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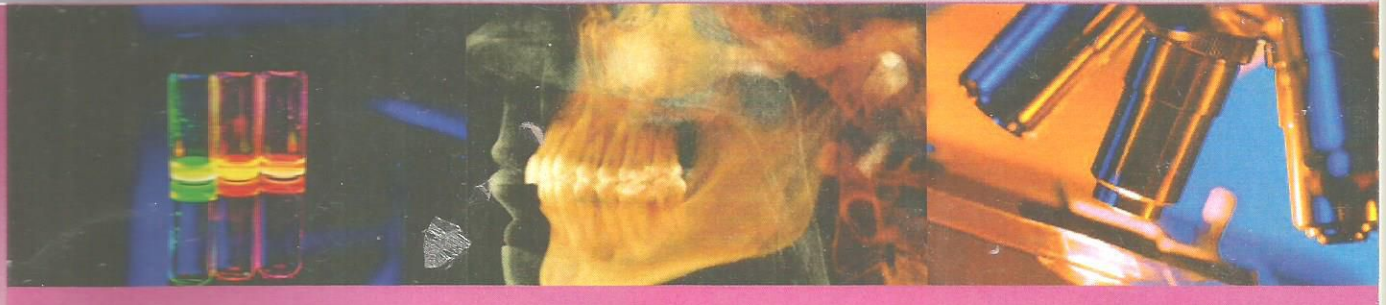

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Vol 2 • Issue 2 • 2016

Contents

ORIGINAL ARTICLES

REVIEW ARTICLES

Journal of Oral and Dental Health
Vol 2 • Issue 2 • 2016

CASE REPORTS

Original Article

Journal of Oral and Dental Health

Dissolution of Three Root Canal Sealers in Two Organic Solvents

Abstract

Aim: To evaluate the solubility of three types of root canal sealers used in endodontics in two organic solvents. **Methodology:** The solubility of AH Plus, Apexit Plus, R C Fill wasassessed in orange wood oil and chloroform. Twenty samples of each root canalsealer were prepared and then divided into six groupsfor immersion in solvents for 2 and 10 min. The mean percentage loss of weight was determined for each material in each solvent and for each immersion period, by the difference in pre–immersion and post–immersion weight of samples, and the valueswere compared by Tukey's test and Kruskal Wallis test. **Results:** In the Epoxy resin based sealer and Chloroform group highest solubility was seen followed by Calcium hydroxide based sealer and Chloroform group. Both these groups showed higher solubility in 10 min immersion as compared to 2 min immersion period. The other groups did not show significant difference in solubility. **Conclusions:** The sealers AH Plus and Apexit plus dissolved to some extent, and more so than R C Fill, using either orange wood oil or chloroform as thesolvent. However, AH plus root canal sealer is highlysoluble in the solvents orange wood oil and chloroform.

Key words: Endodontic sealers, Organic solvents, Weight loss

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Introduction

Failure of Root canal treatment can be ascribed largely to microbial infection either due to technical inadequacies in primary treatment, or orthograde reinfection of the canal system.[1] The retreatment procedure comprises re-entry into the root canal system and removal of the existing root filling throughout the canal length, to allow complete disinfection of the root canal system.[2] The primary requirement for retreatment is removal of root canal filling material.[2] Several techniques for removing the root canal filling materials include the use of solvents,heat, hand files, rotary files and ultrasonic instruments, used either alone or in combination.[2] However, root canal sealers are more difficult to remove from anatomical ramifications where they may be inaccessible to mechanical methods of removal.[3] In these circumstances, solvents become essential if canals are to be thoroughly cleared of residual materials for effective disinfection and resealing.[3] Orange wood oil is most commonly used but many studies have suggested chloroform as the most effective solvent for most filling materials.[2] It has been shown to have an excellent capacity for dissolution compared with other solvents, such as orange oil, eucalyptol or xylol.[2] However, Barbosa et al states that chloroform can damage the periapical tissues when extruded.[2] But with proper handling of chloroform, it can be used in many cases.[3]

Epoxy Resin based Sealer

The advantages of using Epoxy resin based sealer are its long term sealing properties,good dimensional stability, self adhesive properties and high radiopacity.

Calcium Hydroxide based Sealer

The advantages of using Calcium hydroxide based sealer are that calcium hydroxide helps to improve periapical healing, it is eugenol free and it is radiopaque.

Zinc Oxideeugenol based Sealer

The advantages of using Zinc oxide eugenolbased sealer are that it causes no irritation of the periapical tissues, it has high radiopacityand it has great adhesion.

Aim

To evaluate the solubility of three types of root canal sealers used in endodontics in two organic solvents.

Materials and Methods

Three different root canal sealers tested in this study were Epoxy resin based sealer (AH Plus, Dentsply, Konstanz, Germany), Calcium hydroxide based sealer (Apexit Plus, IvoclarVivadent, Leichtenstein) and Zinc oxide eugenol based sealer (R C Fill, Prime dental, India). The organic solvents used to evaluate the solubility of sealers were Orange wood oil (R C Solve, Prime Dental,India) and Chloroform (Figure 1). All root canal sealers were mixed according to the manufacturers' instructions. Freshly mixed sealers were placed in aluminium molds with 5 mm diameter and 2 mm height, and twenty samples of each sealer were prepared.The samples were divided into six experimental groups

(n = 10) according to the root canal sealer and solvent that was used.The samples were stored in a chamber with 80% relative humidity at 37°C for 72 hours to allow the materials to set completely.The samples were then weighed in milligrams on a Digital weighing scale (Schimadzu, Uni Bloc, HongKong) initially before immersion in solvents (Figures 2 and 3). The samples were then immersed in orange wood oil and chloroform for 2 min and 10 min (Figure 4). The samples were then weighed again after 2 min and 10 min and the mean values were calculated. The mean percentage loss of weight was determined for each material in each solvent and for each immersion period, by the difference in pre – immersion and post – immersion weight of samples (Table 1). Statistical analysis was performed by Tukey's test and Kruskal Wallis test.

