metal copings for upper lower right side.



**Fig. 14:** Anterior metal coping for Maxillary and Mandibular arches



**Fig. 15:** Cementation of upper posteriors



**Fig. 16:** Cementation of lower posteriors



**Fig. 17:** Pre operative intraoral view



Fig. 18: Post operative intraoral view



Fig. 19: Pre-operative extraoral picture



Fig. 20: Post-operative extraoral picture

### Procedure

Maxillary and mandibular impressions were made in the irreversible hydrocolloid impression material and diagnostic casts were obtained. Based on patient's loss on vertical dimension, increase of 3 mm in the vertical dimension of occlusion was carried out using an anterior jig and interocclusal record based on the evaluation of the mounted diagnostic cast in centric relation. Then the maxillary cast was mounted using face-bow transfer onto a semi-adjustable articulator and the mandibular cast was mounted using the jig and centric relation record.<sup>3</sup>Diagnostic wax-up was done according to hobo condition 1 with sagittal condylar path inclination  $25^{\circ}$ , bennett angle  $15^{\circ}$ , anterior sagittal inclination  $25^{\circ}$ , lateral wing angle  $10^{\circ}$ . Condition 2 values were sagittal condylar path inclination  $40^{\circ}$ , Bennett angle  $15^{\circ}$ , anterior sagittal inclination  $45^{\circ}$ , lateral wing angle  $20^{\circ}$  at the established new vertical to see the final outcomes.<sup>4</sup>

Then an occlusal splint was provided to the patient as part of reversible treatment modality to evaluate adaptation of the patient to altered VDO. The patient was kept in observational period of 6 weeks before the definitive restorative phase of rehabilitation was started.<sup>5</sup>The teeth were endodontically treated and cast post and core were done in 11 12 13 21 22 23 order to receive stage I chair side temporaries. The definitive phase for metal-ceramic tooth preparations was completed for the entire dentition with minimal occlusal reduction; Stage II heat cure temporaries were fabricated using the putty index of the diagnostic wax-up and cemented with ZnO non-eugenol cement. For three months, interim restorations were adjusted, and used as a guide for the definitive oral rehabilitation.<sup>5</sup>A final full arch impression for maxillary/mandibular teeth was made using polyether impression material and casts were poured in die stone. This assembly was mounted on semi-adjustable articulator using the face-bow, Lucia jig, and centric record at the previously determined vertical dimension. Articulator was programmed to different condition values of Hobo's twin stage procedure.<sup>6</sup>The metal copings were tried in and adjusted as needed. The definite restoration planned was DMLS crowns for better marginal fit of the prosthesis. Permanent cementation was done with GIC type I luting cement. Functional impression and altered cast was fabricated for cast partial denture in relation to 36 37 for Kennedy's class II.<sup>7</sup> (Fig. 4-20)

### Discussion

In this case, the patient was carefully monitored for a month to evaluate the adaptation to the removable occlusal overlay splints.<sup>2</sup> Patient had fixed partial denture which had dislodged that further lead to resorption of the exposed tooth structure. In addition, maxillary posterior base metal prostheses might have accelerated the wear of mandibular teeth and unbalance of wear rate. Minimally invasive prosthodontics was the key for rehabilitation of this dentition.<sup>8</sup> Cast post and core were carried out in order to achieve favourable crown root ratio. Also the patient's adaptation to the provisional restoration was monitored for 2 months. There was no discomfort, wear, and muscle fatigue observed during that period. The restoration of VDO was determined by patient's physiologic factor like interocclusal rest space and speech.<sup>8</sup>

Group function occlusal scheme was planned, wherein the posterior cuspal morphology was contoured as per standard values formulated by the hobo's twin stage technique and anterior teeth caused disocclusion of posteriors in protrusion.<sup>3</sup> The idea was to fulfill the requirements of an ideal occlusion, for a harmonious functioning of the stomatognathic system.

The idea for taking TMJ scan before and after temporization in this case was to study and evaluate the position of the condyles in fossa.<sup>9</sup>

There had to be modifications made in the treatment plan due to missing 14. The posterior segment could not be separated from 13 and canine had to be included as the abutment for the bridge.

The lower left side was edentulous and option for implants with fixed prosthesis was ruled out due to insufficient bone. Cast partial denture was prosthesis of choice as attachment on 35 was not possible due to compromised condition of the abutments.

The rehabilitation using restoration of anterior crowns and RPD providing posterior support is economical and common for many patients who require the treatment of teeth wear because of financial reasons or less bone. However the patients must be encouraged and properly educated to use the RPD, as failure to do so may lead to excessive occlusal load or supra-eruption of the maxillary teeth opposing RPD. Regular checkup for the occlusal adjustments CPD fitting is essential.<sup>10,11</sup>

A 6 months follow-up was done, there was no abnormalities seen in relation to the performed treatment.

### Conclusion

The restoration of form, function, and esthetics in mutilated dentition is a demanding procedure and should be carried out only when absolutely indicated. Proper diagnosis and multidisciplinary treatment planning with adequate knowledge and judgement are paramount success. In this clinical report, restoring vertical dimension of occlusion using removable occlusal overlay splint and following minimally invasive procedure with fixed provisional based on accurate diagnosis showed successful full mouth rehabilitation for severely worn down dentition.

### Source of funding

None.

### Conflict of interest

None.

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**How to cite the article:** Dhumal P, Singh R, Mistry G, Rathod A. Full mouth rehabilitation of a patient with mutilated dentition. *J Dent Specialities* 2019;7(2):122-6.

## Conservative management of oral pyogenic granuloma with diode laser: A case report

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### Abstract

The oral pyogenic granuloma is a commonly occurring tumor like reactive lesion that occurs as a response to different stimuli such as hormonal imbalances, low grade chronic irritation, trauma or certain type of drugs and oral contraceptives. It is frequently seen in the gingiva, and also lips, tongue and buccal mucosa are the other commonest sites. The present case reports a localized inflammatory hyperplasia of the maxillary gingiva of a 20-year-old male patient which was interfering with normal eating and brushing.

