DENTISTRY TODAY...

The last decade has witnessed the most rapid advances in the field of oral and maxillofacial radiology. With the advent and acceptance of CBCT (3D) imaging in various fields of dentistry, the dentists today are taking more accurate and informed decisions regarding complicated patients and their treatment planning. However, today’s patients demand more and more comfort and less intraoperative time; even if it comes at a higher treatment cost. With ever increasing patient affordability as well as expectations, the least should be left to dental surgeon’s imaginations.

Welcome to the era of 3D printing; the next step after 3D imaging. With 3D printed models on hand, the dentist can actually perform a mock surgery on a model, which represents the patient accurately in three dimensions; and hence reduces the intraoperative time. 3D printing, also called additive manufacturing, creates a physical object by layer by layer deposition of material. This technology can be helpful in preparing surgical stents for implant placements, models for oral and maxillofacial trauma and pathology cases, prosthetic rehabilitation cases, complicated endodontic cases as well as for orthodontic appliances.

Let’s keep up with the pace of advancing technology. Think 3D, Print 3D!!
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Contact: Ahmedabad Dental College & Hospital
Vivekanand Society, Bhadaj-Ranchhod Pura Road, Santej, Post: Rancharda, Ta: Kalol, Dist: Gandhinagar, Gujarat, India.
Dear friends,

Dentistry has witnessed tremendous advances in all its branches over the past three decades. With these advances, the need for more precise diagnostic tools, specially imaging methods, have become mandatory. Changing from Analogue to Digital Radiography has not only made the process simpler and faster but also made image storage, manipulation (brightness/contrast, image cropping, etc.) and retrieval easier. However, there are certain limitations of two-dimensional Radiography, which can be overcome by three-dimensional imaging techniques such as Cone Beam Computed Tomography, Magnetic Resonance Imaging etc. Cone Beam Computed Tomography uses a narrow fan-shaped X-ray beam and multiple exposures around an object with a high spatial resolution to reveal its internal structures especially bones and teeth, which helps the clinician to view morphologic features and pathology in three-dimensions. Magnetic Resonance Imaging is fast outpacing any other modality for in vivo viewing of soft tissues. The main dental applications of MRI is the investigation of soft-tissue lesions in salivary glands, TMJ and tumour staging etc. Recent advances in imaging technologies have revolutionized dental diagnostics and treatment planning. Correct use of appropriate imaging technology and their correct interpretation helps in detecting the pathologies in early stage and planning better treatment which in turn gives better future to the patient.
ABSTRACT

Bonding in orthodontics is said to be the most fundamental and crucial part. The success of orthodontic treatment enormously depends upon the precision of the bracket placement, which requires greater skills and chairside time. So as to overcome this shortcoming, we have followed a new technique in our department to do indirect bonding, which is done with the help of a glue gun and a transfer tray made up of a bioplast sheet that accounts as the laboratory procedure and the trail on the patient which was efficiently done with precise positioning of the brackets within minimal time. Thereby we can say that this new method is easy, quick and also economic.

Keyword: Indirect bonding, orthodontics, glue gun

Received: 05-03-2018; Review Completed: 25-04-2018; Accepted: 01-07-2018

INTRODUCTION:

Bonding in orthodontics is said to be the most fundamental and crucial part. The success of orthodontic treatment enormously depends upon precise bracket placement, and thus it is said that the orthodontist with greater skills for bracket placement are more likable to achieve successive treatment results. The concept of indirect bonding was first mentioned in the literature during 1970s, and has evolved till date as more precise and meticulous technique which allows better three-dimensional visualization of tooth positioning and, as a result, greater accuracy while positioning brackets, also errors associated with bracket positioning were minimized under all the three aspects of observation: height, mesiodistal position and angulation. On the other hand with countable advantages, laboratory procedure and additional cost of the materials limits it usage thus we have demonstrated a new method which is more efficient, simplified and routinely employed in our department with minimum expenses, with the help of glue gun material and a transfer tray made of bioplast sheet.

INDIRECT BONDING TECHNIQUE

All steps involved in indirect bonding are divided into three stages:

1) Clinical Stage I
2) Laboratory Stage
3) Clinical Stage II.

Clinical Stage I

Perform dental prophylaxis, followed by upper and lower full-arch impressions with alginate, examine the impression in detail to ensure that every possible minute detail has been obtained paying special attention to the areas corresponding to teeth in order to avoid potential flaws that may lead to distortions in the dental cast. The dental cast has to be poured with type III dental stone (Orthokal). This procedure should be carried out cautiously so as to avoid any form of imperfections (positive and negative bubbles) as surface flaws will hinder brackets and tray fitting to the teeth, when the former are transferred to the oral cavity.

Laboratory Stage

Once the cast have been obtained draw bracket positioning guidelines on the cast with the help of lead pencil. First, determine the long axis of each tooth on the center of its crown, using an OPG as an auxiliary method to observe root angulation. After determining the long axis the height for the bracket placement has to be determined, which is done by selecting the series closest to the predetermined MBT chart series for the particular case, once the series is decided, with the help of MBT gauges the horizontal lines are marked. This procedure has to be repeated for both the casts, the final cast will have a horizontal and vertical lines determining the bracket height and long axis of tooth respectively thus arbitrate the centre of the crown for placement of the brackets.

Subsequently, apply glue with the help of glue gun to the bracket base and position it over the cast surface such as the slot and long axis of brackets lie over the drawn guidelines. Press the bracket over...
the pre-established location and remove excess. This procedure has very less working time and thus it has to be done very skilfully once all brackets are placed, positions are to be checked once the bracket positions are satisfactory proceed for the fabrication with the help of a transfer tray using Biostar unit, before fabricating this trays the 1st layer of tray is made by using a vacuumformer over the cast bopolyethylene high density i.e. Isofolan Foil0.1 * 125 mm sheet by Scheu Dental Technology and 2nd layer of thermoplastic polyurethane/polycarbonate i.e. Durasoft pd. 1.5*125 mm a 1.5-mm thick sheet by Scheu Dental Technology. The purpose of these layers is that the hard outer layer provides rigidity to the bonding tray, and the soft inner layer permits easy separation from the brackets. After which excess part of the tray has to be trimmed with carbide burs, it has to be trimmed until the marginal regions of gingiva, such that the trays can be separated from the cast easily. This tray now is to be place in warm water for 1-2 min in order to remove the adhesive and glue from the bracket base. Once the entire tray is being cleaned and excess is trimmed off it to be cut into 3 segments, one anterior and two posterior segments for the ease of handling. The decision to use a single tray for an entire arch, or whether sectional trays are used, is based on the degree of isolation of the teeth that is feasible and crowding, the degree of isolation and ease of tray placement are the determining factors on whether to section the trays or not. If isolation is difficult, the tray may be sectioned at the midline to permit easier bonding.

Clinical Stage II

A thorough prophylaxis using extra-fine pumice is to be done and etch tooth area which has to be bonded, with 37% phosphoric acid for 20 seconds. Wash the etched surface, for additional 20 seconds. A frosty white appearance can be appreciated after this isolate area with cotton rolls and dry thoroughly. Followed by application of primer (Transbond XT Primer adhesive (3M Unitek)) to tooth surface, with the help of applicator tip followed by gentle air spray and then light cure for 15 seconds. Then apply composite (Transbond XT light cure adhesive paste (3M Unitek)) to bracket base and in vitro studies have demonstrated satisfactory results when is used for direct orthodontic bonding. After this carefully position the tray over the teeth, while doing this ensure that it has been fitted completely, no excess pressure should be applied to stabilize the tray. After which recheck and confirm the accurate positioning followed by light-curing for 30 seconds on each tooth and if required the curing cycle can be repeated as well. Follow the same procedure for all the remaining segments. Remove the firm tray with the aid of a smooth tip instrument, first pressing to dislodge it towards the occlusal edge. After the tray is completely removed the excess composite material can be removed with the help of scaler tip or bur with very low speed. Once everything is done Orthodontic wires can be inserted immediately.

DISCUSSION

Achieving success with the described technique is not complex, provided attention is paid to the recommended details. It allows precise orthodontic appliance installation in only one appointment, and can be used to place any bracket. The advantages of indirect bonding technique includes accurate bracket placement, optimizing the use of doctor's time, avoiding band fitting on posterior teeth thus eliminating the need for separators, improved ability to bond posterior teeth, improved patient comfort and hygiene and simple execution.

Till date many techniques have been evolved for indirect bonding and they have claimed it to be of utmost precision and bond strength, in our technique the key point is to transfer the bracket from cast surface to the transferring tray and as we have also used the Biostar Unit to make the transfer the brackets thus overcoming the drawbacks of use of soft materials which can result not only in imprecision inbracket positioning, but also in high incidence of bond failure as a result of poor fitting. And our technique of fabricating transfer tray is in harmony with the AnupSondhi (2007) technique.

Some of the amendments greatly improve accuracy in bracket placement. The gain in outer tray thickness and boundaries offers improved hardness and stability to the bracket transfer system. At this moment, it is highly recommended that trays be only lightly fitted, without application of additional force to stabilize them, which could cause deviations in ideal bracket positioning. Differences in placement accuracy between right and left sides can arise from non-compliance to this recommendation.
An additional factor contributing to technique efficiency is the clear tray. It not only allows visual confirmation of fitting and bracket position at the moment of transference, but also permits the use of light-curable material. The latter provides higher initial bond strength than self-curing materials, an asset at the moment of tray removal and immediate insertion of orthodontic archwires. In addition, it provides enough time for correct tray fitting, since curing only starts upon activation by the operator.

Other advantage of this technique over other is it uses simple glue to stick the brackets to the cast, which is very cost effective and easy to handle. The glue can be immediately removed from the bracket base under warm water and thus leaving behind clean surface for bonding.

LIMITATIONS:
Some setbacks are present in this technique that is the bond strength of glue which is used is questionable, as a result there can be dislodgment of the bracket, secondly the working time for the glue is very less as it is in molten state which sets immediately and so require precision and skills, and as its bond strength is questionable it can be used as an advantage as well to reposition them. But still the results with this are quite accurate which leads to its efficiency as an orthodontic bonding method, providing the advantages related to indirect bonding to benefit both professionals and patients involved in this process.

FINAL CONSIDERATIONS
The indirect bonding technique is a better method when it comes to precision in placing brackets. However, in order to be successful, the technique must offer sufficient criteria that allow this advantage to be achieved. By judiciously following the steps described herein, it is possible to carry out the procedure with adequate precision and efficiency.

CONCLUSION
Thus, this technique is very simple, yet cost effective while providing the advantage of indirect bonding for both patient and orthodontist as well, thus providing effective and efficient treatment results.

REFERENCES:
SUCCESS OF DENTAL IMPLANTS IN PATIENTS WITH BRUXISM: A SYSTEMATIC REVIEW & META ANALYSIS

Darshana Shah* Chirag Chauhan** Harshil Modi*** Poonam Vasava*** Palak Batavia***

ABSTRACT

Aim: The aim of this systematic review is to find out a co relation of bruxism as a threat to dental implants and find the success rate of the dental implants in patients with Bruxism. Materials and Method: An electronic search was conducted for articles in English listed with PubMedScience Direct, Ebsco host till April, 2018 and final 10 studies were included based on inclusion and exclusion criteria in which the survival rate of dental implants in patients with bruxism was evaluated. Result: The mean success rate in patients of dental implants with bruxism is 74.59%. Whereas, the mean success rate in patients of dental implants without bruxism is 92.8%. Conclusion: Bruxism is a contributing factor for causing the occurrence of dental implant complications and plays an important role in dental implant failure.

Keyword: Dental Bruxism, Implants, Failure, Systematic Review, Meta-Analysis

Received: 12-03-2018; Review Completed: 03-05-2018; Accepted: 18-07-2018

INTRODUCTION:

A promising method for the replacement of the missing teeth in completely and partially edentulous patients is Endosseous Dental Implants [1,2]. Only 66.4% of patients are completely free from any type of reported complications following the restoration of the implant supported fixed prosthesis[3]. Complications with the dental implants may include Biological failures (marginal bone loss & peri–implantitis) & Technical failures (superstructure fracture, loosening of retention & screw loosening). [4-8]

Bruxism is one of the major risk factor for dental implant failure, that has always remained a controversial topic [9-11]. Bruxism seems to be mainly regulated centrally, not peripherally. [11]

The Biological damages that may occur to the dental implants may include early and late dental implant failures. In case of early failures, osseointegration was insufficient, the implant is lost before the first prosthetic loading. Late biological failures are characterized by pathological bone loss after full osseointegration was obtained at an earlier stage. [12]

In case of biomechanical complications, one or more components of an implant system failure are fracture of an implant itself, loosening or fracture of connecting screws or abutment screws, loosening or excessive wear of mesostructural components in overdentures and excessive wear or fracture of suprastructural porcelain or acrylic teeth. [13]

The forces responsible for failure of the dental implants are mainly in terms of magnitude, duration, direction, type and frequency. [14] Use as many implants as possible, splint the implants for even distribution of the load, respect the normal time for loading of the prosthesis, flatter the cuspal inclines to lower the lateral forces on the implants, giving hard protective occlusal splint. [15]

Hence there is a need to reach deep to the issue of the effects of bruxism on dental implants and its survival rate by performing a systematic review of the literature.

Materials and Methods:

Source used: An electronic search was conducted for articles in English listed with PubMedScience Direct, Ebsco host till April, 2017. The search methodology was performed using the following keywords: “dental implants”, “bruxism”, “risk factor”, “success”. Review articles and references from different studies were also used to identify the relevant articles.