Results

The Group II (Epoxy resin based sealer + Chloroform) showed highest solubility followed by Group IV (Calcium hydroxide based sealer + Chloroform). Both the Group II and Group IV showed higher solubility in 10 min immersion as compared to 2 min immersion period.The other groups did not show significant difference in solubility (Graph 1).

Discussion

Nonsurgical endodontic retreatment of previously obturated root canals is the initial treatment of choice for the management of endodontic failures.[4] Removing as much sealer and gutta-percha as possible from inadequately prepared and obturated root canal systems is critical to uncover remnants of necrotic tissue or bacteria that may be responsible for periapical inflammation and failure.[4] However, the root canal sealers cannot be completely removed. Therefore, organic solvents have been used and proposed to decrease the resistance of filling materials in the root canal space.

Although there are few reports in the literature regarding the solubility of endodontic sealers immersed in organic solvents, there exist no specific standards for the measurement of endodontic

Table 1: Mean values of weight (in mg) and the percentage loss of weight of sample groups

Groups	Mean values of weight (in mg)			Percentage loss of weight	
	Pre-immersion	Post-immersion			
		2 min	10 min	2 min	10 min
Group I	137	146	147	9	10
Group II	163	80	11	83	152
Group III	80	90	90	10	10
Group IV	84	60	25	24	59
Group V	155	169	163	14	8
Group VI	150	138	133	12	17

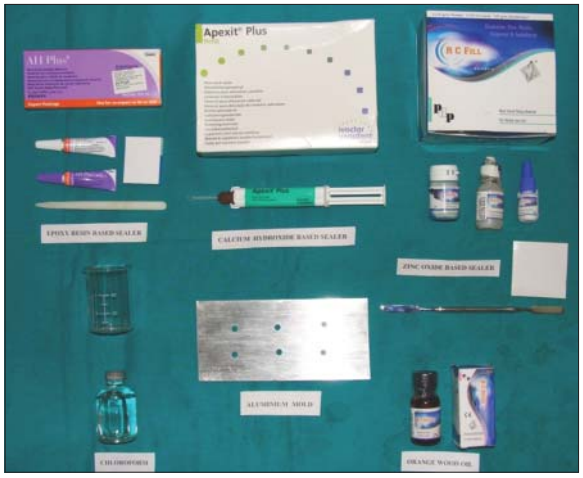
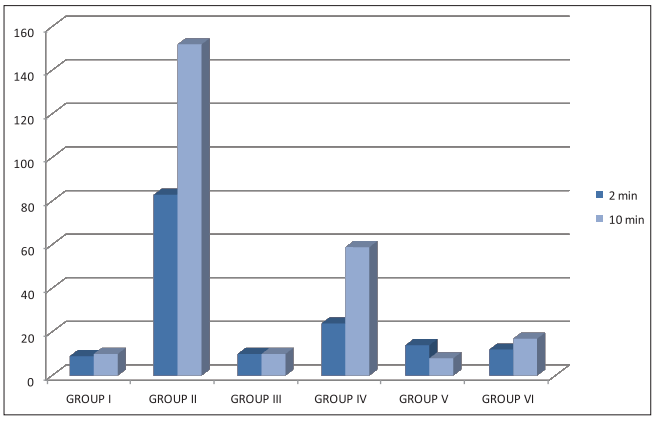


Figure 1: Armamentarium

Figure 2: Digital weighing scale

Figure 3: Weighing of samples

Figure 4: Immersion of samples in solvents



Graph 1: Graphical representation showing mean percentage loss of weight of sample groups after 2 min and 10 min

solvents on root canal sealer solubility.[5] However, in the present study, the method that was generally preferred was also used in most of the earlier literature.

Controlled and careful use of chloroform in dental practice has exhibited that it can be valuable for success of removal of root canal filling materials.[5] The Food and Drug Administration does not have the jurisdiction to prohibit the use of chloroform by dentists and does not have proof that it is carcinogenic to humans.[5] Chutich et al demonstrated that it does not have a toxic risk for patients when a minimal quantity of solvent is used.[5] Some authors mention the high toxicity of chloroform and suggest that orange oil is efficient alternative at a temperature of 37°C. Pécora et al presented orange oil as an alternative solvent which has softening action without deleterious effects.[5] Its toxicity, however, will need more detailed study.Considering the toxic and carcinogenic effects of some solvents, this study shows that substances which fulfill the requirements of speedy action, harmlessness to the tissues adjacent to the tooth, a pleasant smell and non-toxicity to the professional, the patient and the environment such as orange oil should be indicated for endodontic retreatment.

Conclusion

The sealers AH Plus and Apexit plus dissolved to some extent, and more so than R C Fill, using either orange wood oil or chloroform as thesolvent. However, AH plus root canal sealer is highlysoluble in the solvents orange wood oil and chloroform. Therefore, this factor should be considered by clinicians as they make decisions on material selections. Further investigation should be conducted to find a more universally effective solvent for use in root canal retreatment.

References

1. Martos J, Bassotto AP. Dissolving efficacy of eucalyptus and orange oil, xylol and chloroform solvents on different root canal sealers. Int Endodon J, 2011 Nov;44.
2. Bodrumlu E,Ozgur Er, Kayaoglu G. Solubility of root canal sealers with different organic solvents.Oral Surg Oral Med Oral Pathol Oral Radiol Endod September, 2008.
3. Vinothkumar T, Kandaswamy D. Influence of different organic solvents on degree of swelling of poly (dimethyl siloxane) based sealer. Journal of conservative dentistry, Apr-Jun 2011,14;2
4. Ruddle CJ. Nonsurgical endodontic retreatment. J Calif Dent Assoc 2004;32:474-84
5. Oyama K, Siqueira E. *In vitro* study of effect of solvent on root canal retreatment. Braz. Dent. J, 13;3.