**Keywords:** Pyogenic granuloma, Diode laser, Gingival enlargement.

### Introduction

Pyogenic granuloma (PG) is a well-known benign inflammatory hyperplastic growth seen inside the oral cavity as a tissue reaction to irritation, trauma, or hormonal imbalances. The term “pyogenic granuloma” is misnomer as it is a non-neoplastic lesion of vascular origin, also it does not contain pus nor it is granulomatous. It is considered as capillary haemangioma. It was first described by Hullihen in 1844.<sup>1</sup> Other names for the pyogenic granuloma are granulation tissue-type haemangioma, granuloma gravidarum, lobular capillary haemangioma, pregnancy tumour, eruptive haemangioma.<sup>2</sup>

It is presented as an elevated sessile or pedunculated growth, surfaced with red hemorrhagic and erythematous papules covered by a fibrinous membrane that usually shows ulcerations. Based on the vascularity of the lesion, the color varies from purple pink to red. Clinically, the lesion rarely exhibits rapid growth, is symptomless, and does not cause pain. The radiographic findings are typically absent, but in long standing gingival Pyogenic granuloma, localized alveolar bone resorption can be seen.<sup>3</sup> Marginal gingiva is the most common intraoral site to be affected by pyogenic granuloma but lesions have been reported on palate, buccal mucosa, tongue, and lips. The skin of face, neck, upper and lower extremities, and mucous membrane of nose and eyelids are also commonly involved extraoral sites.<sup>2</sup>

The Conventional Excisional therapy is the treatment of choice for pyogenic granuloma, but some alternative approaches such as cryosurgery, electrosurgery, laser therapy, flash lamp pulsed dye laser, injection of corticosteroid or ethanol, sclerotherapy have been reported to be effective. The definitive treatment involves excision of the lesion along with histopathological evaluation to confirm the diagnosis. Careful monitoring is necessary during the excision of PG because of its vascular nature leading to profuse bleeding and it should be completely removed otherwise recurrence chance is more. The biggest disadvantage of conventional surgical excision is difficulty of controlling bleeding during the surgical procedure.<sup>4,5</sup>

Since the introduction of laser in dentistry, different wavelengths have been used for oral soft tissue dental procedures. Various laser devices have been successfully used to treat PG, such as neodymium-doped yttrium aluminium garnet (Nd:YAG), carbon dioxide laser, erbium-doped yttrium aluminum garnet (Er:YAG), and the diode laser. The dental laser is able to provide clean incision of tissues, immediate coagulation, and minimal postoperative pain, and edema. Minimum surgical expertise is required with laser therapy as compared to conventional surgical excision.<sup>6,7</sup>

The diode laser acts as a semiconductor device consisting of several active medium like aluminum, gallium, arsenide, and occasionally indium. The coherent radiation is produced by the device in the visible or infrared spectrum with wavelengths ranging from 810 nm to 980 nm. Thus, the pigmented tissues like melanin and hemoglobin tend to absorb all wavelengths properly. However, they are poorly absorbed by calcified tissue such as hydroxyapatite and water present in the enamel.<sup>6</sup> Several studies have reported success using diode lasers in surgical procedures performed on soft tissues. Diode laser therapy is simple, safe, non-invasive and completely effective for oral soft tissues. High precision, negligible blood loss and better patient compliance are the advantages associated with it. The diode laser ensures various procedures like Cuts, vaporization, curettage, coagulation, and hemostasis.<sup>8</sup>

This case report presents a case of a peculiar Oral Pyogenic Granuloma in a young adult patient excised successfully with minimal postoperative complications and also highlights the use and advantages of diode laser in the surgical excision of oral pyogenic granuloma.

### Case Report

A 20-year-old male patient reported to the outpatient Department of Periodontics with the chief complaint of painless overgrowth of gum related to upper left back teeth region in the oral cavity. The growth was associated with frequent bleeding and interfered with normal eating and brushing. He first noticed the growth 2 months back when it was very small and gradually increased to reach the current



size. (Fig. 1) The medical and family history were not significant. No extraoral swelling was found on extraoral examination. On intraoral examination, during inspection, an elongated oval-shaped, pedunculated mass-like growth seen in relation to the buccal aspect of gingiva with respect to 25, 26 teeth region, measuring approximately  $2.5 \times 3$  cm. The Colour of the growth was dark red and surface was smooth. The growth covered approximately whole of the interdental region of the teeth. This erythematous and distinct growth was originating from the marginal gingiva and interdental gingiva in relation to 25 and 26. On palpation, the mass was well defined, smooth, and soft to firm in consistency and non-tender. The lesion was bleeding on probing. Periodontal examination revealed 5mm of pocket probing depth in relation to the interdental area between 25 and 26. (Fig. 2) Radiographic examination showed the mild alveolar bone loss in the involved region and hematological examination revealed normal blood values.

The treatment plan included oral prophylaxis and excisional biopsy of the growth with diode Laser. Written informed consent was obtained from the patient prior to the laser excision of the lesion and all necessary precautions were taken throughout the procedure.

The surgical area was anesthetized using local anesthetic agents (2% lidocaine with 1/100,000 epinephrine), the lesion was treated by Soft-tissue Diode Laser (Biolase Epic 10 Diode laser 940nm, USA) with continuous wave, in contact mode with a power output of 2 watt. A 0.4-mm diameter disposable laser fiber optic tip was initiated. (Fig. 3) The tip was moved around the base of the lesion with a circular motion at a slight angle of 5 to 10 degrees. The base of the lesion was cut precisely. As massive hemorrhage from the surgery area was seen, therefore, the laser fiber tip was moved in a sweeping motion on the surgical site in order to achieve coagulation and after 30 seconds the bleeding was stopped. The area was left for healing with secondary intention. (Fig. 4) The procedure took 3-4 minutes to complete. The mass was excised completely as one piece, and immersed in 10% formalin solution and sent for histopathological examination. (Fig. 5) The patient was discharged with well written prescription and all the necessary post-operative instructions for maintenance of good oral hygiene with 0.12% chlorhexidine mouth rinse for 10 days, and scheduled for routine scaling and curettage. He was recalled for followed up to evaluate the healing process. The use of diode laser enabled an optimum combination of clean cutting of the tissue and hemostasis. The patient was extremely comfortable, reported no post-operative complications, and complete healing was observed within 7 days after surgery. (Fig. 6)