Selection of Studies:

For the review, first the titles of the search articles were initially screened and relevant articles were obtained. After going through abstracts, relevant articles were included.

From these relevant articles, by using inclusion and exclusion criteria, relevant and suitable articles were isolated for further processing and data extraction.
INCLUSION CRITERIA:
1. In Vivo studies were included.
2. Patients undergoing dental implant treatment and having bruxism as a risk factor.
3. Dental implants placed in both maxilla and mandible with a minimum of 1 year follow up.
4. Failures in dental implants that includes Biomechanical and biological failures.

EXCLUSION CRITERIA:
1. Duplicate and irrelevant studies were eliminated.
2. Grafted sites, advanced surgeries for implant placement were not included.
3. Immediate implant placement after extractions were not included in this study.

Keywords: Dental Implants, Bruxism, Success, Meta-Analysis, Systematic Review
### Table-1: Evidence Level of Selected Articles

<table>
<thead>
<tr>
<th>NO.</th>
<th>Author</th>
<th>Year</th>
<th>Study Design</th>
<th>Evidence Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Roland Glauser et al [16]</td>
<td>2001</td>
<td>PS – In Vivo</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>De Boever et al [17]</td>
<td>2006</td>
<td>PS – In Vivo</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Richard Kinsel et al [18]</td>
<td>2009</td>
<td>RS – In Vivo</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Francesco et al [20]</td>
<td>2013</td>
<td>PS – In Vivo</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Ramos et al [21]</td>
<td>2015</td>
<td>SR – In Vivo</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>B.R. Chrcanovic et al [22]</td>
<td>2016</td>
<td>PS – In Vivo</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>Bruno Ramos et al [23]</td>
<td>2016</td>
<td>RS – In Vivo</td>
<td>2</td>
</tr>
<tr>
<td>Sr No.</td>
<td>Author</td>
<td>Year</td>
<td>Study Design</td>
<td>Events /Total: Bruxers (B) Versus Non Bruxers (NB)</td>
</tr>
<tr>
<td>--------</td>
<td>--------</td>
<td>------</td>
<td>--------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Study Authors &amp; Year</td>
<td>Year</td>
<td>Study Type</td>
<td>Prosthesis (P)</td>
</tr>
<tr>
<td>---</td>
<td>---------------------</td>
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<td>----------------</td>
</tr>
</tbody>
</table>
| 5. | Panos et al in 2012 [7] | 2012 | PS In Vivo | P: 10/74 Versus 0/123 ; I: 4/4 Versus 0/10 | Screw Retained | Natural | 2-4 Years | 13.51%-B 0%-NB  
| 10. | Aekaterini Mikeli et al [24] | 2017 | RS In Vivo | I: 24/69 Versus 10/75 | Cement Retained | Artificial | 14 Years | 34.78%-B 13.3%-NB  

P = Prosthesis, I = Individuals, B- Bruxers & NB – Non Bruxers
### TABLE –3: MEAN SUCCESS RATE IN PATIENTS OF DENTAL IMPLANTS WITH BRUXISM

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Author</th>
<th>Mean Success Rate in Patients of Dental Implants with Bruxism</th>
<th>Mean Success Rate in Patients of Dental Implants without Bruxism</th>
</tr>
</thead>
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<tr>
<td>1.</td>
<td>Roland Glauser et al [16]</td>
<td>59</td>
<td>87.62</td>
</tr>
<tr>
<td>2.</td>
<td>Boever et al in 2006 [17]</td>
<td>60.5</td>
<td>76.9</td>
</tr>
<tr>
<td>4.</td>
<td>Ting Jen Ji et al in 2012 [19]</td>
<td>70.87</td>
<td>95.4</td>
</tr>
<tr>
<td>7.</td>
<td>Ramos et al [21]</td>
<td>93.6</td>
<td>96.36</td>
</tr>
<tr>
<td>8.</td>
<td>B.R. Chrcanovic et al [22]</td>
<td>87.03</td>
<td>95.3</td>
</tr>
<tr>
<td>10.</td>
<td>Aekaterini Mikeli et al [24]</td>
<td>65.22</td>
<td>86.7</td>
</tr>
<tr>
<td>Mean of Success Rate</td>
<td>74.59%</td>
<td>92.6%</td>
<td></td>
</tr>
</tbody>
</table>

**Fig 2: Success Rate in Patients with Dental Implants with Bruxism**

**Fig 3: Success Rate in Patients with Dental Implants without Bruxism**

### Discussion

Bruxism and Dental Implants failure have a statistical significance in this meta-analysis. In contrast to non bruxers, the bruxers have a high failure rate. Ten studies have been included, out of which seven studies are based on number of prosthesis & rest three studies are based on number of prosthesis as well as individuals/patients. Based on number of prosthesis – non bruxers have a total of 14253 prosthesis out of which 699 failed. Whereas bruxers have 1881 prosthesis out of which 254 faced a failure. Based on number of individuals/patients, 352 individuals were included & 140 out of them have a history of bruxism. 53
individuals out of them faced a failure. Out of the ten studies included, failure rate was individually calculated (Table 2) which included Bruxers and Non Bruxers as different groups. The mean success rate was calculated, which turned out to be 74.59% for patients having dental implants with bruxism & 92.6% for patients having dental implants without bruxism.

Figure 2, shows the forest plot chart for bruxers. Estimate value for this group was 74.60, with p value 0.001 indicating a high significance value (p<0.005). The heterogeneity is (I=86.74%). The group shows a mean success rate of 92.68%.

Figure 3, shows the forest plot chart for the nonbruxer group. Estimate value was 92.68, with p value 0.032 indicating a highly significance value (p<0.005). The heterogeneity is (I=89.10%). This group shows a mean success ratio of 92.68%.

Figure 2 & 3 when compared, shows that in contrast to nonbruxers the bruxers exhibit a higher failure rate, suggesting that bruxism is a prime factor for failure in patients with dental implants. Some studies included also suggested a high failure rate in maxilla then in mandible. Failure rate was also seen high in Implant supported fixed partial dentures.

**Conclusion:**

This systematic review & meta-analysis was performed to evaluate the relationship of bruxism and dental implant failure.

The mean success rate in patients of dental implants with bruxism is 74.59%.

Whereas, the mean success rate in patients of dental implants without bruxism is 92.8%.

In contrast to nonbruxers, prostheses in bruxers had a higher failure rate. It suggests that bruxism is a contributing factor of causing the occurrence of dental implant complications and plays an important role in dental implant failure.

Researchers should use several evaluation methods to justifiy bruxism instead of incomplete diagnosis. The units of measurements for future studies should be unified as the sample size may be the main shortage when units were based on the number of patients.

However, the systematic review & meta-analysis performed here shows a significant value & positive causal relationship of dental bruxism as risk factor for patients having dental bruxism.

**REFERENCES:**

1. Pjetursson BE, Thoma D, Jung R, Zwahlen M, Zembic A. A systematic review of the survival and complication rates of implant-supported fixed dental prostheses (FDPs) after a mean observation period of at least 5 years. Clinical oral implants research. 2012 Oct 1;23(s6):22-38.


7. Papaspyridakos P, Lal K. Computer-assisted design/computer-assisted manufacturing zirconia implant fixed complete prostheses: clinical results and technical complications up


The advent of nanotechnology has revolutionized science in the 21st century. The terminology “NANOTECHNOLOGY” originated from Greek word meaning “dwarf”[3]. The concept of nanotechnology was based on the discussion in 1959 by renowned physicist Richard Feynman who described that it could be possible to directly manipulate the atoms.

NANO DENTISTRY is the science and technology of maintaining near-perfect oral health through the use of nanomaterials including tissue engineering and nanorobotics.[4]

APPLICATION OF NANOTECHNOLOGY IN ORTHODONTICS

A. Nano coated arch wires
Friction plays a major role in alignment or retraction of teeth during orthodontic treatment. To overcome friction, we can use several methods by applying higher but it leads to undesirable anchor loss or to vary wire size and shape. Other alternative is to alter the bracket design or coating over the wire to reduce friction.

A recent innovation in the form of metal nanoparticle coating has been introduced that significantly reduces friction of various surfaces including archwires. The coating consists of electrodeposited Ni film impregnated with inorganic fullerene-like nanospheres of tungsten disulfide.[5] Syed SS Kulkarni (2015)[6] Used three types of orthodontic wires, stainless steel, titanium molybdenum and nickel titanium and coated them with a uniform and smooth nanoparticle film using 100 ml of nanoceramics with the sol gel thin dip coating method. The ESEM images were found to be smoother with less surface deteriorations than the conventional ones.

A. Nano Brackets
A new material which contained polysulfone embedded with hard alumina nanoparticles was developed in the year 2012 by UC3M for making orthodontic brackets. The material innovated had the properties of strength, reduced friction and biocompatibility while maintaining the transparency of the bracket.[7]

Advantages of the new material introduced by UC3M were
• Increase in mechanical and frictional resistance
• Maintenance of bracket transparency
• Better wear and tear resistance
• Biocompatible

C. Nano Composites
The latest advancement of nanoparticle technology in the domain of biomaterials is introduction of nanocomposites and nanoionomers. When inorganic phases in an organic/inorganic composite become nano-sized, they are called Nanocomposites.

Uysalet al. conducted a study in 2010 to evaluate the bond strength of nanocomposites and nanoionomers and have shown that these nanomaterials may be suitable for bonding in orthodontics as they fulfill the previously suggested...
shear bond strength ranges for clinical acceptability.\textsuperscript{[8]}

A. To prevent white spot lesions

It is a well-established fact that the unaesthetic WSL caused due to demineralization is rightfully termed as the scars of orthodontic treatment.\textsuperscript{[9]} Plaque in association with fixed appliances can result in clinical problems such as demineralization of the adjacent enamel and gingival inflammation. Gold standard to prevent this is use of fluoride and chlorhexidine mouthwash. Major drawback encountered is epithelial desquamation causing altered taste sensation and brownish discoloration of teeth while using chlorhexidine mouthwash for prolonged periods.

Nano-hydroxyapatite has been introduced as nanotechnological advancement in the products for the remineralization of enamel. Medeiros et al. in their study in 2013 concluded that calcium nanophosphate forms a protective layer on the enamel surface and provides protection against erosion.\textsuperscript{[10]} In a comparative study by Carvalho et al. in 2013, on the effect of calcium nanophosphate and CCP-APP paste, it was concluded that calcium nanophosphate is a better remineralizing agent for eroded enamel surfaces.\textsuperscript{[11]}

A. Nanomechanical sensors for orthodontic forces and moments measurements

Researchers have been working towards development of brackets that can carry three dimensional mechanical sensors, to measure the real time forces that have been applied to the teeth.

In order to achieve this Lapatki (2007) proposed the introduction of “smart” bracket. A large size prototype bracket that utilized microsystem chip encapsulation. Development of the nano chip that can be encapsulated into small low profile bracket systems with reduced mesio distal and occluso gingival dimensions will allow the clinical testing of utilization of this technology.\textsuperscript{[6,12]}

FUTURE APPLICATION OF NANOTECHNOLOGY IN ORTHODONTICS

I. Nanorobotics in orthodontics

Orthodontic nanorobots working on acoustic data signals could directly manipulate the periodontal tissues, allowing rapid and painless tooth straightening, rotating and vertical repositioning within minutes to hours. Nanorobots may be used for manipulation of tissues directly at nano level and research has begun on the use of nanorobotics for medical applications like drug delivery, management of aneurysms and tumors.

II. Use of shape memory polymer in orthodontics

Applications of nanoparticles in shape-memory nano-composite polymers can increase thermal conductivity of the polymers\textsuperscript{[13,14]}. These wires can also be made with clinically relevant levels of elastic stiffness. Once placed in the mouth, these polymers can be activated by the body temperature or photoactive nanoparticles activated by light and thus influence tooth movement. Future research directions in shape-memory nanocomposite polymers to produce esthetic orthodontic wires can be of interesting potential in orthodontic biomaterial research.

III. BioMEMS/NEMS for orthodontic tooth movement and maxillary expansion

BioMEMS- biological microelectromechanical systems. A term referring to the application of microelectromechanical systems to micro and nano systems for genomics, proteomics, drug-delivery analysis, molecular assembly, tissue engineering, biosensor development, nanoscale imaging, etc.Implantable bioMEMS have been used as biosensors for in vivo diagnostics of diseases and as drug delivery microchips\textsuperscript{[15-17]}. Nanoelectromechanical systems (NEMS) are devices integrating electrical and mechanical functionality on the nanoscale level.

IV. Nano lipus device

Ultrasound is a form of mechanical energy that is transmitted through and into biological tissues as an acoustic pressure wave at frequencies above the limit of human hearing, is used widely in medicine as a therapeutic, operative, and diagnostic tool\textsuperscript{[18,19]}. LIPUS has been reported to enhance bone growth into titanium porous–coated implants\textsuperscript{[20]} and bone healing after fracture\textsuperscript{[21,22]} and after mandibular distraction osteogenesis\textsuperscript{[23]} and has also stimulated mandibular cartilaginous growth\textsuperscript{[24]}.

CONCLUSION

Nanotechnology in orthodontics is in its emergence phase. The addition of nanoparticles to currently available materials enhances their properties and clinical use. Use of nanotechnology in accelerating
orthodontic treatment, preventing white spot lesions, orthodontic bonding, nano coating proves out to be a niche for orthodontists. Application of nanotechnology should be further explored in the field of orthodontics.