Original Article

Journal of Oral and Dental Health

Comparasion of the Arch Width Changes in Patients Treated with Functional Appliance Therapy

Abstract

Aim: The aim of the article is to examine any change in the arch width in patients who were treated with removable functional appliance as part of their treatment. 20 Class II div I patients[age between 11 to 15 yr] with overjet of more than 5 mm were selected. **Materials & Methods:** Pre treatment and post treatment casts were analysed for change in intercanine and intermolar width in both the arches. The maxillary and the mandibular intercanine and intermolar widths were measured using digital Vernier calliper. **Results:** Arch width was wider in males as compared to females. There was no significant change seen in the intercanine width in the arches. While change in the intermolar width was seen mainly in the upper arch. **Conclusion:** Male arches grow wider than female arches. Changes in arch width may not be accompanied by changes in arch length.

Key words: Intercanine and intermolar width, Class II cases, Functional phase

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Introduction

The most critical age for treatment in orthodontics is during the changeover phase from mixed dentition to the permanent dentition. During this phase there can be various changes in the arch width dimensions. In orthodontics, maintaining the transverse width is one of the major challenges in orthodontic treatment. Therefore, a thorough watch must be kept on the individuals during the same.

The size and shape of the arches will have significant implications in orthodontic diagnosis and treatment planning, which will affect the space available, dental esthetics, and stability of the dentition. These considerations, along with anteroposterior movements of the dentition, will determine the requirements for extraction or otherwise.[1]

In 1907, E H Angle believed that each individual had the potential for normal growth and development with orthodontic therapy, stating that "The best balance, the best harmony, the best proportions of the mouth in its relation to the other features, requires that there shall be a full complement of teeth and that each tooth shall be made to occupy its normal position & normal growth."[1,2]

With growth, arch dimensions changes are seen. Hence, it is necessary to differentiate changes from appliance therapy and those from natural growth. Moorrees has pointed out that variation in arch form will occur with normal growth. And there is a general tendency towards an increase in the intermolar width during the change from the deciduous to the permanent dentition.[1,3,4]

The aim of this study is to measure the difference in the intercanine and intermolar width of upper and lower arches in patients treated with functional appliance.

Aim and Objectives

To measure the difference in the intercanine and intermolar width of upper and lower arches in patients treated with functional appliance phase.

Materials and Method

This study was performed using the study models of 20 Class II division 1 malocclusion subjects from Department of Orthodontics, A.C.P.M DENTAL COLLEGE AND HOSPITAL, DHULE. Of which 10 cases where grouped as control cases (n=1-10), while the other 10 cases where delivered activator as the appliance for their treatment as shown in fig (Figure 1) (n=11-20). The distribution of age in the study is from age 11 to 15 yrs (both males and females). Both the groups had the same inclusion and exclusion criteria.

Inclusion Criteria

In the Class II groups:

1. permanent canines present in the dentition and
2. Class II molar and canine relationship,
3. Overjet ≥5 mm.

Exclusion Criteria

1. No history of any orthodontic treatment,
2. No history of any surgical procedures(cleft palate etc)

As shown in fig,[5,6] the arch width measurements were recorded from each subject's dental casts by one examiner using a digital Vernier calliper (Figure 2) and recording the data to the nearest 0.1 mm (Figure 3). Re-examination of the data, by other examiner, was done to avoid any bias.

Results

After measuring the upper and lower intercanine and intermolar width, it was found that there was no significant change in the intercanine width in both the arches when compared to the control group (Table 1). In contrast, the intermolar width showed significant increase as compared to the control group. Increase in the intermolar width was seen mostly in upper arch (Table 2). Males had a wider arch width compared to females.

Figure 1: Activator delievered during treatment

Figure 2: Digital vernier calliper

Discussion

Tollaro et al,[5] investigated the relationship between posterior transverse interarch discrepancy and mandibular size and position. Similarly in a study by, Staley et al,[7] they calculated the posterior transverse interarch discrepancy as the difference between maxillary and mandibular intermolar widths. This interarch discrepancy was found to be a simple and effective parameter for assessing the transverse harmony of dental arches.

It is apparent that changes in arch width vary between males and females and more growth occurs in the upper than the lower arch. This growth occurs mainly between the ages of 7 and 12 years of age and is approximately 2 mm in the lower arch and 3 mm in the upper. After the age of 12, growth in arch width is seen only in males. Sinclair et al have confirmed that in males and females, the increase in intermolar width after the age of 12 is statistically different, without an increase in arch length or perimeter.[8-15]

Some authors, in different populations reported that in girls, little or no change occurred in molar and canine arch width regions after 13 years of age.[9,17] This supports our study, where males showed increase in the intermolar width compared to the females. Arch width continues to increase to a lesser extent in the third and fourth decades, but this is associated with arch length shortening.[10-14]

Activator, given by Anderson, is the most commonly used functional appliance in the early permanent dentition. It is bulky, monoblock appliance which the patient is asked to wear for atleast 12-14hrs a day. The cases were given the basic activator without any modifications.

The use of expansion can be considered applicable in the growing child. However, it is difficult to predict the amount to which this would have occurred from natural growth in any individual. There is no evidence that appliances can stimulate growth beyond the natural growth potential of an individual. Therefore, in our study, no expansion screw was placed in the appliances given to the patients during treatment.