**Fig. 1:** Preoperative view showing pyogenic granuloma



**Fig. 2:** Preoperative IOPA



**Fig. 3:** Diode laser



**Fig. 4:** Diode laser assisted surgical excision of lesion



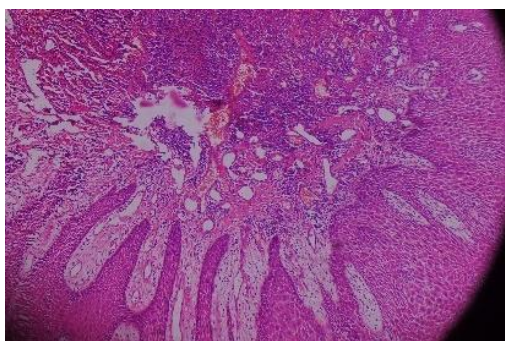
**Fig. 5:** Excised tissue sent for histological examination



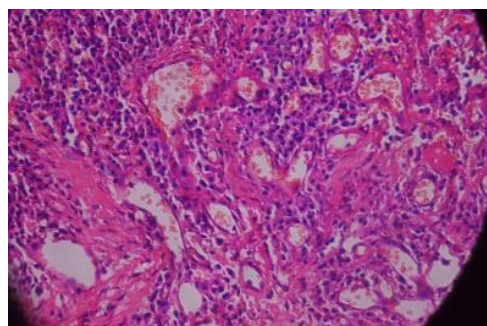
**Fig. 6:** Post-operative clinical view

### Histopathological Examination

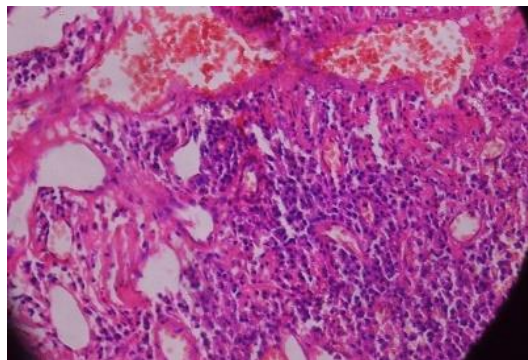
The excised mass was sent for histopathologic evaluation. The H&E stained section of tissue showed para keratinized stratified squamous epithelium with thin elongated and irregular rete ridges overlying fibrovascular connective tissue stroma. The epithelium showed prominent nucleoli and prominent intercellular junctions. The underlying fibrovascular connective tissue stroma showed thick and thin collagen fiber bundles interspersed with plump fibroblasts. Numerous blood vessels of varying caliber were seen lined by endothelial cells. Areas of hemorrhage and dystrophic calcifications were also evident. Diffuse mixed inflammatory cell infiltrate was seen chiefly composed of neutrophils, plasma cells and lymphocytes. The above histopathologic features were suggestive of pyogenic granuloma.(Fig. 7-9)



**Fig. 7:** 10x Histologic section



**Fig. 8:** 20x Histologic section



**Fig. 9:** 30x Histologic section

### Discussion

The oral pyogenic granuloma is a most common tumor like reactive lesion having etiological factors such as low grade chronic irritation, hormonal imbalances, trauma or certain type of drugs and oral contraceptives. It occurs at any age but most frequently affecting young adults and women. The anterior maxillary gingiva is involved more frequently than the mandibular gingiva; the facial gingiva is involved more than the lingual gingiva. Poor oral hygiene and chronic oral irritation are most frequent risk factors. Early lesions bleed easily due to extreme vascularity and have a rapid growth pattern.<sup>10</sup>

Histopathologically, oral pyogenic granuloma is considered into lobular capillary hemangioma (LCH) because of its inflammatory nature and presence of multitudinal blood vessels. The histologic appearance of pyogenic granuloma shows exuberant granulation tissue which is covered by hyperplastic epithelium that may be ulcerated at times. It is characterized by the presence of numerous endothelium-lined vascular spaces and proliferation of fibroblasts and budding endothelial cells. Presence of mixed inflammatory cell infiltration can also be observed. The differential diagnosis of pyogenic granuloma includes peripheral giant cell granuloma, pregnancy tumor, peripheral ossifying fibroma, bacillary angiomatosis, metastatic cancer, kaposi's sarcoma, and non-hodgkin's lymphoma, angiosarcoma, hyperplastic gingival inflammation and hemangioma.<sup>11</sup>

Conservative surgical excision of a pyogenic granuloma is the treatment of choice. Depending on the extent and size of the lesion management of pyogenic granuloma varies. The excised tissue should be submitted for histopathologic examination to make a proper diagnosis. Bleeding, suturing, and postoperative discomfort are the major drawbacks of surgical intervention. Re-excision is necessary in case if the lesion recurs. Other less invasive treatment modalities have been attempted in the past with limited benefits, such as: cryosurgery, cauterization with silver nitrate, sclerotherapy.<sup>12</sup>

Among the various treatment modalities, the advantages of laser application are relatively bloodless surgery, better visualization of the site and a sutureless procedure with minimal postoperative pain. Additionally, the laser instantly disinfects the surgical wound with

consequent less postoperative infection, minimal swelling, and enhanced healing. In areas where aesthetics are important, the laser is a less invasive method compared to scalpel and cryosurgery techniques. Laser excision was reported to be well tolerated by patients with no or minimal adverse effects.<sup>13</sup>

Relatively smaller size and lower cost make the diode laser most suitable to use in various surgical indications in comparison with other laser equipment.<sup>14</sup> Iyer and Sasikumar<sup>15</sup> highlighted the advantages of a 940nm diode laser over the conventional treatment option in excision of oral Pyogenic Granuloma. Moreover, a diode laser with 810-980nm wavelengths has been used for soft tissue cutting in young patients.<sup>6</sup> In children, the benefits of lasers in removal of soft tissue lesions include no need for anesthesia, which reduces the child's apprehension, and less hemorrhage, and postsurgical discomfort.

The application of a 940nm diode laser in the present case presented the best treatment option to reduce the risk of postoperative infection and impaired healing. This finding is in correlation with numerous studies demonstrating that the laser creates locally sterile conditions, which would result in the decreased bacteremia concomitant to the operation due to the bactericidal effect of laser energy.<sup>6,14,15</sup>

It has been observed that, in gingival excisions, lasers tend to decrease the need for sutures and reduce bleeding quantities, whereas increasing working comfort.<sup>16</sup> Powell *et al*<sup>17</sup> demonstrated that use of laser for Pyogenic granuloma excisions has a lower bleeding risk and is associated with a higher coagulation rate as compared with other conventional techniques. Rai *et al*.<sup>18</sup> shown that a diode laser could be a good treatment option for intraoral Pyogenic Granuloma due to its advantages such as ease of working and decreased recurrence rate. They utilized 808 diode laser with an output energy of 0.1-7.0 W for the successful removal of Pyogenic granuloma. Mavrogiannis *et al*.<sup>19</sup> found that the recurrence rate with laser gingivectomy was less when compared with the conventional gingivectomy.