REFERENCES:


EFFECT OF FOUR COMMERCIAL MOUTHRINSES ON THE MICROHARDNESS OF NANOHYBRID COMPOSITE RESTORATIVE MATERIAL- AN IN VITRO STUDY.

Yash Shah*, Krutika Chudasama**, Kushani Shah ***, Shraddha Chokshi****, Zarana Sanghvi***** Pruthvi Patel******

ABSTRACT

Aim: To evaluate the effect of four commercial mouthrinses on the microhardness of nanohybrid composite restorative material. Materials and Method: Forty specimens of nano-hybrid composite material (Tetric-N- Ceram Ivoclar Vivadent) with 3mm diameter and 3mm height were prepared using Teflon moulds. The baseline microhardness of the specimens were recorded using Vickers Microhardness Tester. The specimen were randomly divided into four groups according to mouth rinses used, each containing ten specimens as follows: GROUP A: LISTERINE (Alcohol based)
GROUP B: PERIOGARD (Alcohol based) GROUP C: FRESHCLOR (Alcohol Free) GROUP D: HIORA (Alcohol Free). The pH of all mouth rinses were recorded. Then the specimens were immersed in 20 ml of respective mouthrinses and kept in incubator at 37°C for 24 hr. The post immersion microhardness values of the specimens were recorded using Vickers Microhardness Tester and results were subjected to statistical analysis which was done by one-way ANOVA and Post Hoc analysis Result: The decrease of microhardness was seen highest in GROUP A followed by Group B and least in GROUP C and GROUP D. Conclusion: All the mouth rinses showed reduction in surface hardness of the esthetic restorative material. Highest reduction of surface hardness was seen with use of Listerine®mouth rinse followed by Periogard®. There was no statistically significant difference between Freshclor® and Hiora® mouth rinses.

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INTRODUCTION:

In the recent years, there is a great research and development in the field of esthetic dentistry as esthetics is the main concern for an individual. There is a marked increase in the use of composite resin as it is a tooth colored restorative material. Various internal and external factors influence the longevity, durability, and degradation of dental composite resins. Failure of resin restoration may occur due to change in the mechanical and chemical properties of the composite resin material. Both of them are inter-dependent on each other. Mechanical properties may be altered as the resin is exposed to unwanted compressive and tensile forces while chemical properties of resin is altered by the internal environment of oral cavity, food or other materials used; which further affects the mechanical properties.

The wear resistance of a resin composite is affected when there is reduction in surface hardness. Due to decrease in wear resistance there may be increase in surface roughness which is favourable for plaque accumulation, staining of resin composite and finally early loss of restoration, requiring re-restoration.

To overcome plaque accumulation and periodontal problems there is increase in prescription of mouth rinse by the dentist also there is increased purchase of over-the-counter mouthrinses by the patients.

Mouthrinses contain water, antimicrobial agents, salts, preservatives and in some cases alcohol. The variation in the concentration of these substances affects the pH of the mouthrinses. Although mouthwashes are effective in reducing periodontal disease and dental caries, there are some risks associated with them when used daily. The risks include dry mouth, pigmentation of tongue and change in the physical properties of composite resin restorations.

Alcohol containing mouthrinses such as LISTERINE and PERIOGARD are most frequently used mouthrinses; The alcohol in the mouthwashes influences the degradation of composite resins and this effect is found to be directly related to the concentration of alcohol. Furthermore, low pH affects sorption; solubility and surface degradation of there storative material. Therefore, alcohol-free mouth washes have been introduced into the market. However, studies have reported the fact that both alcohol and alcohol-free mouth rinses can reduce the hardness of the restorative materials.

Recently, manufacturers have introduced a new nano hybrid restorative composite material (IVOCLAR TETRIC-N-CERAM ®), which they
claim to be resistant to wear in the oral environment. In addition, an alcohol-free mouthrinse (FRESHCLOR®) and a new alcohol free herbal mouth rinse (Hiora®) are available in the market. As these products are recently introduced, there are no studies assessing the effect of these mouth rinses on the composite resin restorative material. Hence, the aim of the present study was to assess and compare the effect of these newly available mouth rinses (Hiora® and Freshclor®) on the newly introduced restorative composite (IVOCLAR TETRIC-N-CERAM®). This was studied by assessing the change in the surface micro hardness of the restorative composite after exposure to the mouth rinses.

MATERIALS AND METHOD

Forty specimens of nano hybrid resin based composite material (IVOCLAR TETRIC-N-CERAM) with 3 mm in diameter and 3 mm in height were prepared using a teflon mould which was custom modified to get the desired size. Moulds were placed on glass slide and then filled with composite resin using Teflon coated composite instruments. Excess material was removed using glass slide, following which clear matrix strip was placed and cured with LED light for 40secs from top and bottom. The samples were then removed from the mould.

The baseline microhardness of each specimen was recorded using Vickers Micro Hardness Tester with load of 40g and dwell time of 15secs. The specimens were then immersed in 20 ml of respective mouth rinses in a glass beaker and kept in an incubator at 37°C for 24 hrs. Each specimen were removed from mouth rinses and dried. The specimens were then checked for post immersion microhardness using the same micro hardness tester previously mentioned for base line values. The change in the microhardness values of the specimens were recorded. The obtained result was subjected to statistical analysis using one way ANOVA and Post Hoc Analysis in which P < 0.05 and was considered statistically significant.

RESULTS

<table>
<thead>
<tr>
<th>GROUPS</th>
<th>BEFORE IMMERSION</th>
<th>AFTER IMMERSION</th>
<th>MEAN DIFFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>124.2</td>
<td>104</td>
<td>20.3</td>
</tr>
<tr>
<td>B</td>
<td>124.2</td>
<td>111.6</td>
<td>13.7</td>
</tr>
<tr>
<td>C</td>
<td>124.2</td>
<td>121.4</td>
<td>2.8</td>
</tr>
<tr>
<td>D</td>
<td>124.2</td>
<td>120.6</td>
<td>3.6</td>
</tr>
</tbody>
</table>

Table 1: Comparison of change in microhardness (VHN) before and after immersion in each group.

The specimens were then immersed in 20 ml of respective mouth rinses in a glass beaker and kept in an incubator at 37°C for 24 hrs. Each specimen were removed from mouth rinses and dried. The specimens were then checked for post immersion microhardness using the same micro hardness tester previously mentioned for base line values. The change in the microhardness values of the specimens were recorded. The obtained result was subjected to statistical analysis using one way ANOVA and Post Hoc Analysis in which P < 0.05 and was considered statistically significant.
INTERPRETATION:
There was reduction in the microhardness of all specimens after immersion in the mouth rinses. Specimens in Group A showed significant reduction in the microhardness compared to the other three groups. There was no statistically significant difference in the microhardness of specimens of Group C and Group D. Mean difference of microhardness before and after immersion in mouth rinses was highest in GROUP A (20.3) followed by GROUP B (13.7). It was lowest in GROUP C (2.8) and then GROUP D (4.3).

DISCUSSION
The ideal requirement of a restorative material is that it should function in the same manner as dental hard tissue in the dynamic oral environment. To have long-term durability in the oral cavity, the restorative material should have sufficient hardness. Hardness is the resistance of a material to indentation or penetration. When there is reduction in the hardness of resin material, there may be premature failure of resin restoration.

Mouth rinses have been reported to affect the solubility of some restorative materials. Asmussen et al. reported that alcohol in the mouth rinses softens the resin composite restorations. Alcohol in mouth rinses is used as a solvent, taste enhancer, and antiseptic agent. Ethanol, which is a component in various mouthwashes, may increase the hydrolytic degradation of composite-based materials. Thus, there is an increasing demand for alcohol-free mouth rinses.

Freshclor® (alcohol free) and Hiora® (alcohol free herbal mouth rinse) are the newly introduced mouth rinses in the market and their effect on the surface hardness of restorative composite material (Ivoclar Tetric-N-Ceram®) is not known.Composite restorative material Ivoclar Tetric-N-Ceram® is claimed by the manufacturers to be resistant to wear in the oral environment. It contains Urethane Dimethacrylate, Bis GMA 15 wt%, Ethoxylted Bis-EMA 3.8%wt, Barium glass, ytteribium trifluoride mixed oxide, silicon dioxide 63.5 wt%, prepolymers 17 wt%, additives, stabilizers, catalysts and pigments 0.7 wt %.

The surface hardness test is important because it may affect the surface properties of esthetic materials. In the present study use of all the mouth rinses, irrespective of the presence or absence of reduced the micro hardness of the tested nanohybrid resin composite material compared to base line values. This may be because of the acidic pH of the mouth rinses which would have caused acid erosion of the resin composite by acid etching and leaching the principle matrix forming cations. This is in accordance with the observations by Diab et al. reported that mouth rinses with low pH are detrimental to the hardness of resin composites.

Basically the low pH of mouth rinses may have acted on the polymeric matrix of the nanohybrid resin composite used in the study, through catalysis of ester groups from dimethacrylate monomers present in the composition (Bis GMA, Bis EMA, UDMA and TEG DMA). The hydrolysis of these ester groups may have formed alcohol and carboxylic acid molecules that may have accelerated the degradation of the resin composite. Inter group comparison showed Listerine (Group A) and Periogard (Group B), containing alcohol 21.6% w/v and 11.6 % w/v respectively, resulted in more reduction in the micro hardness as compared to Freshclor (Group C) and Hiora (Group D) which are alcohol free. This may be because of the presence of alcohol in Listerine (Group A) and Periogard (Group B) but reduction in microhardness in Periogard (Group B) is less as compared to Listerine (Group A). This must be due to lower percentage of alcohol in Periogard (Group B) compared to Listerine (Group A). This observation is in accordance with the observation of Penugonda et al. who reported that the higher percentage of alcohol in the mouth rinses causes more reduction in the hardness of restorative...
materials. The softening effect of alcohol in the mouth rinses on the resin composite may be due to susceptibility of Bis GMA and UDMA based polymers present in them\textsuperscript{14} and irreversible leaching of the components\textsuperscript{17}. This effect may be more pronounced in nanohybrid resin composites according to the observation by Karabela et al\textsuperscript{19} and Almeida GS et al\textsuperscript{13} who showed higher sorption rate for nanohybrid resin composites in ethanol/water than in water or saliva.

The reasons for this may be –Greater surface area to volume ratio derived from the non-agglomerated 20 nm silica filler. Poor impregnation of 5 to 20 nm sized primary particles by the polymeric matrix\textsuperscript{18,13}.

As observed in the study, alcohol content and low pH can have detrimental effect on the microhardness, but these two factors may not be interdependent on each other in reducing the microhardness of the resin composite tested. Though Hiora (Group D) has low pH than Periogard (Group B), it shows less reduction in microhardness than Periogard (Group B) which may be due to absence of alcohol. Hence the long-term, regular use of alcohol based mouth rinses like Listerine (Group A) and Periogard (Group B) with higher alcohol content (21.6% w/v and 11.6% w/v respectively) and low pH may be detrimental to the nanohybrid resin composite used in the present study.

The result of this study are similar to some other studies done by George et al\textsuperscript{19} and Jyothi et al\textsuperscript{20} concluded that use of alcohol based mouthrinses reduces the microhardness of esthetic restorative material like composite.

However, the results of this in vitro study may not be directly related to the clinical situation where saliva may dilute or buffer the mouth rinses.

**CONCLUSION**

- Listerine® mouth rinse containing the highest amount of alcohol showed maximum reduction in microhardness followed by Periogard® of resin composite Ivoclar Tetric-n-Ceram.
- Reduction in the surface microhardness in the tested composite was lower in alcohol free mouth rinses than in alcohol containing mouth rinse.
- All the mouth rinses used in the study irrespective of the presence or absence of alcohol reduced the microhardness of the tested composite resin material.
Samples Placed In Incubator At 37oc For 24 Hrs

Vickers Microhardness Tester

REFERENCES:


ABSTRACT

Aim: The aim of study is to evaluate the effect of ultrasonic scaling on surface roughness of two different toothcolored Class V restoration. Materials and method: 30 freshly extracted human teeth were taken and divided into 3 groups of 10 each. Control group were marked with area of 2 x 2 mm outline of class V cavity. In Group 2 and 3 Class V cavities were prepared with an outline of dimensions (2mm depth 2mm length and 2mm width) on facial surface with carbide bur no. 245 and restored with two different tooth colored restorative materials. Group 1: Control group Group 2: Restored with Fuji II GL(GC) Group 3: Restored with Filtek Z250 XT COMPOSITE (3M ESPE) All specimens were stored in artificial saliva at 37°C for one week. Initial surface roughness value (Ra in μm) of restorations was evaluated with Surface Roughness Tester. Ultrasonic instrumentation was then carried out on the restoration surface and a final surface roughness value was evaluated. Data was then statistically analyzed with ANOVA and Post hoc test. Result: GIC Fuji IIGL had highest, whereas Nanohybrid composites Filtek Z250 XT had lowest pre- and post-instrumentation roughness values. Conclusion: Nanohybrid composites are found to withstand instrumentation better than GIC.