Table 1: Pre and post treatment intercanine width in upper and lower arch

Cases	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	11/M	12/F	11/F	13/M	13/F	11/M	12/M	12/M	13/F	13/M	12/M	13/F	11/F	13/M	12/M	13/F	13/M	13/F	11/M	12/M
Pre-treatment upper	39.0	38.8	31.2	36.5	35.0	35.0	31.3	35.3	37.6	34.4	35.2	33.4	34.6	30.2	35.9	33.1	38.4	37.3	36.4	32.0
Post-treatment upper	39.1	38.8	31.2	36.3	35.2	35.5	31.4	35.1	37.9	34.1	35.9	34.0	35.2	31.0	36.2	33.9	39.0	37.8	37.0	32.8
Pre-treatment lower	26.5	29.3	26.3	23.3	24.1	23.0	29.6	24.3	29.0	26.0	27.3	22.9	28.3	21.6	27.3	25.4	28.4	21.7	22.8	23.2
Post-treatment lower	26.1	29.3	26.4	23.0	24.5	23.5	29.9	24.5	29.4	26.2	27.8	23.3	28.7	22.0	27.8	26.0	28.6	22.1	23.3	23.9

Table 2: Pre and post treatment intermolar width in upper and lower arch

Cases	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	11/M	12/F	11/F	13/M	13/F	11/M	12/M	12/M	13/F	13/M	12/M	13/F	11/F	13/M	12/M	13/F	13/M	13/F	11/M	12/M
Pre-treatment upper	45.2	44.8	45.3	49.3	42.3	51.2	50.8	45.6	47.0	41.1	48.0	46.3	42.6	49.6	45.4	47.1	41.5	46.3	49.6	45.7
Post-treatment upper	46.7	46.0	47.9	51.1	44.2	52.4	52.3	46.4	48.6	42.9	49.2	47.3	43.5	51.1	47.3	48.5	42.8	48.0	51.3	47.5
Pre-treatment lower	43.3	39.9	43.1	43.6	40.1	45.8	48.3	40.6	44.1	38.7	42.2	44.8	38.9	40.6	43.8	44.9	40.9	42.5	37.9	42.7
Post-treatment lower	43.5	40.3	43.9	43.2	40.3	46.4	48.2	41.0	44.3	38.6	43.5	45.9	39.4	41.4	44.3	45.3	42.1	43.7	38.2	43.2

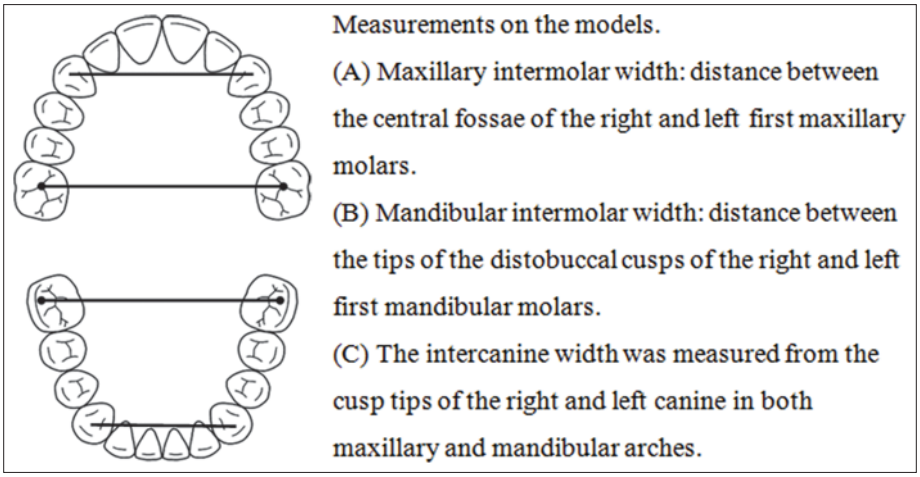

Figure 3

Arch expansion is more likely to be stable in the absence of extractions and is most effective in the posterior region. Unless the canines are displaced lingually by the occlusion, there is unlikely to be stable expansion of the lower intercanine width.

Baccetti et al[5] investigated the early dentofacial features of Class II malocclusion. They found that the Class II features were maintained or exaggerated, during the transition from the deciduous to the mixed dentition. During this changeover of dentition there is increase in the intercanine width seen. After 12 years of age in permanent dentition there is no increase seen in the width. There is increase in the intermolar width seen in patients from 7 to 18 years of age. Along with these changes seen in the dentition there is a little changes also seen in the premolar area.

Nowadays, a number of clinicians favor orthodontic treatment in the deciduous or early permanent dentition to try and induce growth. It is difficult to determine the contribution of appliances, as a normal growth change would be expected. McNamara and Brudon[16] state that "It seems logical to consider increasing arch size at a young age so that skeletal, dental alveolar, and muscular adaptations can occur before the eruption of the permanent dentition." If an appliance is inserted in an actively growing patient, a favourable response can be expected.

However this response may have occurred in the absence of treatment, the relative contribution of the appliance being difficult to determine. The routine expansion of both arches in the permanent dentition has not been shown to produce stable change in arch dimension that is significantly greater than that which would have been achieved through normal growth.

Conclusions

In our study, intercanine and intermolar arch width changes were seen during functional therapy. The intercanine width did not change significantly in the permanent dentition after 12yeras of age but there was significant increase in the mixed dentition. The upper and lower intermolar widths increase unexpectedly to a considerable extent between ages of 7 and 18 especially in males. Male arches grow wider than female arches. Changes in arch width may not be accompanied by changes in arch length.