Being less invasive and sutureless procedure, diode laser therapy is associated with rapid healing and minimal postoperative pain. Need for post-surgical dressing is reduced and improved haemostasis and coagulation are seen with diode laser therapy. It also has role in destruction of many infectious micro-organisms. Its use has been associated with reduced post-operative discomfort, oedema, scarring and shrinkage.<sup>20</sup>

While treating such lesions, importance should be given on maintaining oral hygiene. Incomplete excision is generally a commonest cause for its recurrence. Failure to remove etiologic factors and reinjury of the area are also the other factors resulting in recurrence. Studies have been demonstrated that among the lesions of oral mucosal sites, gingival lesions show a much higher recurrence rate.<sup>21</sup>

## Conclusion

Pyogenic granuloma is a non-specific, hyperplastic, conditioned gingival enlargement. Always the diagnosis should be made with clinical and histopathological findings.

The laser therapy is a successful treatment option for this kind of lesion with no recurrence.

## Source of funding

None.

## Conflict of interest

None.

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**How to cite the article:** Sharma P, Mohan P, Vaish S, Sharma N. Conservative management of oral pyogenic granuloma with diode laser: A case report. *J Dent Specialities* 2019;7(2):127-31.

## Fixed dentulous appliance for maxillary edentate pediatric ridge: A case report

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### Abstract

This article discusses about a fixed dentulous appliance that was constructed to replace the primary upper anterior teeth in a five year old boy. It constituted of a design, where the maxillary primary second molars were used to support the appliance through bands and a wire that contained spurs bearing strip crowns, anteriorly. The appliance was functionally and aesthetically compliant.

**Keywords:** Early childhood caries, Fixed dentulous appliance, Pediatric ridge.

### Introduction

One of the most common condition that we come across in pediatric practice is early childhood caries (ECC).<sup>1</sup> According to American dental association ECC is defined as the presence of one or more decayed (non cavitated or cavitated lesions), missing (due to caries) or filled tooth surfaces in any primary tooth in a pre-school-age child between birth and 71 months of age. The term “severe early childhood caries” refers to “atypical” or “progressive” or “acute” or “rampant” pattern of dental caries. The main cause of this carious pattern is improper feeding habit, intake of sugary food, frequent snacking, lack of oral hygiene, lack of fluoride exposure and enamel defects are some of the major factors responsible for the development of ECC.<sup>2</sup> Labial surfaces of all anteriors are the first to degrade on effect of this lesion following rapid diffuse demineralisation to the gross destruction of all anterior primary teeth.<sup>3</sup>

The psychological status of pre-schooler as well as his/her parents get altered due to early loss of primary anterior teeth due to aesthetic appearance.<sup>4</sup>

So, it becomes greatest challenge for any pediatric dentist to rehabilitate the masticatory function, space maintenance, aesthetic appearance via fixed dentulous appliance.

Few articles have been published describing the design of this appliance,<sup>5-7</sup> but there is a lack of information available with the clinicians for the construction of this appliance using spurs and strip crowns. This paper highlights one type of fixed dentulous appliance for maxillary edentate pediatric ridge using aesthetic crowns and wire.

### Case Report

A 5-year-old boy reported to the Department of Pedodontics and Preventive Dentistry with the chief complaint of missing anterior teeth since 1 month. On taking the history from patient’s parents, it was reported that precocious shedding of upper anterior teeth was due to caries and parents accepted their negligence regarding oral health of the child. Now, they were concerned about the aesthetics of

the child, and they wanted an aesthetic replacement of the anterior teeth.

Intraoral examination revealed missing 51,52,61,62. (Fig. 1). A clinical decision was made to fabricate a fixed dentulous appliance for replacing the missing anterior teeth.



**Fig. 1:** Pre operative Intra oral photograph.

### Appointment Schedule

#### 1st appointment

As it was the first visit of the patient to the dental clinic, so the patient was quite apprehensive about the surroundings and treatment. That’s why in the first visit, patient’s behaviour modification was done with the help of desensitization, live modelling, introducing to the department and making him friendly to the clinician and the environment.

#### 2nd appointment

Treatment was started with Phase 1 therapy i.e. oral prophylaxis. The treatment plan was made. 55,65 were chosen as abutments for the appliance.

#### 3rd appointment

Banding was done irt 55 & 65. An impression was made of both the arches with the help of irreversible hydrocolloid material impression material. The patient was sent and was recalled after 3 days.

### Lab work

The impression was poured with the help of type II dental stone. The U shaped wire component was fabricated in the cast similar to Nance palatal arch. It was soldered to the bands. A second wire component in the form of spurs of about 4 mm was soldered on the main archwire. To this assembly, four crowns were built up with the help of strip crowns and light cure composite in relation to 51,52,61,62.(Fig 2.1,2.2,2.3) The final appliance was trimmed, polished and was ready for a trial.



**Fig. 2.1:** Appliance simulation on cast



**Fig. 2.2:** Appliance Modification and confirmation on cast



**Fig. 2.3:** Extra oral photograph of the finished Appliance

### 4th appointment

The appliance was tried in the patient's mouth and occlusion was checked. The appliance was then cemented using GIC with the help of bands in relation to 55 and 65.(Fig. 3) The patient was followed up for 3 months.



**Fig. 3:** Intra oral photograph of cemented appliance

In the follow up appointment (Fig. 4), we observed the discolouration of teeth due to resident chromogenic bacteria presents in patient's mouth, and intake of coloured drinks.



**Fig. 4:** Follow up Intra oral photograph of cemented appliance

### Discussion

As far as literature is concerned, there is no strong fact quoting the undesirable effects on the growth and development of the child due to the early loss of primary anterior teeth. It totally depends on the patient's desire for the replacement of anterior teeth with the aesthetic appliance.<sup>8</sup>

In 1985, Rickman and El Badravy<sup>9</sup> reported that 4 out of 14 children who prematurely lost maxillary primary incisors due to ECC has some degree of impairment with 2 being severe.