INTRODUCTION:

Class V carious lesions are the defects that occurs on the gingival third of facial and lingual surface of all teeth.1 Non carious class V lesions are commonly referred to as abrasion and erosion. Due to esthetic concerns, these types of defects are preferably restored with tooth-colored restorations such as Glass ionomers and Composites. The main limitation of the glass ionomer cements is their relative lack of strength and low resistance to abrasion and wear. Conventional glass ionomer cements have low flexural strength but high modulus of elasticity, and are therefore very brittle and prone to bulk fracture. With the introduction of composites in dentistry over four decades ago, the issue of aesthetics has been overcome to a certain extent. Composites have an edge over other restorative materials as they offer advantages of easy handling, better aesthetics and relatively low cost.2,3 Although considerable improvements have been made in the properties of dental resin composite since their introduction, however, major developments come from improvements in filler systems. Resin composites have undergone through generations of traditional macrofilled composites, microfilled, hybrid, microhybrid, nanocomposites and nanohybrids.4,5 The trend in the newer microhybrid materials is to maximize filler loading and minimize filler size. The latest version of microfilled hybrids has used nanofiller technology to create nanohybrid composite resins. These nanohybrids can be used in any situation similar to the microhybrids, with possibly a slight improvement in polishability because of the smaller particle size.6,7

It is common clinical finding that plaque and calculus deposits occur heavily in the gingival third of teeth causing irritation to the gingiva. Ultrasonic scaling is a routine periodontal procedure recommended by periodontist every 6 months to 1 year to maintain good oral hygiene.8 Hence to remove these deposits from the gingival third dental practitioner has to run the ultrasonic insert over the surface of the restorations. However the mechanical stimulation may alter the surface integrity of the restoration and tooth thereby increasing the surface roughness which may influence staining, aesthetic appearance, bacterial colonization and accelerate the rate of plaque formation.9,10

MATERIALS & METHOD

Thirty human teeth freshly extracted for orthodontic or periodontal treatment purpose excluding mandibular incisors were used in this study. Tooth samples were randomly selected and divided into 3 groups of 10 each. Out of these, 10 teeth were randomly selected and included in a control group (Group 1). Teeth of control group were

*PG Student, ****PG Student, *****Professor & Head, ******Professor

DEPARTMENT OF CONSERVATIVE DENTISTRY AND ENDOdontICS, AHMEDABAD DENTAL COLLEGE AND HOSPITAL

ADDRESS FOR AUTHOR CORRESPONDENCE: DR. HARSH VERMA, TEL: +91 95580 21953
marked with area of 2x2 mm to simulate outline of class V cavity; no cavity preparation was done on them. On twenty teeth, the standardized class V cavities of 2 mm width, 2 mm length, and 2 mm depth were prepared on facial surface with carbide bur no 245. According to type they were restored as follows:

Group 1: (n=10) Control group teeth with no preparation done
Group 2: (n=10) Teeth restored with GIC Fuji II GL
Group 3: (n=10) Teeth restored with Nano hybrid composite Filtek Z250 XT

In group 2 the cavities were conditioned first with GIC liquid with help of applicator tip for 10 sec. Powder and liquid were mixed on mixing pad with agate spatula in accordance with manufacturer's instructions and placed into the prepared cavities. Mylar strip was placed over it and pressure was applied to extruded excess material with the help of scalpel.

In group 3 the cavities were conditioned with 37% phosphoric acid (Scotchbond Universal Etchant gel) for 15 sec. Then they were rinsed with water for 10 sec and blot dried. A bonding agent (Adper Single Bond 2) was applied over the conditioned and moist surfaces in accordance with the manufacturer's instructions. The material was polymerized for 20 sec by using light curing unit on each surface. Then Nano hybrid composite material (Filtek Z250 XT) was applied using Teflon coated composite instrument (API). Then the material was polymerized for 60 sec by using light curing unit against a Mylar strip. After polymerization, excess material was removed by scalpel. Polishing was done with the help of Soflex polishing discs.

After initial set of each material, excess was carefully removed. Restorations in group 2 was covered with petroleum jelly and allowed to set in 100% humidity. All specimens were then stored in artificial saliva prepared at 37˚C for 1 month. Specimens in each group were rinsed in running tap water for 30 seconds. They were air dried, and initial surface roughness was evaluated in terms of Ra value (μm) using Surface Roughness Tester (Mitutoyo, Japan, SJ 210) with stylus moving at the speed 0.5 mm/s.

Later, ultrasonic scaling was performed on all specimens with (P5 Booster, ActeonSatelec, North America) ultrasonic scaler having N1 insert/tip under copious water flow for 60 seconds at level 2 power setting. The scaling tip was angled approximately to 15˚ to the restoration surface. The direction of scaling was approximately perpendicular to the long axis of the tooth in the horizontal plane, moving the scaler insert slowly from gingival to coronal third of the restoration. All instrumentations were performed by one experienced periodontist who was not aware of the type of restorative material and their groups.

The specimens were rinsed in running tap water for 30 seconds and cleaned in an ultrasonic bath for 6 minutes. All specimens were air dried, and post-ultrasonic instrumentation roughness was then evaluated as mentioned previously. Data was statistically analyzed with ANOVA and Post hoc test.

### RESULTS

<table>
<thead>
<tr>
<th></th>
<th>Control Group</th>
<th>GIC</th>
<th>Composite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>0.305</td>
<td>0.706</td>
<td>0.065</td>
</tr>
<tr>
<td>After</td>
<td>0.191</td>
<td>0.608</td>
<td>0.042</td>
</tr>
</tbody>
</table>

Table 1: Mean initial and final surface roughness values before and after ultrasonic scaling

Graph 1: Mean initial and final surface roughness values after and before ultrasonic scaling
Data was statistically analyzed with ANOVA and Post hoc test. Mean initial and final surface roughness values (\(\mu m\)) are as given in table 1 and graph 1. Initial surface roughness values (Ra) from highest to lowest were in the order of Fuji II GL, Control group, and Filtek Z250 XT, post-instrumentation surface roughness were in the order of Fuji II GL, Control group, and Filtek Z250 XT.

There was statistically significant difference between roughness values before and after ultrasonic instrumentation.

There was no significant difference between control group and Fuji II GL (p value 0.103), whereas there was significant difference amongst control group, Fuji II GL and Filtek Z250 XT (p value <0.001).

**DISCUSSION**

Class V caries usually develops due to many reasons like unclean tooth surface, caries inducing diet, gingival recession, a reduced salivary flow caused by certain medical conditions (e.g. Sjogren's syndrome), medication or head and neck radiation therapy. The other cervical lesions that need to be restored are abrasion, abfraction, and erosion.

Ultrasonic scaling is essential part of periodontal therapy. It is advocated by periodontist within every 6 months to 1 year. Thus, class V restorations are also exposed to the periodontal prophylaxis. The tips of the ultrasonic inserts are found to vibrate between 18,000 and 45,000 cycles per second. These are excellent for removing plaque, calculus, and bacterial debris.

There is increased surface roughness of tooth and class V restorations that are in close proximity to gingiva may lead to more plaque accumulation, staining, gingival irritation, increased patient discomfort, and recurrent caries.

To restore such defects, materials used should have qualities and properties such as good flexural strength, longevity, ease of use, past success, esthetics, bonding ability, good finishing and polishing ability.

Glass ionomer cements are typically used to restore cervical lesions because of its chemical adhesion, anticariogenic property and high flexural strength. The conventional glass ionomer (Fuji II GL) was significantly roughened by both scaling treatments. This might be attributable to its heterogeneous and biphasic nature. The weak poly salt matrix phases are preferentially removed, leaving the harder, unreacted glass particles protruding from the surface. This accounts for the significant increase in Ra values observed after ultrasonic and sonic scaling.

Composite blend in with surrounding tooth structure to give natural appearance. Its advantages include control over working time, immediate finishing of restoration and control over depth of cure since no mixing is required. It means easier handling and minimal porosity. However, recently it has been found that Nanohybrid composites also posses better flexural properties and low surface roughness.

Composite is a single component material, whereas in case of Glass ionomers, powder has to be mixed with liquid, therefore risking the more air bubble incorporation and increased porosity. These porosities may get enhanced after ultrasonic instrumentation leading to greater surface roughness.

Nanohybrid composite have smaller particle size, reaching in order to 0.02 to 2 \(\mu m\). This is explains the superiority in physical properties in comparison with GIC Fuji II GL, as well as their smooth surface.

Eid et al. have mentioned that bacterial adhesion is directly proportional to surface roughness of the restorations. Ikeda et al. also stated that surface roughness has a positive influence on S. mutans biofilm adherence.

In this study, Filtek Z250 XT nanohybrid composite showed less surface roughness than other group. It is sequence as follows:

Control group < Fuji II GL < Filtek Z250 XT

Which is in accordance with study done by Shenoiet al.

In a similar in vitro study, Lai et al. reported that after ultrasonic scaling, Glass ionomer cement (Fuji II) showed significantly higher surface roughness than Composites Z100 and Tetric Flow. Erdilek et al. mentioned in his studies that Glass ionomer has roughest surface value while flowable has smoothest surface. These findings were consistent with those of Hossam et al. and Mourouziset al.

Filtek Z250 XT showed least pre and post-ultrasonic instrumentation roughness, which is
attributable to its smaller and wide distribution of particle sizes, higher filler loading (82% by weight) with resultant high strength and wear resistance when compared to other test groups.\textsuperscript{24,25}

The results of this in-vitro study may vary in in-vivo conditions as they are frequently subjected to various deleterious actions inside oral cavity like abrasion (brushing), attrition and erosion (citrus drinks, fruit, soft drinks, alcoholic and non-alcoholic beverages), exogenous substances including acids, bases, salts, alcohol, oxygen, etc. contacting the restoration surfaces during oral food and fluid intake and oral hygiene\textsuperscript{15,26} and also to the cyclic flexural forces in the cervical region during occlusal loading.\textsuperscript{19}

**CONCLUSION**

Within the limitations of this study, ultrasonic instrumentation has caused significant changes in the surface roughness of both control and test specimen. GC II had highest, whereas Nanohybrid composites Filtek Z250 XT had lowest pre- and post-instrumentation roughness values. Nanohybrid composites are found to withstand instrumentation better than other tested materials but still we would like to pass a message that carry out the routine ultrasonic scaling with caution and subsequently polish the roughened restorations after scaling.
Teeth of Control Group Were Marked With Area of 2 x 2 Mm To Simulate Outline of Class V Cavity; No Cavity

Mixing of Gic

Placement of Gic

Application and Agitation of Bonding Agent

Curing of Bonding Agent
Restoring Cavity with Composite

Curing of Composite Resin

Group 2: Restored with Gic

Group 3: Restored with Composite Resin

Sample Stored in Saliva

Artificial Saliva
Specimens Stored in Artificial Saliva at 37 Degree Celsius in Incubator in 100% Relative

Surface Roughness Tester

Ultrasonic Scaling Performed on all Specimen

REFERENCES:


ABSTRACT

Aim: The aim of this study was to evaluate the effect of three mouthwashes on colour changes of two different composite resins stained with tea. Materials and Methods: Twenty Five specimens were prepared for each of the two composite resins Filtek Z350 (Z350) and Polofil Supra (PS), and the specimens were then stained in a tea solution. Each composite group was randomly divided into five subgroups (n = 5) according to the immersion solution: Distilled water (DW) (negative control); Crest 3D White mouthwash (CR); Listerine whitening mouthwash (LS); Colgate Optic White Mouthwash (CO), and Opalescence PF gel (OP) (16% carbamide peroxide, positive control). The colour of the specimens was measured with a spectrophotometer according to the CIEL*a*b* colour scale at baseline, after staining, and on the 7th, 28th, and 56th days of the treatment period. The colour differences (ΔE) were analysed with a two way ANOVA followed by Tukey’s test (P < 0.05). Results: The discoloration of the specimens after immersion in the mouthwashes decreased significantly over time. Only the staining of the Z350 specimens treated with CR, LS, and OP decreased to a clinically acceptable level at the end-treatment period. Conclusion: The nanohybrid composite (Z350) showed the least discoloration, followed by the microhybrid (Polofil Supra).

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INTRODUCTION:
Composite resins are commonly used in restorative dentistry because they have excellent esthetic properties and can be bonded to dentin and enamel.\(^1\) Their increasing popularity can be ascribed to the esthetic demands from patients for tooth-coloured restorative materials. Although the initial esthetic outcome may be excellent, one of the major disadvantage of composite resins is discoloration after prolonged exposure to varied conditions in the oral cavity.\(^2\) The change in colour and loss of shade matching with the surrounding tooth structure cause esthetic problems and may lead to the replacement of restorations. This is a very expensive and time-consuming process.\(^5,6\)

The colour stability of composite materials has been examined by artificial aging and by immersion in colored solutions, such as tea, coffee, and red wine.\(^5,9\) A number of factors, such as incomplete polymerization, water sorption, chemical reactivity, diet, oral hygiene, and surface roughness of the restoration, can influence the degree of discoloration.\(^10\) The structure of the composite resin and the characteristics of the particles have a direct impact on the surface roughness and susceptibility to extrinsic discoloration. Villita et al reported that hydrophobic materials showed better colour stability and stain resistance than hydrophilic materials.\(^8\)

Mouthwashes are very popular oral hygiene agents. They can chemically control cariogenic biofilms and aid remineralization. Due to the rise in patients' concerns about the esthetic appearance of their teeth in recent years, the number of mouthwash products containing hydrogen peroxide has significantly increased.\(^11\) Mouthwashes that include a low concentration of hydrogen peroxide and sodium hexametaphosphate can help prevent stains and fight plaque buildup.\(^12\) Hydrogen peroxide penetrates the tooth and produces free radicals, which attack and break apart the chromophore bonds of large, long chain, dark-coloured molecules; this eventually breaks down the molecules and chromophore bonds, resulting in changes in tooth colour.\(^13\) However, in some cases, hydrogen peroxide may not whiten teeth substantially due to the method of application and the length of time it is in contact with the teeth. Ganay et al examined the effects of bleaching agents on composite resin materials.\(^13,14\) However, there is little information available on the impact of mouthwashes on stained direct composites.