References

1. Robert T. Lee, DOrth, MOrth, FDSRCS Eng, FDSRCPS Glasg. Arch width and form: A review Am J Orthod Dentofacial Orthop 1999;115:305-13
2. Angle EH. Malocclusion of the teeth, 7th edition. S.S. Philadelphia: White Dental Manufact Co, 1907.
3. Christopher J. Lux, DDS, Dr Med Dent; Christian Conradt, PhD; Donald Burden, BDS, MSc, PhD, FDSRCS, MOrthRCS; Gerda Komposch, DDS, PhD. Dental Arch Widths and Mandibular-Maxillary Base Widths in Class II Malocclusions Between Early Mixed and Permanent Dentitions Angle Orthod 2003; 73:674-685
4. Moorrees CFA, Gron AM, Lebret LM, Yen PK, Frohlich FJ. Growth studies of the dentition: A review. Am J Orthod 1969;55:600-16.
5. Tollaro I, Baccetti T, Franchi L, Tanasescu CD. Role of posterior transverse interarch discrepancy in Class II, Division 1 malocclusion during the mixed dentition phase. Am J Orthod Dentofacial Orthop. 1996;110:417-422.
6. Pont A. Der Zahn-Index in der Orthodontie. Z Zahna¨rztl Orthop.1909;3:306-321.
7. Staley RN, Stuntz WR, Peterson LC. A comparison of arch widths in adults with normal occlusion and adults with class II, Division 1 malocclusion. Am J Orthod. 1985;88:163-169.
8. Sillman JH. Dimensional changes of the dental arches: Longitudinal study from birth to 25 years. Am J Orthod 1964;50:824-42.
9. Sayin MO, Turkkahraman H. Comparison of dental arch and alveolar widths of patients with Class II division 1 malocclusion and subjects with Class I ideal occlusion. Angle Orthod. 2004;74:356–360.
10. Knott VB. Longitudinal study of dental arch width at four stages of dentition. Angle Orthod 1972,42:387-95.
11. De Koch WH. Dental arch depth and width studied continually from 12 years of age to adulthood. Am J Orthod 1972;62:56-66.
12. Moorrees CFA. The Dentition of the Growing Child. Cambridge, Mass: Harvard University Press; 1959: 87-110.
13. Sinclair PM, Little RM. Maturation of untreated normal occlusions. Am J Orthod 1983;83:114-23.
14. Harris EF. A longitudinal study of arch size and form in untreated adults. Am J Orthod Dentofacial Orthop 1997;111:419-27.
15. Bishara SE, Jakobsen JR, Treder J, Nowak A. Arch width changes from 6 weeks to 45 years of age. Am J Orthod Dentofacial Orthop. 1997;111:401-409.
16. McNamara JA, Brudon WL. Orthodontic and orthopaedic treatment in the mixed dentition. Ann Abor, MI, Needham Press; 1993. Chap 3.
17. Burstone CE. A study of individual variation in mandibular bicanine dimension during growth. Am J Orthod. 1952;38:848-865.

Review Article

Journal of Oral and Dental Health

Nanotechnology - A Dead End or Endless Road: A Review

Abstract

This article is explaining the era of nanotechnology which is helping mankind in every possible way. The main purpose is to provide an early glimpse of nanodental applications and to illustrate their far reaching impact on clinical dental practice. The expected development of nanodentistry, which might see its earliest practical uses within next 10-20 years, in the context of today's trends in dental science and practice. It is basically a field of applied science and technology covering a broad range of devices. The main unifying theme is the control of matter on a scale smaller than 1 um normally between 1-100 nm as well as fabrication of devices on this same length scale. It is highly multidisciplinary approach drawing from fields such as colloidal science, device physics and supra molecular chemistry. The two perspectives are followed i.e material and molecular perspectives. Current research is focussing on fabrication of nanostructures, nanoacuators and nanomotors along with means to assemble them into larger systems economically and in great numbers. Such technology has enormous medical implications, programmable nanorobotic devices would allow physicians to perform precise interventions at cellular and molecular level.

Key words: Applications, Dentistry, Nanotechnology

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Introduction

The era of Nanotechnology has helped mankind in every possible way today. Minute particles with diameters of just million of a millimeter are the building blocks of new products known as nanoparticles. Nanotechnology helps us to exploit the smallest particles in this universe and their properties. The term Nanotechnology was given by Professor Kerie Drexler. A Noble laureate physicist Richard P. Feynman in the lecture on 29th December, 1959 noticed the importance of nano size devices.[1]

The word "Nano" is being taken from the greek word "*νανος*" which means dwarf. A nanometer is 10^{-9} meter, or one billionth of a meter. Nanotechnology holds promise for advanced diagnostics, target drug delivery and biosensors. The main objective of this review is to present total insight of these minute discoveries and to explain their potentially far reaching applications in clinical dental practice. There could be advancements in nanodentistry, which can see its clinical applications within the next 10-20 years, in the context of today's trends in dental science and practice.[2] The upcoming field of nano science, engineering and technology and the skill to give efforts at the molecular level, atom by atom, to create more applications with necessarily new functions are leading to exceptional understanding and organization of the basic building blocks and properties of natural and man made things. (Dr. Edward Reifman, Nanotech dentist).

Nanotechnology is Defined as: (Schummer J)

A sphere of the scientific and engineering activity that is connected with organization of the process of creation, fabrication, implementation, use and development of nano-scale systems that is, coordination between the various design tasks and cooperation of different specialties who solved these tasks; support to assemble and to integrate the heterogeneous parts of designed nano system into organic whole.[5]

Robert A. Freitas was known to be a pioneer in nanodentistry. The term 'nanotechnology' was first presented by Norio Taniguchi (1974), who defined it as "mainly consisting of the processing, separation, consolidation and deformation of materials by one atom or one molecule".[1]

3 Steps to Achieve Nanotechnology[6]

1. Clinicians should be competent enough to work on individual particle.
2. Capability to manufacture nanoscopic machines, called assemblers, which can be maintained to work on atoms and molecules according to will.
3. Provide as much assemblers for building consumer goods.

Two main approaches are used in nanotechnology one is a "bottom- up" approach where material and devices are drawn from molecular components that assemble themselves chemically using principles of molecular recognition; the other being a "top- down" approach where nano objects are built from larger entities without atomic level control.[1] Nanotechnology is a concrete methodological position that is connected with the holistic investigation of nano scale systems (Table 1).