The outcomes of premature loss of primary anterior teeth can affect one's self-image and thus affecting the quality of life. However, literature also suggests that pre-school children attribute behavioral characteristics to other children based on their attractive and unattractive appearance.<sup>10</sup>

When taking all the factors into consideration if the parents want the replacement of missing anterior teeth, then that should not be discouraged.<sup>11</sup> This space maintainer offer several advantages in terms of aesthetics, restoration of speech and mastication, and preventing non-nutritive oral habit development

However, the primary advantage is that there is no food accumulation and plaque because of strip crowns.

Knowledge is still at infancy among pediatric dentists for using strip crowns and wire bending as a new combination for anterior esthetic rehabilitation among pediatric patients, So this paper offered an example of new treatment modality.

### Conclusion

Child gets mentally traumatized on losing anterior teeth. So, this appliance gave a huge psychological boost for the child and his parents. It also acts as functional space maintainers, assist in development of proper speech; prevent development of any untoward oral habits thus aiding sound development for the child during the foundation years.

### Source of funding

None.

### Conflict of interest

None.

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**How to cite this article:** Goyal V, Wilson I, Jain A, Mathur S, Chopra R, Sachdev V. Fixed dentulous appliance for maxillary edentate pediatric ridge: A case report. *J Dent Specialities* 2019;7(2):132-4.

## Apexification using MTA: A challenging approach

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### Abstract

It is always a challenge to conserve a non vital tooth with immature root due to open root apices. Apexification is a method which induces a calcific barrier at the apex of a nonvital tooth with open apices.<sup>1</sup> Mineral trioxide aggregate [MTA] is an inert filling material and that is why it makes a perfect seal at the apex. Apexification treatment is supposed to create an environment that permits the deposition of cementum, periodontal ligament and even bone in a non vital pulp tooth. Frank has described four successful results of Apexification and that are continued closure of the canal and apex to a normal appearance, a dome shaped apical closure with the canal retaining a blunderbuss appearance, no apparent radiographic change but a positive stop in the apical area or a positive stop and radiographic evidence of a barrier coronal to the apex of the tooth.

**Keywords:** Apexification, Open apices, Mineral Trioxide Aggregate, Blunderbuss canal.

### Introduction

The apex closure during the root development is last to occur and it takes a minimum of 3-4 years after the tooth eruption leading to 'Open Apices' [Fig. 1]. Cvek's classification defines the maturity of the unerupted incisors.<sup>1</sup> In Group 1 the teeth with wide, divergent root end and root to be less than half the final length. In Group 2, the teeth with roots between one half and two thirds of the final root length are included. In Group 3, the teeth with roots two third of their final root length. In Group 4, the teeth with open apical foramina and full root length and those with completed root length are included in Group 5. Trauma and Caries are regarded as the frequent causes of pulpal necrosis and open apices in young immature permanent teeth as it stops further root development.<sup>2</sup> The endodontic treatment of a necrosed pulp with an open apex tooth has always been a challenge for dentists due to presence of thin fragile dentinal walls, reduced root lengths and a wide apex which do not allow the conventional filling techniques. Apexification with calcium hydroxide has been the treatment of choice in previous years. As it has many limitations like long time span of the treatment, multiple appointments, increased clinical costs and long term usage of calcium hydroxide weakens the dentinal walls making it prone to fractures.<sup>3</sup> These shortcomings are taken care by the use of MTA [mineral trioxide aggregate] in place of calcium hydroxide. When MTA is used for apexification, it is done in a single visit and it produces more favourable results.<sup>4</sup> It also demonstrated a better biocompatibility, antibacterial properties, less setting time and good sealing ability. Therefore the purpose of this article is to emphasize the single appointment Apexification using mineral trioxide aggregate (MTA).

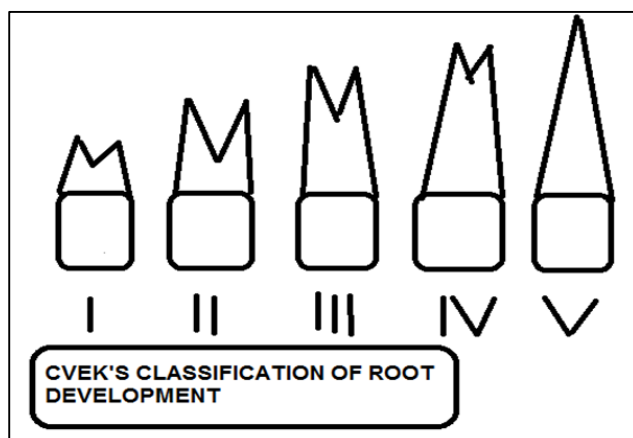


Fig. 1: Cvek's classification

### Case History

#### Case 1

A 20 year old male patient reported in the Department of Conservative Dentistry and Endodontics with chief complaint of discolouration of right maxillary central incisor tooth. He had a history of RCT done w.r.t. 11 following a trauma 1 year back.

The extraoral examination was normal. The pulp vitality tests – cold test, thermal test and electric test were negative. On radiographic examination the root canal was small and filled with Gutta Percha with an Open Apex [Fig. 2]. Apexification using MTA was planned. Gutta Percha was removed w.r.t. 11 [Fig. 3] and working length was determined (23mm). [Fig. 4]

The canal was irrigated with 2.5% NaOCl and was dried with paper points and root canal dressing with calcium hydroxide was given after cleaning and shaping of the canal. The patient was recalled after a week and in the second visit colla plug was inserted at the apical portion (open) of the canal followed by MTA as apical barrier with the help of



pluggers for a thickness of 5mm [Fig. 5]. A wet cotton pellet was placed over the MTA in the canal and a temporary dressing was given. In next appointment obturation was done with Gutta Percha using lateral condensation technique followed by post Endodontic restoration with composite. Tooth was prepared and Crown insertion was done. Patient is being followed up after 6 months [Fig. 6].



Fig. 2: Preoperative radiograph



Fig. 3: Gutta percha removal was done



Fig. 4: Working length determined



Fig. 5: MTA plug formation



Fig. 6: Obturation and post endodontic restoration done



Fig. 7: Follow up radiograph after 6 months

### Case Report 2

A 21 year old male patient reported in the outdoor clinic in the Department of Conservative Dentistry and Endodontics with the complaint of a decayed tooth in upper front tooth region since 1 year. A detailed extra-oral and intra-oral examination was done. The pulp vitality tests were done-where Cold test, Thermal test and electric test came negative indicating Pulpal Necrosis. On Radiographic examination, there was root resorption in relation to maxillary left central and lateral incisor [Fig. 8]. For this patient a non surgical root canal treatment followed by a MTA apical plug was planned.