AIM AND OBJECTIVES:
The aim of this in vitro study was to evaluate colour changes in two stained universal composite resins immersed for different times in three hydrogen peroxide based mouthwashes compared with those immersed in a 16% carbamide peroxide bleaching gel.
The null hypotheses were that:
1. The mouthwashes would not affect the colour stability of the composite resins,
2. The immersion time in the mouthwashes would not affect the results,
3. There would be no significant colour differences among the mouthwashes used.

MATERIALS AND METHOD:
The details of the materials used in this study are presented in Tables 1 and 2. Twenty five specimens from each universal composite resin Filtek Z350 (Z35), and Polofil Supra(PS), A2 shade, were prepared using a silicon cylindrical mould (10 mm in diameter and 2 mm in depth). Each composite resin was loaded into the mold, fixed on a glass slide, and covered with a transparent Mylar strip. Excess materials were then removed by applying pressure on another glass slide placed on the Mylar strip to obtain a flat surface. The composite resins were polymerized with a light-emitting diode (LED-D, Woodpecker) according to the manufacturer’s recommended cure time. The power output of the light unit was checked using a power meter (Bluephase Meter-II, Ivoclar Vivadent, India) to maintain the light intensity at 800 mW/cm². The specimens were removed from the molds, and the top and bottom surfaces of the composites were polished with finer grit (Sof-Lex, 3M ESPE, St. Paul, MN, USA) for 10s. The polishing process was conducted using a low-speed handpiece under dry conditions. To complete the polymerization, the specimens were stored in distilled water and dark containers at 37°C for 24 hours.

The prepared composite specimens were immersed for 7 days in a tea mixture, which was prepared by brewing 3.5 g of black tea (Tata Tea Gold, Tata Tea, India) in 100 mL of boiled distilled water for 10-12 min. The specimens were then washed with running distilled water for 1 min. Twenty-five stained specimens per composite resin were then randomly divided into five different groups (n = 5) according to the immersion solution: Distilled water (DW group, negative control), Crest 3D White whitening mouthwash for 4 min daily for 56 days at 37°C (CR group), Listerine whitening mouthwash for 4 min daily for 56 days at 37°C (LS group), Colgate Optic White whitening mouthwash for 4 min daily for 56 days at 37°C (CO group), and a positive control group, with the specimens placed in glass containers filled with bleaching gel Opalescence PF (16% carbamide peroxide) for 4 hours daily at 37°C, for 14 days (OP group). All the specimens were immersed in distilled water in dark containers at 37°C for the rest of the day. After the completion of bleaching with carbamide peroxide, the specimens were immersed in distilled water until the end of the experiment.

One trained operator used a digital spectrophotometer (VITA Easyscale Advance, Zahndfabrik, Bad Säckingen, Germany) to measure the colour of each specimen in standardized daylight against a standard white background. The spectrophotometer was calibrated according to the manufacturer’s recommendations. The spectrophotometric data were recorded according to the colour system recommended by the Commission international de l’éclairage (CIELAB-CIE1976 L*a*b*). The L* scale indicates the amount of lightness in a specimen and varies from black (0) to white (100). The a* scale indicates the amount of red (+a*) and green (−a*) in the specimens, and the b* scale denotes the amount of yellow (+b*) and blue (−b*).

The colour measurements were performed at different times: Baseline (before staining the prepared composite specimens); after immersion in the tea solution; and after 7 days, 28 days, and 56 days of whitening. The colour difference between two measurements was calculated using the following formula:

$$\Delta E = \sqrt{(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2} = \sqrt{(L_1 - L_0)^2 + (a_1 - a_0)^2 + (b_1 - b_0)^2}$$

Where the subscripts 0 and 1 denote the initial and final measurements, respectively.

When ΔE values are below 3.3 units, the difference is clinically acceptable. Colour differences in this study were calculated using baseline colour parameters at each measurement time: After staining (T0), and on the 7th (T1), 28th (T2), and 56th (T3) days of the treatment period. In the Opalescence group, the colour differences were calculated on days 7, 14 (recorded as 28 days in this study), and 56 of the treatment period.

Graph Pad Prism 7.0 was used to analyze the data. Parametric tests were used, as the data were normally distributed. After staining, the data
obtained were assessed by a paired t test. Between treatments (vs distilled water), mean colour change overtime was analysed by repeated measure two-way ANOVA. Within treatment, mean colour change at specified time was analysed by paired t test. After the whitening period, analysis of the mean ΔE values (between each mouthwashes) was performed with a two-way repeated-measure ANOVA and Tukey’s multi-group comparison test at P < 0.05.

### Table 1 - Composition of mouthwashes and bleaching gel used in this study

<table>
<thead>
<tr>
<th>Brand name (code)</th>
<th>Manufacture</th>
<th>Material composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listerine whitening mouthwash (LS)</td>
<td>Johnson &amp; Johnson Healthcare Products, Skilman, NJ, USA</td>
<td>Water, alcohol (8%), hydrogen peroxide, tetrapotassium pyrophosphate, pentasodium triphosphate, citric acid, poloxamer 407, flavor, sodium saccharin, sucralose</td>
</tr>
<tr>
<td>Crest 3D White Multi-Care whitening mouthwash (CR)</td>
<td>Procter &amp; Gamble, Cincinnati, OH, USA</td>
<td>Water, 1.5% hydrogen peroxide, propylene glycol, sodium hexametaphosphate, poloxamer 407, sodium citrate, flavor, sodium saccharin, citric acid</td>
</tr>
<tr>
<td>Colgate optic white mouthwash (CO)</td>
<td></td>
<td>Water, Glycerin, Propylene Glycol, Sorbitol, Hydrogen Peroxide, Tetrapotassium Pyrophosphate, Polysorbate 20, Phosphoric Acid, Tetrasodium Pyrophosphate, Flavor, Citric Acid, Sodium Saccharin, Sucralose</td>
</tr>
<tr>
<td>Opalescence PF 16% (OP)</td>
<td>Ultradent Products Inc., South Jordan, UT, USA</td>
<td>Glycerin, water, xylitol, carbamide peroxide, flavor, carbomer, PEG-300, sodium hydroxide, potassium nitrate, EDTA, sodium fluoride</td>
</tr>
</tbody>
</table>

### Table 2 - Composition of composite resin materials tested in this study

<table>
<thead>
<tr>
<th>Composition (code)</th>
<th>Resin type (Universal,A2)</th>
<th>Manufacture</th>
<th>Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filtek Z350 (Z35)</td>
<td>Nanofilled</td>
<td>3M ESPE, St. Paul, MN, USA</td>
<td>Resin- bis-GMA, UDMA, TEGDMA and bis-EMA Filles-20nm silica filler, 4-11nm zirconia filler, and aggregated zirconia/silica cluster filler. Filler amt-63.3vol % (78.5 wt %)</td>
</tr>
<tr>
<td>Polofil Supra(PS)</td>
<td>Microhybrid</td>
<td>Voco GmbH, Germany</td>
<td>60% vol % (76.5 wt %), inorganic fillers, microfillers (approx.. 0.05 um %) and micro particle fillers (approx. 0.5-2 um)</td>
</tr>
</tbody>
</table>
RESULTS

The colour changes (ΔE) of all the composite resins after immersion in the tea solution are represented in Figure 1. The level of staining differed significantly among the composite resin groups (P < 0.01) ** p < 0.01

Figure 2: The mean± standard deviations colour change over time after various mouthwashes treatment (N=5 in each treatment)

** p < 0.01, * p < 0.05 denotes statistically significant difference
** p < 0.01, * p < 0.05 denotes statistically significant difference

Table 1: The results of two way repeated measure ANOVA

<table>
<thead>
<tr>
<th>Effect</th>
<th>DF</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tests of between-treatment effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mouth wash</td>
<td>3</td>
<td>8.65</td>
<td>6.4</td>
<td>0.0007</td>
</tr>
<tr>
<td>Composite</td>
<td>3</td>
<td>56.5</td>
<td>41.83</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Mouthwash x Composite</td>
<td>9</td>
<td>0.95</td>
<td>0.71</td>
<td>0.69</td>
</tr>
</tbody>
</table>

In Filtek Z350 composite, the results of the repeated measure ANOVA revealed that the immersion time in the mouthwashes and mouthwash used, and the interactions among them did not significantly affected the ΔE values (p=0.69)

Table 2: The results of two-way repeated-measure ANOVA

<table>
<thead>
<tr>
<th>Effect</th>
<th>DF</th>
<th>Mean Square</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tests of between-treatment effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mouth wash</td>
<td>3</td>
<td>24.89</td>
<td>132.84</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Composite</td>
<td>3</td>
<td>172.39</td>
<td>920.16</td>
<td>&lt;.0001</td>
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<tr>
<td>Mouthwash x Composite</td>
<td>9</td>
<td>6.48</td>
<td>34.61</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

In Polofil Supra composite, the results of the repeated measure ANOVA revealed that the immersion time in the mouthwashes and mouthwash used, and the interactions among them significantly affected the ΔE values (p=<.0001)
DISCUSSION:
This in vitro study evaluated colour changes of stained composite resin specimen treated with commercially available mouthwashes containing hydrogen peroxide. The findings of the two-way ANOVA revealed that the immersion period and the mouthwashes had a major influence on colour changes. Thus, the null hypothesis that the mouthwashes would have no effect on colour stability of stained composite resin was rejected.

The colour stability of different composite resin materials has been reported to be inconsistent. The staining susceptibility of a composite resin may be attributed to its resin matrix or filler type. Antonson et al reported that the size and composition of filler particles affect the roughness of composite resin materials, with smaller voids left on the surface of nanohybrid composite resins compared to other composite materials. The results of our study showed that the staining susceptibility of a nanohybrid composite, Filtek Z350, was significantly lower than that of the other composites.

One of the most prevalent drinks in the world is tea. Tea produced more severe staining in tooth-colored restorative materials than did cola-based beverages. In the present study, tea staining was preferred because tea has been proven to have a higher capacity for staining composite resins than other solutions, such as coffee or other beverages.

The findings of the current study demonstrated that the colour of the tea-stained Z350 specimens in the Listerine and Crest 3D groups returned to baseline after 56 days of immersion (ΔE < 3.3). Only the mean ΔE values of the Z350 composite specimens bleached with the at-home bleaching gel decreased to an acceptable level after 14 days of the treatment. Villalta et al. examined the effects of bleaching systems on colour changes of nanocomposite and microhybrid resins stained with different solutions and reported that the colors of both types of composite specimens returned to the baseline. On the other hand, in a study of the effectiveness of mouthwashes in the colour recovery of a stained microhybrid composite, Harorli et al. found that the immersion time in the mouthwash and the brand of mouthwash had a significant effect on the color recovery of the stained composite.

In the present study, Distilled Water was selected as the negative control group because water is a common component of both solid and liquid diets. Hattab FN et al demonstrated that although water helped to dissolve stains and ameliorated color changes in composite resins, it did not fully dissolve hydrophobic molecules. In the present study, the level of staining of Polofil Supra composites significantly decreased with increased time when immersed in Distilled Water but that of the Z350 composites did not change, which may be attributed to various factors, such as the filler content, filler type, and water solubility.

The mouthwashes tested in this study included whitening products containing a low concentration of hydrogen peroxide (1-2%), sodium hexametaphosphate, and pyrophosphates. These products work either by bleaching or by removal and control of stains. The actual teeth whitening mechanism of hydrogen peroxide is not fully known, but it is thought to be the result of an oxidation reaction in which the pigment molecules are broken down.

Lu H et al suggested that the colour change of composite resins after the use of whitening agents was due to extrinsic cleansing of specimens, not an intrinsic colour change. In the present study, the mouthwashes were effective in removing stains from the composite resins over time. At the end of the 56-day treatment period, there were no statistically significant differences in the color change of any of the composites tested, irrespective of the type of mouthwash used. Only the Listerine mouthwash was as effective as the at-home bleaching gel in removing stains from all the composite resins tested.

Carbamide peroxide (16%) was chosen as the positive control group because home bleaching methods are commonly used in dental practice to whiten teeth. Home bleaching gel (10% carbamide peroxide) contains 3.5% hydrogen peroxide, and this percentage is greater than that found in the mouthwashes examined in this study. The efficacy of whitening mouthwashes may be decreased by the fact that they are in contact with the teeth for a short period of time compared with bleaching gel for use at home. In the present study, the immersion time in the mouthwash had a significant influence on stain removal from the
composite. However, the continuous use of a mouthwash can cause side effects, such as mucosa desquamation, ulceration, inflammation, allergic reactions, and burning mouth sensation.

Mouthwashes have become extremely popular teeth whitening agents because of their ease of application, low cost, and wide availability. Consequently, after using whitening products, the colour of the composite resin restoration may not match that of the surrounding whitened teeth. Thus, patients should be informed that replacement of composite restorations in teeth may be required after use of whitening mouthwash, depending upon the extent of the color change.