Table 1: Approaches in nanotechnology

Top down approach	Bottom up approach
• Nanoneedles	• Local anaesthesia
• Nanoencapsulation	• Hypersensitivity cure
• Nano based bone replacement materials	• Tooth regeneration
• Nanoparticles coating in dental implants	• Orthodontic treatment nanorobots
• Nano impression materials	• Nanodiagnosis
• Nano light curable glass ionomer cements	• Endodontic regeneration
• Nanocomposites	• Oral tissues biomimetics
	• Impression materials

Current applications of nanodentistry

1. Nanotubes:- In vitro application of titanium oxide nanotubes for initiating the mechanism of hydroxyapaptite formation, mostly in the usage of bone growth application for dental implant coatings. Rods of carbon are also found which share approximately half the diameter of molecule of DNA.[2]
2. Nanosolution:-The nano particles which can be dispersed, may be used in the bonding agents in dentistry.[2] Advantages include increased bond strength of dentin and better performance. Thus homogeneity is maintained and so the operator can now have full assurity that mixing of adhesive has been done properly each time.
3. Nanocomposites:- Nanocomposites are geared up when the inorganic phases in organic/inorganic fuse and turn out to be nanosized. Nanofillers have proportions below the wavelength of visible light (0.4-0.8 um), they are incapable to scatter or absorb visible light. The diminished visibility of these filler particles and their property of opacity pose importance and are advantageous. Filtek O Supreme (3M ESPE, St. Paul, MN, USA) contains nanomers and nanoclusters.[3] Another commercial product available in market is Premise (Kerr/Sybron, Orange. CA, USA) which is a nanohybrid composed of 3 different types of filler components: non agglomerated "discrete" silica nanoparticles, prepolymerized fillers and barium glass fillers.[2]

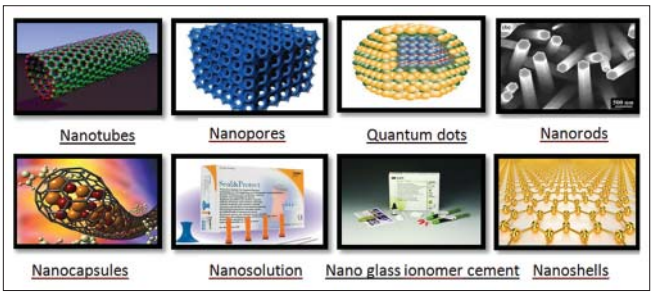
   Higher gloss retention is another advantage possessed by commercial product (Atabek D, Sillelioglu H, O" Imez A) compared to conventional composites. A commercial product Ceram- X (Dentsply, Detrey, Konstanz, Germany) is an ormocer based, nanoceramic composite. Another properties provided by nanocomposites are low visual opacity and high translucency due to reduced dispersion of light with wavelengths much longer than nano particle size. This allows clinician to assemble wide range of shades and opacities and thus offer highly esthetic restoration in all posterior and anterior applications.
4. Nanocomposite denture teeth:- New type of denture tooth, fabricated of nanocomposite resin, has recently been developed as a highly polishable stain and impact resistant material. It consists of comonomer of urethane dimethacrylate (UDMA) and methyl methacrylate (MMA). Polymethyl methacrylate (PMMA) are uniformly dispersed nano sized filler particles.
5. Nanoimpression:- Impression materials Nanotech Elite H-D from the company Zhermack is available with nanotechnology application. In the impression material manufactured by the application of nano technology, nano fillers will be integrated in the vinyl polysiloxanes producing a unique addition siloxane impression material having added advantages of better flow, enhanced detail precision and improved hydrophilic properties hence, fewer voids at margins and better model pouring.[3]
6. Nano light curing glass ionomer restorative:- The world's first Nano- Glass- ionomer is Ketac™ Nano light curing Glass Ionomer Restorative. It gives an esthetically pleasing class restoration. Ketac Nano is an ideal alternative esthetic glass ionomer solution for everyday dentistry.[7] This product can be used for primary teeth restorations, transitional and sandwich restorations, small class I, III and V restorations and even in core build ups.
7. Nanoneedles:- The needles used in suturing contain nano sized stainless steel crystals and were discovered by the name of Sandvik Bioline, RK 91™ needles (AB Sandvik, Sweeden).[3]
8. Orthodontic nanorobots:- They can activate the tissues of periodontium allowing speedy and unproblematic tooth straightening, rotation and vertical movement within minutes to hours.[6]
9. Nanoencapsulation:- An institute named South West Research Institute (SWRI) has manufactured targeted release system that contain nanocapsules with novel vaccines, antibiotics and drug delivery with reduced side effects.[3]
10. Laser plasma application for periodontia:- Dimensions of titanium oxide crystals are reduced to nanoscale (20-50 nm particles) and present on human skin in the form of gel like emulsion, these particles can be optically broken down with accompanying effects. Laser plasma combines with oxides of titanium and has been proven effective in periodontal treatments, melanin removal, incision of soft tissue without anesthesia, caries preparation, cutting of enamel and dentin.
11. Nanorods:- Enamel prism like hydroxyapatite nano rods possess self assemblage properties. They mimic enamel rods that comprise the basic crystalline structure of dental enamel.
12. Bone replacement material:- The materials in bone based on nanotechnology has to act on genes in the cells while responding well to internal as well as environmental stresses. Hydroxyapatite nanoparticles which help in managing defects in bone are Ostim(Osartis GmbH, Germany) HA and VITOSSO (Orthovita, Inc, USA) HA + TCP.[4]
13. Nanopores:- Minute pores which will permit DNA to enter through one strand at a time and will lead to good sequencing of DNA.
14. Quantum dots: - These are tiny dots that shine very brightly when illuminated by ultraviolet light with a coating of material which allow the dots to combin to the molecule to be tracked. Quantum dots bind themselves to proteins unique to cancer cells, literally bringing tumors to light.
15. Nanoshells:- Minute bead like structures coated with gold are the nanoshells. The thickness of the layers can be altered making up the nanoshells, thus scientists can design these beads to absorb near-infrared light, creating an intense heat that is lethal to cancer cells.
16. Nanoanesthesia:- For nanoanesthesia to work, a colloidal suspension which contain millions of active analgesic micrometer sized dental nano robots particles and are placed on the patient's gingival surface. On coming in contact with the surface of crown or mucosa, the nano robots reach dentin by migrating into the gingival sulcus. On reaching dentin, the nano robots enter dentinal tubules and then into the pulp.[4] This movement of nano robots is guided by a combination