The access opening was done and the working length was determined [22mm] (Fig. 9). Biomechanical preparation was done using conventional method by 80 size K file with circumferential motion. Root canal debridement was done by irrigation using 2.5% sodium hypochlorite (31 gauge needle) and saline alternatively. Root canal was dried and root canal dressing was given by Calcium hydroxide [Ca(OH)<sub>2</sub>] and patient was recalled after 5 days. On subsequent appointment the canal was debrided with 2.5% sodium hypochlorite and dried with paper points. Colla plug was placed at the site of open apex followed by MTA as apical barrier using plugger until thickness of 5 mm and a wet cotton pellet was placed over it (Fig.10).

The access was sealed by temporary filling [as MTA takes 24 hours to set] and patient was called after a week [Fig. 11]. On subsequent appointment the temporary filling was removed and obturation was done using Gutta Percha with lateral compaction technique and post endodontic restoration was done with Composite [Fig. 12] and the patient was called after 3 days. On next appointment tooth preparation was done and the putty impression was taken and the impression was poured with die stone and cast models were made.

Zirconia Crown cementation was done after it was fabricated in the lab. The periapical radiograph was taken after 6 months of treatment which showed no further root resorption. (Fig 13 – 15)



Fig. 8: Preoperative radiograph

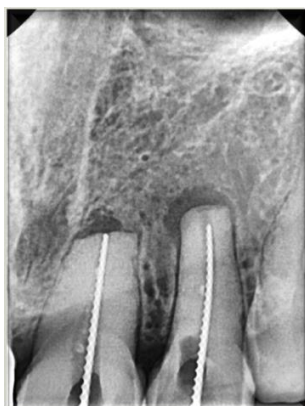


Fig. 9: Working length was determined



Fig. 10: MTA plug formation done



Fig. 11: Master cone radiograph



Fig. 12: Obturation and post endodontic restoration done





**Fig. 13:** Follow up radiograph after 6 months



**Fig. 14:** Crown cementation-palatal view



**Fig. 15:** Crown cementation- buccal view

### Discussion

Dental injuries are very common in children. The type of injuries varies from the tooth fracture to tooth avulsion. The common factor in these injuries is the pulp necrosis. Whenever there is pulp necrosis in an immature tooth, there is interruption in the vascular and nerve supply to the root<sup>5</sup> and thus the root development gets halted resulting into an open apex and the tooth longevity and stability gets compromised. To fix this problem, a non surgical procedure is used which is called as Apexification.<sup>6</sup> This is a method which produces an apical barrier in an immature root with

open apex and induces the apical development of an incomplete root in a tooth with necrotic pulp.<sup>7</sup>

An apical barrier is mandatory to keep the filling material in place. Previously calcium hydroxide was used and considered as an efficient material for Apexification. Calcium hydroxide has many disadvantages such as it needed many appointments and a long duration procedure so patient compliance was poor. Furthermore if calcium hydroxide was kept for long as apical barrier,<sup>8</sup> it weakened the dentinal walls and so it made tooth fracture more common.<sup>9</sup> The best alternative to calcium hydroxide is MTA and that is mineral trioxide aggregate. Mineral trioxide aggregate was developed by Torabinejad<sup>5</sup> and members of Linda University, USA. Initially it was used for root filling material during root canal treatment.<sup>10</sup> It is a mixture of Dicalcium silicate, Tricalcium silicate, Tricalcium aluminate, Tetracalcium aluminoferrite and Bismuth oxide. MTA was approved by the US Food and Drug administration for the use in human for the endodontic application in 1998. MTA has good antimicrobial activity<sup>11</sup> and that is related to its pH value. Its pH value is 12.5 in comparison to calcium hydroxide which has pH 16. The setting time of MTA varies as for Proroot it is 2 hours 50 minutes and for MTA Angelus it is 10 minutes. MTA showed low solubility and it is slightly more radio-opaque than dentine. MTA is used for Apexification, it has many advantages. The first and foremost advantage is the “One visit Apexification” and it is defined as the non surgical condensation of a biocompatible material into the open apex of an immature root canal. So that an artificial apical barrier is made and now the root filling material is filled to complete the single visit Apexification.<sup>7</sup> MTA has shown good cementing property to amalgam,<sup>12</sup> zincoxide, IRM [intermediate restorative material], eugenol super ethoxybenzoic acid.

In Apexification procedure, MTA acts as a scaffold for the tissue regeneration.<sup>10</sup> It is capable of activation of cementoblasts and helps in laying down of new cementum. It also facilitates formation of new PDL and allows bone healing.<sup>13</sup> That is how it relieves the patient from his clinical symptoms. Holland et al in 1999 found calcite crystals at the opening of dentinal tubules near to MTA plug. They suggested that the tricalcium oxide in MTA reacts with tissue fluids to form calcium hydroxide that induces dentin bridge formation.<sup>14</sup> The difference from calcium hydroxide is that the formed dentin bridge is faster, its structural integrity is more and is complete and provides a better biologic root cap seal.

Apexification process starts with cleaning and shaping of root canal system, then the MTA is introduced in the apical region through plugger followed by the suitable restoration in the root canal system.<sup>15</sup> The advantages of MTA are short duration treatment, tooth restoration is immediate, it does not harm the mechanical properties of the dentinal walls and so the chances of root fracture is minimal, the healing is faster and complete. There are few disadvantages of MTA, the prime being is its difficult manipulation and its placement in a wide open apex as there

are many chances where it can be extruded into periapical region. Lemon advocated that the dentist should use some matrix material when the diameter of the open apex is more than 1 mm. The matrix material would provide a base over which MTA can be placed at its predictable position. Biodentine<sup>7</sup> and various matrix materials are available like calcium sulfate, hydroxyapatite, platelet rich fibrin and colla cote. We have used Collacote in our two cases which is a soft biocompatible sponge obtained from bovine collagen. First colla cote was placed at open apex and then MTA was condensed against it. The apical matrix Colla Cote used in our patient was user friendly, cost effective and easily available.

### Conclusion

During the last 18 years there have been changes in the rationale governing the treatment of the immature teeth with wide open apex. The dentist should have thorough understanding of the compatibility of the material, its physiological nature, and the histological changes that takes place during and after the use of the material. In present time MTA is a promising material and plays an important role in sealing of root apex and its further development to a mature root and so it saves the patient from psychological trauma of surgical procedures.