This in vitro study evaluated the color stability of two different composite resin materials after immersion in only tea solution. The consumption of different staining substances, immersion time in staining solution, and absence of cleaning or brushing of the specimens during the study are significant factors affecting the colour stability of composite materials. Therefore, additional studies should be conducted to evaluate the effect of mouthwashes in the composite materials under the oral environment and different storage conditions.

**CONCLUSION:**

In conclusion, immersion in a tea solution caused severe discoloration of the two composite types studied. The nanohybrid composite (Z350) showed the least discoloration, followed by the microhybrid (Polofil Supra). The discoloration of the specimens after immersion in the mouthwashes decreased significantly over time. The colour alteration ($\Delta E$) in all the composite groups differed significantly at the time intervals evaluated compared to the Distilled Water group. Only the composites treated with the Listerine mouthwash showed a similar colour change to that of the Opalescene group. The staining of the Z350 composite treated with Crest 3D and Listerine decreased to the clinically acceptable level after the 56-day period.
REFERENCES:


SMILE ENHANCEMENT BY LIP REPOSITIONING SURGERY: A CASE REPORT

Dipen Barot*, Shikha Mavani**, Tejal Sheth***, Dhwanit Thakore****

ABSTRACT

Objective: One of the most important goals of dental clinicians is to meet the esthetic expectations of the patients. Excessive gingival display upon smiling is defined as “gummy smiling” and this situation may be a problem for the patients. Orthognathic surgery performed in gummy smile cases resulting from jaw deformities eliminates this problem. However, these procedures are quite invasive and requires hospitalization of the patients. For these reasons, “lip repositioning procedure”, which involves retraction of smile elevator muscles, may be an alternative in the treatment of some gummy smile cases. Materials and Methods: Gummy smile resulting from lip hyperactivity was diagnosed in a 34-year old female in the Department of Periodontics & Oral Implantogy, At Ahmedabad Dental College & Hospital with the complaint of excessive gingival display upon smiling. Lip repositioning procedure depending on the removal of a strip of mucosa from the maxillary buccal vestibule and suturing the lip mucosa to the mucogingival line was performed. The procedure restricts the muscle pull of the elevator lip repositioning to reduce gingival display. Results: Clinical success was achieved. The patient complained about tension while talking or smiling, which lasted for one week. At the 1-year follow-up, it was observed that the results were maintained and patient was satisfied with her clinical appearance. Conclusions: Lip repositioning procedure performed in the true indication may be an alternative in the treatment of gummy smile.

Key Words: Gummy smile; Excessive gingival display; Lip repositioning; Periodontal plastic surgery

INTRODUCTION:

One objective of the dental clinician is to meet patient expectations. A person's smile is one of the most important factors for the first impression. Patients with excessive gingival display, also known as “gummy smile,” usually experience dissatisfaction with their clinical appearance.

A gummy smile has four different etiologies. The first is passive eruption where gingiva does not complete its apical migration. In these patients, the problem can be solved through crown lengthening, which is a very simple and effective procedure involving hard and soft tissue resection. The second etiology is a dentoalveolar extrusion. Patients with a dentoalveolar extrusion must be treated by an orthodontist or through orthognathic surgery. The third etiology is a vertical maxillary excess; for these patients, orthognathic surgery is the inevitable treatment choice. The fourth etiology is a hyperactive upper lip; these patients have different treatment choices available with variable outcomes reported for each, including a myectomy, botulinum toxin injection, lip elongation (associated with rhinoplasty), detachment of lip muscles, and lip repositioning. Lip repositioning was first defined in plastic surgery literature in 1973; the topic was recently explored again in periodontology literature. The objective of lip repositioning is to partially inhibit gingival display by limiting the retraction of elevator smile muscles (i.e. zygomaticus minor, levator anguli, orbicularis oris, and levator labii superioris). This technique involves removing a strip of maxillary vestibule mucosa and suturing the mucosa to the mucogingival line. Other procedures are invasive, require patient hospitalization, or involve a long treatment period. For these reasons, lip repositioning may be an effective and alternative treatment in particular cases of gummy smile.

The aim of this case report is to present the one-year outcome of gummy smile treatment using lip repositioning.

CASE REPORT:

A 34-year-old woman visited the Department of Periodontics & Oral Implantogy, At Ahmedabad Dental College & Hospital. Her chief complaint was excessive gingival display upon smiling (Figure 1). She desired to minimize the gingival display of while smiling. Her medical history was unremarkable. On clinical examination, it was determined that the etiology of gummy smile was delayed tooth eruption and lip hyperactivity.

*PG Student, **PG Student, ***Reader, ****Senior Lecturer

DEPARTMENT OF PERIODONTICS AND IMPLANTOLOGY AHMEDABAD DENTAL COLLEGE AND HOSPITAL

ADDRESS FOR AUTHOR CORRESPONDENCE: DR. DIPEN BAROT, TEL: +91 9898620373
Treatment options mentioned above were then explained to the patient. In accordance with the patient choice of therapy, a lip repositioning surgery was scheduled. Before surgery, the patient signed the informed consent.

**Figure 1: Pre-treatment excessive gingival display upon smiling.**

**SURGICAL PROCEDURE:**
Thirty minutes prior to the operation, 100 mg ibuprofen was given to the patient to reduce post-surgery pain. Povidone iodine (was used as an extraoral antisepsis and the patient rinsed with 0.12% chlorhexidine for 1 minute. Local infiltration anesthesia was performed from maxillary right first pre-molar to left pre-molar, a sterile pencil was used to mark the border line of incisions on the mucosa. The incision began horizontally from maxillary right first pre-molar to left pre-molar of maxilla.

This incision was approximately 1 mm coronal to the mucogingival line; the second incision was performed 10-12 mm apical to the mucogingival line and was parallel to the first incision. Finally, two parallel incisions were connected by two vertical incisions. Strips of outlined mucosa, as well as minor salivary glands and fat tissue, were removed. All incisions and mucosal removal were performed using #15c blades. After that Perio-col as a GTR membrane for maintenance of space was placed. The parallel incisions were sutured with 4.0 Vicryl.
Debridement of the Surgical Area

POST-OPERATIVE MANAGEMENT:
Postoperative care included one week of analgesics (100 mg of ibuprofen) taken twice daily and an antimicrobial mouth rinse (0.12% chlorhexidine) used twice daily for one week. Patient was given a soft diet, an ice compress on the day of surgery and was informed to minimize lip movement on smiling and talking or avoiding any mechanical trauma.

RESULTS:
Postoperative healing was uneventful and she disclosed minimal discomfort for few days. The patient complained about tension while talking or smiling, which lasted for one week. Sutures were removed at 14 days following surgery. A minor scar formation occurred along the suture lines. There was excessive gingival display of 11 mm preoperatively it was reduced to 6 mm postoperative.

DISCUSSION:
This case presentation aimed to present the one-year outcome for a gummy smile treated with lip repositioning surgery which demonstrated hyperactive upper lip. In this case, 12 mm of mucosa was removed as the other investigators suggested without any prediction on the amount of reduction in gingival display. Riberio-Junior et al., have already reported that no correlation existed between the amount of tissue removed and
reduction of gingival display. In the postoperative period healing of the operation area was uneventful. Our patient experienced little discomfort (tension and swelling) upon smiling and talking which lasted 2 weeks. In literature, similar post-operative symptoms during the first week were also reported by the other clinicians. Discomfort following operation showed variance between the case reports depending on the patient's perceptions.

Previous studies reported that a relapse can occur after lip repositioning surgery. One of the most important predisposing factor for relapse is the presence thin biotype. In our case, no relapse occurred through 1 year of follow-up. Thick biotype in our patient probably played the key role in this outcome. Although having not occurred in our case, asymmetry upon smiling could have been encountered as another important complication.

Various techniques such as myectomy, botulinum toxin injection, lip elongation (associated with rhinoplasty), detachment of lip muscles have been used in the treatment of gummy smile. Dental clinicians should prefer the least invasive and more simple and predictable treatment choice in such cases. Lip repositioning performed in our patient serves as a good sample in this sense.

The 1-year follow-up showed a reduction of gingival display with minor scar formation. The patient was satisfied with her clinical appearance.

CONCLUSION:

The least invasive way of treating gummy smile requires proper diagnosis of the underlying etiology. Lip repositioning surgery may be a good treatment alternative to reduce the amount of gingival display in patients with upper lip hyperactivity as reported in this case. Both the patient and the clinicians were satisfied with the final outcome which was maintained a year.

REFERENCES:


ABSTRACT

Erythema multiforme (EM) is a mucocutaneous disorder, which ranges from a mild, self-limited, cutaneous, exanthematous variant with minimal oral involvement to a progressive, fulminating, severe variant with extensive mucocutaneous epithelial necrosis (Stevens-Johnson syndrome; and toxic epidermal necrolysis). EM results from a cell-mediated immune reaction against a precipitating factor, it is characterized by ulcerations, erosions, and bleeding within the mucosa associated with encrustations and tissue tags. Dermal counterparts present with target iris lesion. Here, we report a case of EM major where there are classical oral and dermal lesions in a 40-year-old male patient.

Key Words: Erythema multiforme, Mucocutaneous disorder, Target lesion, Vesiculo-bullous lesions

Received: 30-07-2018; Review Completed: 23-10-2018; Accepted: 18-01-2019

INTRODUCTION:
Ferdinand Von Hebra described erythema multiforme (EM) in the year 1866 as a self-limited and acute skin disease that is symmetrically scattered on the extremities with a typical recurring concentric pattern in the form of “target lesion”. Despite being often caused by, or at least associated with, infection or drug therapy, the pathogenic mechanism of EM remains unclear, and as a consequence there are no evidence-based, reliably effective therapies. EM and related disorders comprise a group of mucocutaneous disorders characterized by variable degrees of mucosal and cutaneous blistering and ulceration that occasionally can give rise to systemic upset and possibly compromise life.

CASE REPORT:
A 40 year old male presented with a painful mouth owing to ulcers associated with bleeding since 2 weeks.

History revealed fever 2 weeks ago, following which he noticed vesicles on the bilateral buccal mucosa [Figure 1 & 2] and labial mucosa [Figure 3 & 4]. The vesicles subsequently ruptured leaving ulcerated areas and encrustations associated with severe pain and bleeding on mastication, making it difficult to consume food. Five days after the appearance of oral lesions, he developed cutaneous lesions on the upper and lower extremities, which were preceded by itching. General physical examination unveiled multiple concentric target or iris lesions on upper and lower extremities [Figure 5.
Encrustations that bleed readily on provocation were noticed on the lips and upper and lower labial mucosa which were jagged and tender, sparing gingiva. Compromised oral hygiene, diffuse multiple ulcers, and erosions were present on the upper and lower labial mucosa, bilateral buccal mucosa extending to the retromolar area. The floors of ulcers were covered by pseudomembrane, surrounded by erythematous halo with irregular margins and a nonindurated base with bleeding on provocation.

Erythema Multiforme, Stevens-Johnson syndrome, Mucous membrane pemphigoid and pemphigus vulgaris were considered as differential diagnosis. As patient was not ready for biopsy, cytosmear was taken. Cytosmear report showed basophilic cells and a few nucleated eosinophilic cells. Allergy test showed patient was allergic to groundnut, cabbage and housedustmite.

Considering the history, prodromal symptoms, hemorrhagic crustations involving the upper and lower lips in addition to widespread involvement of oral mucosa and symmetric distribution of the target/iris/bull eye shaped dermal lesions (pathognomic) on extremities; the condition was diagnosed as Erythema Multiforme major.

The patient was prescribed ointment Betnovate 0.1% t.i.d., along with a topical antiseptic analgesic gel (Dologel CT). Total resolution of the oral and dermal lesions with hypopigmentation in oral mucosa.
DISCUSSION:

Erythema multiforme is an acute, sometimes recurrent, mucocutaneous condition of uncertain etiopathogenesis that can follow the administration of drugs or infections. Medical literature has coupled numerous factors to the development of EM. These include infections, use of certain medications, malignancy, autoimmunity, radiation, immunization, and menstruation. Of these, infection represents approximately 90% cases, and the most common agent is herpes simplex virus (HSV), which is drawn in up to 70–80% of the cases.

Classification of EM is according to the degree of mucosal involvement and existence of dermatologic lesions:

i. Erythema Multiforme minor (EM minor) - typical targets or raised, edematous papules distributed acrally.

ii. Erythema multiforme major (EM major) - Typical targets or raised, edematous papules distributed acrally with involvement of one or more mucous membranes; epidermal detachment involves less than 10% of total body surface area (TBSA).

iii. Stevens-Johnson syndrome (SJS) - detachment below 10% of the TBSA plus widespread erythematous or purpuric macules or flat atypical targets and iv. Toxic epidermal necrolysis (TEN) - detachment above 30% of the body surface area plus widespread purpuric macules or flat atypical targets.

Typical and/or raised atypical target lesions are the hallmark of Erythema Multiforme. Disease involves less than 10% of the body surface area. Lesions are often symmetric in distribution, with a predilection for the extensor surfaces of the extremities. Our case was presented with typical target lesions on upper & lower extremities.

Erythema Multiforme usually affects the lingual, buccal, and/or labial mucosa, and less frequently the floor of the mouth, palate and the gingivae.