Table 2: Application of nanotechnology in density with available products

Discipline	Available Materials
Restorative Dentistry	Ketac™ (3M ESPE, St. Paul, MN, USA), Ketac N100; Nano-ionomers (3M ESPE), Filtek Supreme XT (3M ESPE), Fuji IX GP (GC, Leuven, Belgium), Nano-primer, Premise™ (Kerr/Sybron, Orange, CA, USA), Adper™ Single bond plus Adhesive (3M ESPE), Ceram X™ (DENTSPLY International, Milford, CT, USA).
Regenerative Dentistry and Tissue Engineering	Ostim® (Osartis GmbH, Elsenfeld, Germany), VITOSSO™ (Orthovita-Inc, Malvern, PA, USA), Nano-Bone® (ARTOSS, Rostock, Germany).
Periodontics	Arestin® (Valeant, Bridgewater, MA, USA), Nanogen® (Orthogen, Springfield, IL, USA).
Preventive Dentistry	NanoCare® Gold (Nano-Care, Saarwellingen, Germany).
Orthodontics	Ketac™ N100 Light Curing Nano-Ionomers (3M ESPE), Filtek Supreme Plus Universal (3M ESPE).
Prosthodontics	Nanotech elite H-D plus (Zhermack, Badia Polesine, Italy), GC OPTIGLAZE color® (GC).
Oral Implantology	Nanotite™ Nano-coated implant (BIOMET 3i, Palm Beach Gardens, FL, USA).
Endodontic	AH plus™ (DENTSPLY International), Epiphany (Pentron Clinical Technologies, Wallingford, CT, USA), Guttaflow® (Coltène, Altstätten, Switzerland).

of chemical gradients, temperature differentials and position of navigation, all controlled by onboard nano computer as directed by dentist Freitas RA Jr. On reaching the pulp, the dentist commands the analgesic dental nano robots to shut down all sensitivity in selected tooth that requires treatment. This will cause immediate anesthesia of the tooth.

17. Nanorobotic dentifrice (dentifrobots):– Dentifrobots supplied through mouthwash or toothpaste could clean all supragingival and subgingival surfaces at least once a day, converting trapped organic matter into harmless and odorless vapors and performing continuous calculus debridement. Dentifrobots are invisibly small (1–10 micron), with 103–105 nanodevices/oral cavity, crawling at 1–10 microns/second. Dental nanorobots that are produced using indigenous biological materials could efficiently obstruct dentinal tubules within minutes. The nanorobots on reaching the dentin start moving towards the pulp via dentinal tubules that are 1 – 4 μm in diameter.[6]
18. FIeld of oral cancer:- Nano electromechanical system (NEMS) which can convert biochemical to electrical signal and cantilever array sensor which is an ultrasensitive mass detection technology, can be used for detection of 10-12 bacteria, viruses and DNA. These are extremely useful for diagnosis of oral cancer and diabetes mellitus. Nanomaterials for brachytherapy like 'BrachySilTM' delivers P, are in clinical trial. Drug delivery system that can cross the blood brain barrier is vision of the future with this technology. Parkinson disease, Alzheimer disease, brain tumour will be managed more efficiently by the use of this technology. Nanovectors for gene therapy are in a developing stage to correct disease at molecular aspect.[3]
19. Nanotweezers:- In 1999, Philip Kim and Charles Lieber at Harward University manufactured the first nanotweezer. Its working end is a pair of electrically controlled carbon nanotubes made from a bundle of multiwalled carbon nanotubes. For operating the tweezers, a voltage is applied across the electrode, causing one nanotube arm to develop a positive electrostatic charge and the other to develop a negative charge.
20. Dental biomimetics:- The main aim of biomimetics is the manner to mimic utilize nanotechnology which involves dealing between amelogenin and the formation and directional orientation of hydroxyapatite crystals to compose enamel. The process may resemble the actual enamel formation (Table 2).[4]



Drug delivery devices

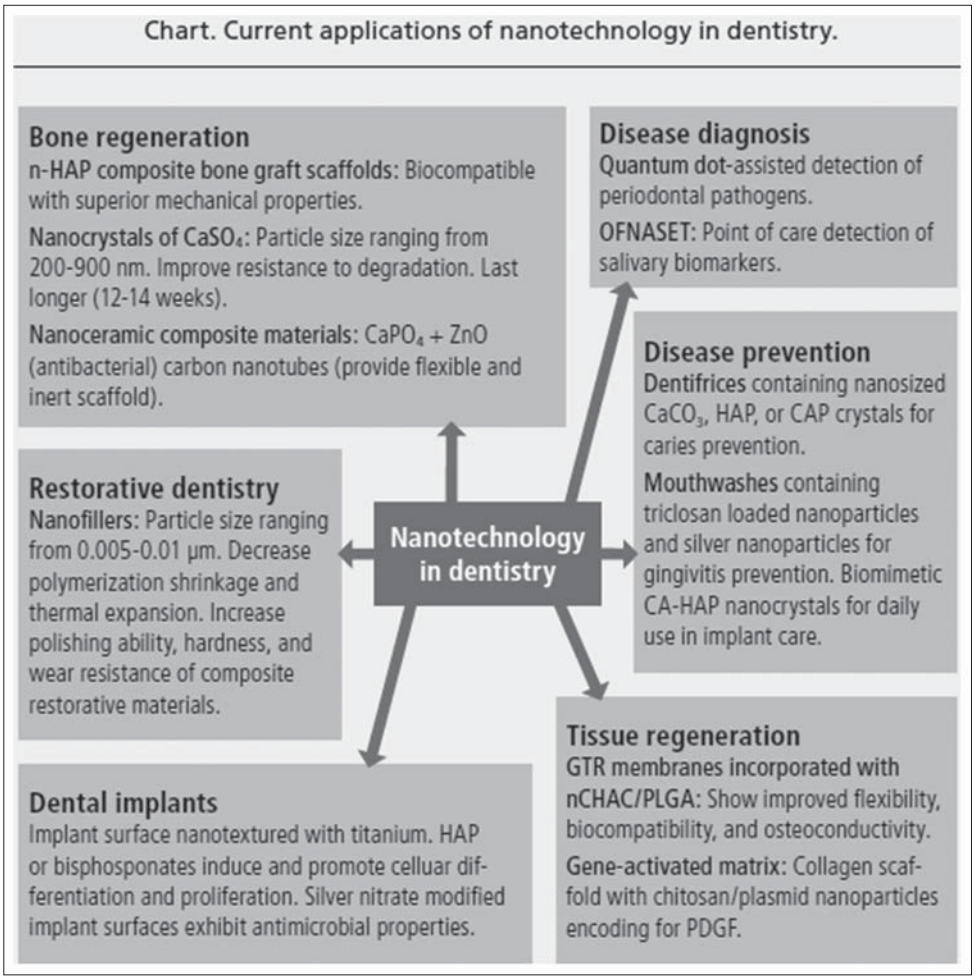
1. Nanotubes:- Sheets of graphene which can be rolled into cylinders and are described by lijim in 1991.
2. Carbon Fullerenes:- Buckyballs which are the insoluble hollow spheres of carbon, first described by Kroto et al in 1985.
3. Magnetic Nanoparticles:- The source of action is thermal exchange coupling and are dual core particles.
4. Lipid nanoparticles:- Biodegradable drug filled lipid particles without an outer coating but can penetrate stratum corneum.