### Source of funding

None.

### Conflict of interest

None.

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**How to cite this article:** Mahajan T, Kochhar R, Kumari M. Apexification using MTA: A challenging approach. *J Dent Specialities* 2019;7(2):135–9.

## Novel modality for management of mandibular fracture by 3D non-locking miniplate: A case report

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### Abstract

Mandible fractures have a vital place within the injuries of the other bones of the oral and maxillofacial system and Trauma is the common etiological factor that involves break in continuity of bone. Mandible fractures management involves cosmetic and functional aspects such as chewing, speaking, and swallowing. Mandible anterior fractures are most common form of mandible fractures. They involve the breach in continuity of mandible leading to masticatory and occlusal problems due to the biomechanical forces. The purpose of this case report is to discuss the management of mandible anterior fracture by 3D non locking miniplate.

**Keywords:** Miniplate, Breach, Trauma, Mandible fracture.

### Introduction

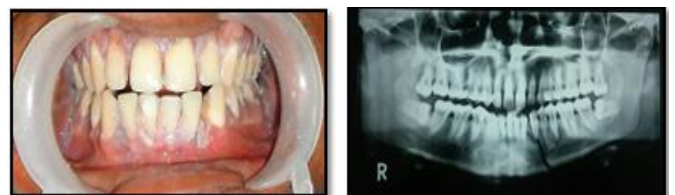
Immobilization is the first requirement in healing of mandible fracture and the purpose of all therapies for fractures is the restoration of the original form and function. Failure to achieve these conditions of healing results in the complications like infection wound dehiscence etc. Osteosynthesis implies functionally stable internal fixation of bone fractures, which allows the early recovery of function. Champy suggested that when the plates are placed along the ideal line of osteosynthesis they give maximum stability and proper osteosynthesis.<sup>1</sup> Open reduction and internal fixation (ORIF) with miniplates and screws has proven to be the most effective method, associated with minimal morbidity, early mobilization and return to work. Rigid systems have been replaced by more functionally oriented systems and the term "semi rigid" has gained more importance. Rigid fixation can produce three dimensional stability of the fracture site, promoting primary fracture healing. This 3D plate with quadra angular design formed by joining two miniplates with interconnection crossbars was developed by Framand in the year 1992. 3D titanium plates and screws were then gradually developed, and reported by Dupoirieux.<sup>2,3</sup> The stability is gained over defined surface area in three dimensions due to its configuration, not by thickness or length and it offers good resistance against torsional forces.<sup>4,5</sup> We report the case of mandibular anterior fracture which was managed by 3D titanium non locking miniplate. For fixation of a fracture segment, one has to consider many things such as size, number of fixation devices, their location ease of adaptation and fixation biomechanical stability, surgical approach and amount of soft tissue disruption necessary to expose the fracture and place the fixation devices.<sup>6-8</sup>

### Case Report

A 30 year old patient reported to the department of oral and maxillofacial surgery with the chief complaint of pain in lower front tooth region since one day. Patient gave a history of road traffic accident one day back and an

emergency treatment was given at nearby hospital. The patient was conscious with GCS score of 15 (E4V5M6). Patient gave a history of bleeding from the mouth immediately after trauma but no history of unconsciousness & bleeding from the ear and nose as well as no intraoral and extra oral laceration. On intraoral examination a step was felt at canine region which was tender on palpation and hematoma was seen in the floor of the mouth. There were no other injuries elsewhere in the body; all the teeth were clinically present. Based on the history and clinical features, a provisional diagnosis of mandible fracture involving the parasymphysis was made.

Following immobilization, for confirmation of the provisional diagnosis, an OPG was advised. The radiograph revealed a well-defined radiolucent line running from distal to lateral incisor and downward to the inferior border of mandible. (Fig. 1) But on correlating with the type of injury and the extra oral clinical findings, the presence of a mandibular left parasymphysis fracture was ruled out. Exploratory surgery was explained to the patient and informed consent was taken. After all the basic hematological investigations and pre-anesthetic checkup, patient was taken for open reduction and internal fixation under general anesthesia. Erich's arch bar fixation was achieved under local anesthesia preoperatively. Under proper aseptic condition patient was painted with 2% providone iodine intraorally and extraorally and draping was done after that 2% lignocaine (1: 80,000) was infiltrated at surgical site.



**Fig.1:** Preoperative occlusal view and OPG



An intraoral mandibular vestibular degloving incision was used and curvilinear (vestibular) incision 5 mm apical to the mucogingival junction was given. The mentalis muscle was exposed and incised perpendicular and deep to the bone, leaving a flap of muscle attached to bone for closure. A full thickness mucoperiosteal flap was raised carefully keeping the mental neurovascular bundle intact and expose the fracture site. (Fig. 2) After obtaining adequate exposure of the fractured segments, the segments were manipulated and satisfactorily reduced. After reduction of the fractured segments, temporary intermaxillary fixation was done to achieve the satisfactory occlusion and fixation of the fractured segment was achieved by 2mm 3-D non locking titanium miniplate. (Fig. 3) The area was irrigated with Betadine & saline and adequate hemostasis was achieved. The deeper layers of the wound were closed using 3-0 Vicryl and mucosal layer was closed with 3-0 silk. (Fig. 4) Intermaxillary fixation was released and an adhesive pressure bandage was given extraorally. Radiograph was taken postoperatively to check the adequacy of reduction and fixation. (Fig. 5) After discharge the patient was recalled on the 1<sup>st</sup> week, 1<sup>st</sup> month, 3<sup>rd</sup> month follow up respectively. (Fig. 6) However patient was also instructed to report for any complaint post operatively any time. On each appointment apart from the routine examination and wound care, occurrence of complications was checked.