The oral manifestations of the spectrum of EM range from tender superficial erythematous and hyperkeratotic plaques to painful deep hemorrhagic bullae and erosions. The oral lesions initially
manifest with edema, erythema, and erythematous macules of the lips and buccal mucosa, followed by the development of multiple vesicles and bullae that quickly rupture and result in pseudomembrane formation. The lips tend to become swollen and show diagnostically distinctive bloody excrutions. Intact vesicles are rarely observed because they rapidly breakdown to form illdefined ulcers. Affected patients may also have trismus, dysphonia, dysarthria, and/or dysphagia. Our patient had presentation of encrusted lesions that bled readily on provocation on the lips, upper and lower labial mucosa. Patient had compromised oral hygiene, diffuse multiple ulcers and erosions were also present on the upper and lower labial mucosa, bilateral buccal mucosa extending up to the retromolar area. Differential diagnosis are to be considered in the lesion confined to oral cavity are herpes, vesiculobullous lesions like pemphigus vulgaris, bullous pemphigoid. Herpetic lesions are usually smaller and well circumscribed, more common in keratinized mucosa especially in gingiva. Our case did not have any gingival ulceration. Extensive irregular ulcerations in the lining non keratinized mucosa were seen in our case also showed mild ulcerations, which were typical of EM and were not feature of herpes infections. Temporal relationship between the drug intake and onset of disease excludes the possibility of any infectious etiology.

Microscopic examination of skin lesions reveals edema just below the epidermis that when mild or moderate, produces urticarial lesions; when the edema is severe, blisters are formed. Other histological features consist of dilation of blood vessels, accompanied by a perivascular infiltration composed mainly of lymphocytes, nuclear dust resulting from disintegration of neutrophils and eosinophils (leukocytoclasis), edema, acanthosis and erythrocytes extravasations. The characteristic histopathological change of EM minor is epidermal cell death, which is termed “satellite cell necrosis”, mimicking apoptotic cell death. In our case cytosmear report showed basophilic cells and a few nucleated eosinophilic cells. There were no tzanck cells seen in cytology report which further excluded herpes simplex virus.

The mainstay of treatment is topical like kenacort, flucort or betnovate; and/or systemic corticosteroids like prednisolone (0.5–1.0 mg/kg/day tapered over 7–10 days) or azathioprine, or both or other immunomodulatory drugs such as cyclophosphamide, dapsone, cyclosporine, levamisole, thalidomide or interferon-a. Cyclosporine given intermittently may control recurrent EM. Antiseptic, analgesic and anesthetic mouthwash containing benzidamine hydrochloride, diphenhydramine hydrochloride and diclofen are also prescribed. In our case the patient was prescribed ointment Betnovate 0.1% t.i.d., along with a topical antiseptic analgesic gel (DologelCT).

Most cases of EM are self-limited, with lesions evolving over 1-2 weeks and subsequently resolving within 2-3 weeks. Patients who form keloids may be at higher risk. Hypopigmentation or hyperpigmentation may follow resolution of lesions. Our case showed healing with hypopigmentation of oral lesions and hyperpigmentation of dermal lesions on follow up in 1 month.

Recurrence is common in EM (up to one-third of cases) but is not common in Stevens - Johnson syndrome (SJS) / Toxic Epidermal Necrolysis (TEN). Failure to diagnose SJS early in the course may result in a premature discharge of the patient, with subsequent deterioration in patient's condition. Patients and parents, when appropriate, should be warned about potential long-term complications.

CONCLUSION:

In conclusion, EM is a mucocutaneous disease that requires a prompt and precise diagnosis. An important step in the management of erythema multiforme is recognition and withdrawal of the causative agent. The treatment with topical corticosteroids along with an antiseptic analgesic can be considered before prescribing systemic corticosteroids. By delivering apt information, educating the patient and prevention of contact with the causative agent oral physicians can play a role in preventing the recurrence of these lesions.
REFERENCES:


Tooth extraction whether traumatic or atraumatic, results in alveolar bone loss both in height and width. An average of 40-60% of original height and width is expected to be lost after extraction, most of which takes place within the first year. Socket Preservation is a procedure in which graft material or scaffold is placed in the socket of an extracted tooth at the time of extraction to preserve the alveolar ridge. In this case report, it is described how the socket of the upper molar teeth is preserved with collaplugs. PRF plugs also maintains the soft tissue contour of the ridge.

Key Words: Extraction, Socket preservation, resorption

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INTRODUCTION:
Soft tissue contour depends on the underlying bone anatomy, following tooth extraction, sockets undergoes a remodeling process that influences the implant rehabilitation treatment of the edentulous areas. Socket preservation procedure following tooth extraction will reduce the need for any further ridge augmentation technique prior to implant placement and will conserve the existing bone. The aim is to preserve the original bone dimensional contours by limiting the normal post extraction resorptive process. The rate of reduction of residual alveolar ridges is greater in mandibular (0.4mm/year) than in maxillary arches (0.1mm/year), 1mm in vertical bone 2-2.5mm in horizontal bone resorption corresponding to 2mm soft tissue recession.

Socket Preservation differs from Ridge Augmentation; in Socket Preservation, the graft or scaffold is placed inside the tooth socket immediately after extraction, whereas the Ridge Augmentation grafting procedure is done to bring back the lost bone after the bone has resorbed and there is insufficient ridge height or width for further treatment procedure.

INDICATIONS:
1. Immediately after tooth removal in extraction socket site prevents immediate bone resorption.
2. Preparation of healthy soft and hard tissue bed for future dental procedures
3. When immediate implant placement is contraindicated and delayed implant placement is more appropriate, especially in esthetic cases.
4. Maintains contour and integrity of the socket.

Without socket preservation, residual bones could loose volume resulting in loss of facial vertical and horizontal dimension and changes in facial soft tissues aesthetics.

CONTRAINDICATIONS:
1. Severe and uncontrolled diabetic patients
2. Patients undergoing radiation therapy on the oral cavity
3. Infected extraction site with acute condition
4. Patients with severe gum disease
5. Patients with systemic diseases contraindicating placement of scaffolds
6. Heavy smokers
7. Deciduous teeth socket
8. Patients having allergic reaction to synthetic materials.

CLINICAL ASSESSMENT:
1. Careful radiographic evaluation.
2. Evaluation may be enhanced using Cone beam CT.
3. Decision making on type of extraction required.
4. Bone sounding, confirm the condition of labial, buccal and palatal bone height.
5. Quality and quantity of gingival tissues around the tooth should be evaluated to access the need for connective tissue grafting.
Keys to successful Extraction-socket Grafting

According to Dr. Carl Misch, some keys to successful bone grafting of extraction sites include:

1. Atraumatic tooth removal.
2. An evaluation of the remaining walls of bone following the extraction, and evaluation of the size of the defect.
3. Asepsis and complete removal of granulomatous tissue.
4. Ensuring adequate blood supply to the graft site.
5. Graft containment and soft tissue closure.
6. Choice of an appropriate graft material.
7. Ensuring adequate time for healing.

CLINICAL CASE:

A 57 year old patient male with a noncontributory medical history, presented to our clinic with chief complaint of decayed teeth and difficulty in chewing in upper right back teeth region since 5 years. The tooth was deemed hopeless and referred for extraction with socket preservation for future dental implant placement. After tooth was atraumatically removed with forceps technique, the extraction socket was filled with collaplug. Primary closure was achieved. Follow is taken at one week and 4 months.

Preoperative Radiograph

Preoperative Clinically

Extracted Root pieces

Collaplug
Presuturing and collaplug placed

Suturing

One week follow up

4 Month follow up

4 Month follow up Radiographically

Discussion:
The resorption of the alveolar ridge following tooth extraction is a physiological phenomenon. The preservation of the morphology of the extraction socket has become critical due to increase bone volume in order to accommodate implant and thus improve implant stability. Bone graft materials have played an important role in regenerative dentistry for many years. There are three distinct properties of graft materials: Osteogenecity (ability to directly deposit bone by the viable osteoblasts present in the bone graft), osteoconductivity (ability of the graft to act as passive scaffolding that supports new bone formation and ingrowth of capillaries), and osteoinductivity (ability of differentiating factors that facilitate the recruitment and differentiation of mesenchymal stem cells and specifically induce them to form osteoblasts which deposit the new bone).

Among these the focus is on the osteoinductive property. The osteoinductive bone grafts contain the growth factors responsible for these stimuli, which are of the family of bone morphogenetic proteins, transforming growth factors, insulin-like growth factor, platelet derived growth factor and epidermal derived growth factor.

Today’s concept in tooth extraction shall routinely consider maintainence of the existing extraction socket dimensions with some sort of bone replacement material. This procedure has been called ARP or preservation. Traditionally, ARP includes the use of particulate
alloplasts, xenografts, autografts, and membranes manufactured from various materials, including that are bioabsorbable or nonresorbable, naturally derived or synthetic. Most of these materials have been shown not only to be osteoconductive but also many of them are associated with a number of disadvantages, such as increased overall cost, the requirement for a second surgical site and the use of anima-derived products.5

Till date, the rich and readily available autologuous source of growth factors is from platelets derived from the peripheral blood. They contain a number of different growth factors which are released into the tissue after injury. These include TGF-β, PDGF, IGF, AND FGF, which act as a differential factors on regenerating tissues. The PDGF is angiogenic and is known to stimulate the reproduction and chemotaxis of connective tissue cells and matrix deposition.3

A different approach for socket preservation is the use of bioabsorbable collagen. Collagen is the most abundant extracellular matrix and component of connective tissue. The collagen used in dental procedures is readily isolated and purified from various animal species by enzyme treatment collagen Type 1 is the main organic component that is originally secreted by osteoblasts, which then becomes mineralized at a later stage of bone development.6 Collagen has been actively investigated as a favorable artificial environment for bone in-growth. It was shown that endothelial cells adhere, spread, and proliferate on a collagen membrane. Collaplugs, an absorbable collagen sponge, consists of 85 to 95% of bovine collagen type I and 5-15% bovine collagen type III and has been used with great success. The sponge serves as a support to prevent the collapse of the surrounding soft tissue during the healing process. Hence the present study was to preserve the extraction socket with CollaPlug.4

In this case report, the post operative radiograph shows mature bone has formed in the extraction socket for implant placement.

CONCLUSION:
The socket preservation technique seems to show important results concerning bone volume conservation and favorable architecture of the alveolar ridge in order to obtain ideal functional and esthetic prosthesis after implant rehabilitations.

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ABSTRACT
Odontomas are the most common type of odontogenic tumors. They are included under the benign calcified odontogenic tumors. Odontomas are basically classified into two types, complex and compound odontoma. Various theories or etiological factors are been quoted for the occurrence of odontomas. Generally, they are asymptomatic. Occasionally, signs and symptoms relating to their presence do occur. The sole management depends upon the early diagnosis, histopathological examination and excision of these tissues. Here we report a case of compound odontoma in a 18-year-old male that has caused the impaction of upper right maxillary permanent central incisor.

Key Words: Odontoma, compound odontomas, Odontogenic tumour, Retained primary teeth, Impacted teeth.

INTRODUCTION:
The term odontoma was first used in 1967 by Paul Broca to describe all the odontogenic Tumors. Now odontomas are considered as hamartomas rather than true neoplasms. Odontomas are the most common type of odontogenic tumors. Odontomas constitute of about 22% of all odontogenic tumors of the jaws. They are more common in females. Odontomas occur more often in the permanent dentition and are very rarely associated with the primary teeth.

Odontomas are composed of enamel, dentine, cementum and, in some cases, pulp tissue.

 Clinically, odontomas are asymptomatic lesions often associated with alterations in tooth eruption. Odontomas are subdivided into compound and complex types. Compound odontomas are usually seen in the anterior region of the maxilla, over the crowns of unerupted teeth or between the roots of erupted teeth. Complex odontomas are mostly seen in the mandibular posterior region.

The diagnosis is made on routine-radiological studies, or on evaluating the cause of delayed tooth eruption. The lesions are unilocular that contain multiple radio-opaque miniature tooth-like structures known as denticles. Compound odontomas are usually not associated with bony expansion, but complex odontomas can cause marked bony expansion.

Here we report a case of compound odontoma in a 18-year-old male that has caused the impaction of maxillary right permanent central incisor.

CASE REPORT:
A 18 year old male presented with the difference in the size (broken tooth) (figure-1) of upper anterior teeth region since 3-4 years and gives the history of trauma in 51, pain and also bleeding at that time by falling down from stairs which had become annoying for him aesthetically.

Patient had not had not taken any treatment for the same.

Intraoral examination revealed missing 11 and 51 is present (figure-2) which is fractured and discoloured. The tooth was non-tender and non mobile.
Provisional diagnosis of retained deciduous 51 with impacted or missing 11 was considered.

Periapical radiograph (figure-3) in relation to 51 revealed a single radiopacity near the root of 51 and impacted 11 was present, the radiopacity was of around 0.5 cm in size and it gives tooth like appearance and the root of 51 is resorbed and the root canal cannot be traced.

To check the presence of similar radiopacities in other area, opg was advised. Orthopentamogram (opg) (figure-4) showed a single radio-opacity is seen on the maxillary front region near the crown of impacted 11 distal to the root of 12 and at the apex of 51 which is of around 0.5 cm in size. Three button shaped radio-opacity are seen which is impacted and apical to retained 51 same as tooth like in relation to 11.

Final diagnosis of odontoma in relation to 11 was made.

Extraction of 51 with removal of odontoma and passive eruption of 11 was advised.

**DISCUSSION:**

Odontomas are often found to disrupt the eruption of teeth, it may be associated with retention of deciduous teeth or may lead to mal-positioning of the permanent tooth, delayed eruption of a
permanent tooth or its impaction. Our patient had an retained deciduous 51 with impacted permanent 11.

Odontomas are benign tumors of odontogenic origin combining mesenchymal and epithelial elements. They chiefly consist of enamel, dentin and variable amounts of cementum and pulp. They are slow-growing, benign tumours showing nonaggressive behaviour. In odontome, the hard tissues are laid down in an abnormal pattern because the organisation of odontogenic cells fails to reach a normal state of morphodifferentiation. As this lesion is composed of more than one type of tissue, it is called as composite odontoma. Odontomas are subdivided into compound and complex types. Compound odontomas is composed of multiple, small tooth like structures. If the calcified dental tissues appear as an irregular mass bearing no morphologic similarity to even rudimentary teeth, they are called as complex composite odontoma. Complex odontomas are less common than the compound variety and are in the ratio of 1:2. In our patient a single radiopacity is seen on the maxillary front region near the crown of impacted 11 distal to the root of 12 and at the apex of 51 which is of around 0.5 cm in size. Three button shaped radiopacity are seen in which one is tooth like structure.

Four lesions containing enamel and dentine of normal appearance are defined in the WHO classification (1992). They are as follows.

1. **Ameloblastic fibro-odontoma:** Consists of varying amounts of calcified dental tissue and dental papilla-like tissue, the latter component resembling fibroma. The ameloblastic fibro-odontoma is considered as an immature precursor of complex odontoma.

2. **Odonto-ameloblastoma:** Its a very rare neoplasm which resembles an ameloblastoma both structurally and clinically but contains enamel and dentine.

3. **Complex odontoma:** When the calcified dental tissues are simply arranged in an irregular mass bearing no morphologic similarity to rudimentary teeth.

4. **Compound odontoma:** Composed of all odontogenic tissues in an orderly pattern that results in many teeth-like structures but without morphologic resemblance to normal teeth.

According to their position within the jaws Junquera classified odontomas as in 2005.

a. **Intraosseous (erupted odontoma):** They occur inside the bone and may erupt into the oral cavity. To date, 12 cases of the erupted variety have been described in the literature

b. **Extraosseous or peripheral odontomas:** These are odontomas occurring in the soft tissue covering the tooth bearing portions of the jaws, having a tendency to exfoliate.

According to Thoma and Goldman (1946). Odontomas are classified as:

- Germinated composite odontoma—two or more, more or less well-developed teeth fused together
- Compound composite odontomas—made up of more or less rudimentary teeth
- Complex composite odontomas—calcified structure, which bears no great resemblance to the normal anatomical arrangement of dental tissues
- Dilated odontomas—the crown or root part of tooth shows marked enlargement
- Cystic odontomas—an odontoma that is normally encapsulated by fibrous connective.

Gravey et al in 1999 classified compound odontomas as.

1. **Denticulo type:** Composed of two or more separated denticles having crown and root, dental hard tissue resembling that of the tooth.
2. **Particulate type:** Composed of two or more separate masses or particles, bearing no resemblance to the tooth.
3. **Denticulo-particulate type:** In this both denticles and particles are present together.

There are essentially two types of odontoma.

- **Complex composite odontoma.**
- **Compound composite odontoma.**

Z Gorlin et al eliminated the term composite as redundant and classified odontomas as either complex or compound.

On the basis of gross, radiographic and microscopic features two types of odontoma are recognized: (a) compound and (b) complex.

Our case presented with intraosseous particulate
type of odontoma. Although it has said that odontoma has a limited potential for growth, but its surgical removal is indicated as it is derived from tooth forming epithelial cells making it susceptible to cystic change, which may lead to extensive destruction of bone. The treatment options range from simple observation with periodic radiographs to monitor the odontoma, clinical evaluation of eruption of dentition or surgical removal. 

It has been reported that approximately 70% of the odontomas are associated with pathologies in the adjacent teeth such as malformation, malposition, aplasia of the tooth as a whole or resorption. In our patient, over retained 51 was present, the right maxillary central incisor was impacted by the presence of odontoma in the path of eruption.

CONCLUSION:

Odontoma present as the most common type of benign odontogenic tumours affecting the jaws. They are seldom symptomatic, so their detection relies on radiographic examinations. However, they cause impaction of permanent teeth and careful treatment planning is required to manage the case. The treatment approach of such odontoma requires interdisciplinary management by an Orthodontist, maxillofacial surgeon, periodontist and prosthodontics.

REFERENCES:

ACHIEVING EXCELLENT ESTHETIC AND FUNCTIONAL OUTCOME BY A MULTIDISCIPLINARY APPROACH: A CASE REPORT

Darshana Shah*, Chirag Chauhan**, Paras Doshi***, Monal Vora****, Devashree Toprani*****

ABSTRACT

Full mouth rehabilitation is a challenging treatment modality that improves the appearance of the patient and corrects imperfections in the occlusion. Vertical dimension, centric relation, speech and muscle tone are essential fundamentals of full mouth rehabilitation. There is a need to analyze each aspect carefully with regard to existing natural dentition and its relationship with the stomatognathic system. Full mouth rehabilitation tends to create smile that is not only esthetic but also functionally comfortable. This case report describes the full mouth prosthetic rehabilitation of a patient by Pankeymann-Schuyler philosophy as it is a well-organized procedure, where anterior guidance is first established followed by restoration of the posterior teeth.

Key Words: Full mouth rehabilitation, tooth wear, pankeymann-schuyler technique

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INTRODUCTION:

Full mouth rehabilitation cases are one of the most difficult cases to manage in dental practice. The severe wear of anterior teeth facilitates the loss of anterior guidance, which protects the posterior teeth from wear during excursive movement. The gradual wear of the occlusal surfaces of teeth is a normal process during the lifetime of a patient. However, excessive occlusal wear can result in pulpal pathology, occlusal disharmony, impaired function, and esthetic disfigurement. Full mouth reconstruction is basically a set of procedures that are aimed at correcting an improper bite position as well as restoring chipped or worn out teeth. Full mouth rehabilitation is done where severe tooth wearing off is present. Severe tooth wear is a potential threat for dentition and masticatory function. Many factors may combine to produce the worn dentition, and the etiology often remains unidentified. Full mouth rehabilitation is a challenging treatment modality that enhances the appearance of the patient and corrects imperfections in the occlusion. The complexity in treating a full mouth rehabilitation case is not only because of its long treatment time but also at times the lack of clarity in the treatment objective. A case has to be treated not only by correcting worn out, broken or discolored teeth but also requires treating the oral cavity holistically. Every patient with extreme tooth wear has unique treatment needs. The steps in treatment of these patients include a comprehensive examination, diagnostic mounting, careful planning and sequencing of various steps, discussion with the patient of the different treatment alternatives and careful execution of the treatment plan. This article reports a sequence of full mouth rehabilitation in a patient with completely worn dentition.

CASE REPORT:

A 62 year old female patient reported to the Department of Prosthodontics in Ahmedabad Dental College and Hospital with a chief complain of difficulty in chewing due to missing teeth, worn out dentition and poor esthetics.

Intraoral examination revealed missing teeth- 17, 46; root pieces- 26,27,35,36,45; grossly carious-24; mobility-28 and generalized attrition. (Figure-1)

An OPG (OrthoPantomoGram) (Figure-2) was advised for further treatment planning.

The treatment plan decided was extraction of 26,27,28,35,36,37,45; Root canal treatment in 31,32,33,41,42,43; Post and core in 22,23 and implant placement in 26,35,36,45,46 followed by full mouth rehabilitation.

Another OPG was advised after extractions. (Figure-3) A diagnostic impression was taken with alginate impression material and casts were prepared (Figure-4, Figure-5) for stent preparation prior to implant placement. A CBCT was taken before implant placement. (Figure-6) Implants were placed in 26, 35, 36, 45, 46 region of equinox-

*Professor and Head, **Professor, ***Professor, ****PG Student, *****PG Student

DEPARTMENT OF PROSTHODONTICS AND CROWN AND BRIDGE AHMEDABAD DENTAL COLLEGE AND HOSPITAL

ADDRESS FOR AUTHOR CORRESPONDENCE: DR. DARSHANA SHAH, TEL: +91 9824510309
myriad with the size of 4.5 × 11 mm, 4.5 × 9.5 mm, 5.7 × 9.5 mm, 4.5 × 9.5 mm and 5.7 × 8 mm respectively. An indirect sinus lift was done for placement of implant in 26 region. After implant placement was done (Figure-7), other treatment procedures like root canal treatment, post and core and flap surgery in maxillary anteriors; were completed and after few months an OPG was taken. (Figure-8)

After 3 months, the second stage for implant prosthesis was carried out. Healing caps were placed and after 7 days the maxillary and mandibular anterior teeth were prepared for PFM crowns. (Figure-9) After this maxillary and mandibular closed tray impressions were taken for implants alongwith prepared teeth and casts were obtained. (Figure-10, Figure-11) Centric records were taken, facebow transfer was done and mounting of the casts was done on Hanau Wide Vue Articulator. (Figure-12)

The wax pattern was made on the anterior prepared teeth (Figure-13) and putty index was taken for preparation of temporary teeth (Figure-14, Figure-15). These temporary teeth were luted with temporary cement (Rely X Temp E) and after checking esthetics and phonetics an anterior guidance was developed. (Figure-16)

An Occlusal Plane analysis was done with the SOPA technique (Figure-17) and a posterior occlusal plane was obtained. Following this, all the remaining posterior teeth were prepared for PFM crowns (Figure-18) and closed tray impressions were taken with putty-light body and casts were fabricated (Figure-19, Figure-20). Further another facebow transfer was done for the final restorations. (Figure-21)

Posterior temporaries were fabricated and cemented in patient's mouth (Figure-22).

Following this, Metal try-in was done and checked in patient's mouth (Figure-23). Then a bisque trial was also carried out (Figure-24) and the final prosthesis was delivered to the patient (Figure-25). The patient's esthetics and functions were verified. A post-treatment OPG was also taken (Figure-26).

**DISCUSSION:**

The concept of complete mouth rehabilitation is dependent basically upon three proved and accepted principles. These are; the existence of a physiological rest position of the mandible which is constant, the recognition of a variable vertical dimension of occlusion and the acceptance of a dynamic, functional centric occlusion. Many clinical studies indicate that, vertical dimension of occlusion is maintained even with rapid wear. As the occlusal surface wears, compensatory alveolar process elongates by progressive remodeling of the alveolar bone. As a result there is no loss of vertical dimension unless tooth loss occurs. However, occlusal wear may occur more rapidly than continuous eruption depending on the etiology of the wear. The three prime requirements of full mouth rehabilitation are healthy TMJ, harmonious anterior guidance and noninterfering posteriors. These three factors are interrelated and any disharmony between these will affect the stomatognathic system. Anterior guidance plays a very important role in full mouth rehabilitation following centric relation. The three main things to be taken care of, while replacing posterior teeth, are achieving posterior discclusion, establishing the plane of occlusion and deciding the type of occlusal scheme. Disclosure refers to separation of opposing teeth during eccentric movements of mandible, as reported by Christensen. Posterior occlusion should have equal simultaneous contacts so that it does not interfere with either the TMJs in the back or the anterior guidance in the front. Occlusal interference can be detrimental to the health of the patient. Deflective occlusal interference can cause painful symptoms in the muscle, teeth or other orofacial structures. A proper plane of occlusion must permit discclusion of all the teeth on the balancing side when the mandible is moved laterally. The provisional restorations play a critical role in the successful treatment of the full mouth rehabilitation patient. The provisional restorations should be esthetic and also fulfill the functions so that the effect can be followed in the temporary before making the final restoration. In previous literature, the wearing time of provisional crown are various. The trial period of intensive fixed provisional prosthesis is 2 - 6 months.

**CONCLUSION:**

Severe tooth wear is frequently multifactorial and variable. Restoration of worn dentition is a challenge to a prosthodontist. A combination of mechanical, biological, esthetic factor is
mandatory, for full mouth rehabilitation. Successful management is a subject of interest in dentistry. A detailed diagnosis and treatment planning is necessary to achieve predictable success. The restoration of normal healthy function of the masticating apparatus is the ultimate aim of full mouth rehabilitation. Full mouth rehabilitation by Pankeymann-Schuyler philosophy is a successful approach. Patient was satisfied with esthetic and masticatory efficiency.

Figure 1- Intraoral View

Figure 2- Pre-operative OPG

Figure 3- Post-extraction OPG

Figure 4- Maxillary and mandibular Diagnostic Impressions

Figure 5- Maxillary and Mandibular Diagnostic casts

Figure 6- Pre-op CBCT for Implant Placement

Figure 7- Implants placed

Figure 8- Post-implant placement OPG

Figure 9- Maxillary and mandibular anterior teeth prepared
Figure 10- Closed tray Impressions taken

Figure 11- Casts fabricated

Figure 12- Centric records taken; facebow transfer done; mounting done on Hanau Wide Vue Articulator

Figure 13- Anterior wax mock-up done

Figure 14- putty index prepared

Figure 15- Temporary anteriors prepared
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Figure 16- Anterior guidance developed with temporary crowns

Figure 17- Occlusal Plane analysis done with SOPA technique

Figure 18- All remaining posterior teeth prepared

Figure 19- Maxillary and mandibular Final Impression made with closed tray impression copings

Figure 20- Maxillary and Mandibular Master casts prepared

Figure 21- Facebow transfer done for final prosthesis
REFERENCES


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