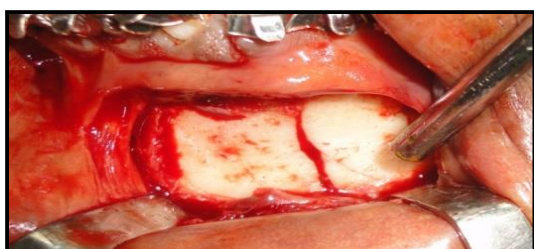


Fig. 2: Exposure of fracture site

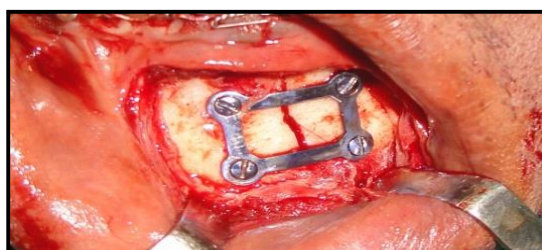


Fig. 3: Fixation of 3-D non locking miniplates



Fig. 4: Closure done with 3-0 mersilk



Fig. 5: Postoperative OPG



Fig. 6: Post operative occlusion & OPG after 3 months

### Discussion

Mandible fractures are the commonest fracture on the face usually caused by accidents and other possible etiologies may be interpersonal violence, falls, sports injuries etc.<sup>5</sup> The newly introduced 3D plating system provides definite advantages over conventional miniplates. The 3D plating system uses fewer plates and screws as compared to conventional miniplates to stabilize the bone fragments. Thus it uses lesser foreign material, reduces the operation time and overall cost of the treatment as described by Zix J, Lieger O and Iizuka T(2007) and Farmand M (1995).<sup>6,9,10</sup> The need of osteosynthesis for mandibular fracture is to minimize the movement between the two fractured segments to promote the sound healing. This healing process can be deterred by the masticatory loads which can cause movements in between the fractured segments. Simplified adaptation is the one of the advantage for the 3D titanium miniplate without any displacement to the fracture with this there is simultaneous adaption of both the superior and inferior border of the mandible. As Champy *et al* described the ideal line of osteosynthesis in which the system of semi rigid fixation with screws and miniplates were introduced but in this case we are using 3D titanium non locking miniplates for the management of mandibular anterior fracture.<sup>1,9,10</sup> Because of their miniature size it can be easily placed and time saving alternative to conventional miniplate. The horizontal cross bar of the 3D titanium miniplate is placed perpendicular to the fracture line and the

vertical cross bar is placed parallel to the fracture line. The less foreign material and maximum stability can be produced by this 3D titanium miniplate due to its closed quadrangular geometric configuration.<sup>7</sup> As it also helps in osteosynthesis because less surgical exposure is done with less implant material is used for the management of mandibular fracture and less amount of periosteal stripping is done in 3D titanium miniplate as compared with the conventional miniplates. According to the recent survey 20-25% of the surgeons do not prefer to use this 3D titanium miniplate because of its disadvantages like difficult to placed in oblique fracture, fracture near mental foramen and areas with limited access. It is exorbitant then other conventional miniplates.<sup>11,12</sup> In this case, it was seen that 3D titanium miniplate was effective in the treatment of mandibular fractures and overall complication rates were less. In the symphysis and parasymphysis region, 3D plating system uses less foreign material, as only one plate and four screws are used as compared to two plates and eight screws in case of conventional miniplates using champy's principle.<sup>1</sup> This also reduces the operating time and overall cost of the treatment.

Thus 3D plate can be used as an alternative to conventional miniplates. The system is reliable and effective treatment modality for mandibular fractures as compared to traditional miniplates. Further, the use of 3D plating system in various procedures of maxillofacial region needs to be explored.

### Conclusion

We conclude that the 3D titanium miniplate are a superior method for the management of mandibular fracture as it provide better stability and approximation radiographically and helps in osteosynthesis and can restore normal form and function easily. Intermaxillary fixation is required for 1 week as comparison with conventional miniplate. This 3D plate is made up of titanium which is biocompatible material and it is a desirable mode of treatment of mandibular fracture.

### Source of funding

None.

### Conflicts of interest

The authors declare they have no potential conflicts of interest regarding this article.

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**How to cite this article:** Agarwal S, Sharma P, Kumar S, Khare G. Novel modality for management of mandibular fracture by 3D non-locking miniplate: A case report. *J Dent Specialities* 2019;7(2):140-2.





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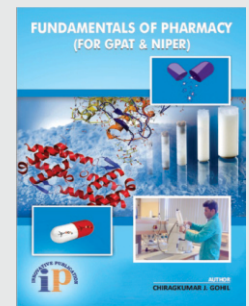
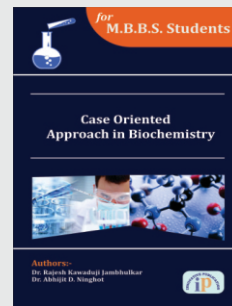
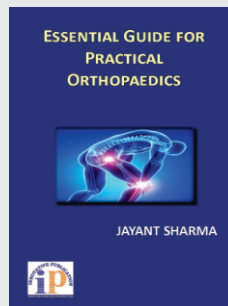
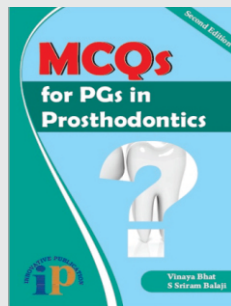
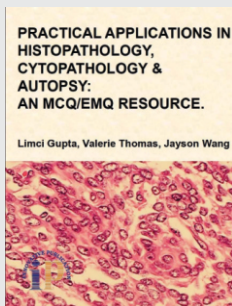
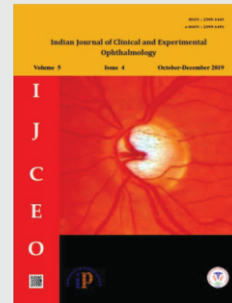
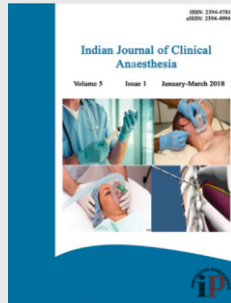
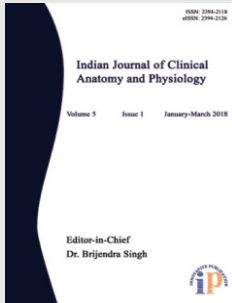
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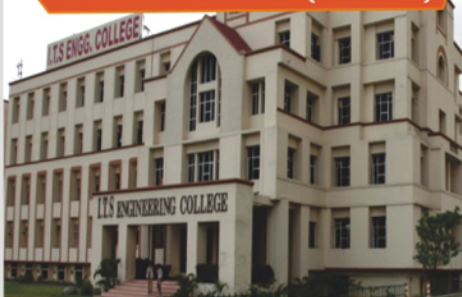
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