Problems for Research in Nanotechnology[9]

- Slow decisions based on strategy
- Lack of funds and low economic status
- Lack of involvement of private enterprises
- Low availability of trained manpower
- Accurate manufacturing of nanoscale parts.
- Biocompatibility reasons.
- Social issues:
  1. Public acceptance
  2. Regulation
  3. Human safety
  4. Ethics[9]

Future fields of nanotechnology

1. Nanomedicine:- Art and science of preservation, diagnosis and treatment of a disease and improvement of human health by application of these minute particles called nanosized particles. Nanorobots used in medicine are basically taken into use for



applications in pharmaceutical research, diagnosis, and also for management of atherosclerosis, treating respiratory diseases, allowing instantaneous homeostasis, supplementing the immune system, replacing DNA sequences in cells, managing brain damage, and resolving gross cellular insults. Nanorobotic analgesics are an excellent modality to provide comfort to the patient and alleviate anxiety.

2. Nanophase carbon:- Nanofibers made from carbon have excellent mechanical properties that contain nanoscale fiber dimensions showing similarity to crystalline hydroxyapatite found in bone and in future to be used as a maxillofacial implant material.
3. Nanoscale cantilevers:- Beams showing a property of superbly advanced flexibility mimics a row of diving boards that can be engineered to bind to molecules leading to cancerous conditions.
4. Tooth regeneration:- The branches of genetic engineering, tissue engineering, and tissue regeneration are nowadays considered to be an essential part for repairing a tooth. Future holds the possibility to form a new tooth in-vitro. To prepare an autologous tooth which contains both mineral and cellular dental components, it can be made possible by improvements in research, and this process will eventually be achieved in the dentist's office.[8]
5. Dental implants: structure, chemistry, and biocompatibility:- Surface contact area and surface topography are the two most important factors on which the process of osseointegration is based. Bone growth and increased predictability can be effectively expedited within plants by using nanotechnology. The addition of nano scale deposits of hydroxyapatite and calcium phosphate creates a more complex implant surface for osteoblast formation (Albrektsson et al., 2008; Goene et al., 2007).[10]

Conclusion

The visions described above may sound unlikely, implausible or even heretic. Yet theoretical and applied research to turn them into reality is progressing rapidly. Nanotechnology will change dentistry, health care and human life more profoundly than many developments of the past. Nanotechnological advances should be viewed in the context of other expected developments relevant to oral health in coming decades. Nanodentistry faces many significant challenges in bringing its promises to fruition. There are larger social issues of public acceptance, ethics, regulation and human safety that must be addressed before molecular nanotechnology can enter modern medical armamentarium.

References

1. Awan KH, Khan S. Nanotechnology and its role in dentistry: A review. Hard Tissue. 2014; 3(1):10.
2. Kanaparthy R. The changing face of dentistry: nanotechnology.

International Journal of Nanomedicine. 2011; 6: 2799–2804
3. Mohan S, Gurtu A, Singhal A, Mehrotra A. Nanotechnology: Its Implications in Conservative Dentistry and Endodontics. Journal of Dental Sciences & Oral Rehabilitation. 2013; July – September
4. Dwivedi S, Chandra A, Sharma N. Nanotechnology boon or bane for restorative dentistry; A review. International Journal of Engineering Science Invention. 2013; 2(11): 1-5
5. Bhavikatti S, Bhardwaj S, Prabhuji M.L.V. Current applications of nanotechnology in dentistry: a review. General Dentistry. July/August 2014
6. Saravana Kumar R, Vijayalakshmi R. Nanotechnology in dentistry. Ind J Dent Res.2006;17(2)
7. Khurshid Z, Zafar M, Qasim S, Shahad S, Naseem M. Advances in Nanotechnology for Restorative Dentistry. Materials. 2015; 8: 717-731
8. Ozak S, Ozkan P. Nanotechnology and dentistry. European Journal of Dentistry. January 2013; 7
9. Bhardwaj A, Misuriya A, Maroli S, Manjula S, Singh A. Nanotechnology in dentistry: Present and future. Journal of International Oral Health. 2014; 6(1):121-126
10. Shetty N, Kumar D. Nanorobots: Future in dentistry. The Saudi Dental Journal. 2013; 25: 49–52

Review Article

Journal of Oral and Dental Health

Ozone Therapy in Periodontology: A Review

Abstract

Ozone therapy has successfully being used in the medical field for treatment of various diseases for more than 100 years. It is a versatile bio-oxidative therapy in which oxygen/ozone is administered via gas or dissolved in water or oil base to obtain therapeutic benefits. The aim of this review article is to summarize the basics of ozone therapy and discuss its application in the management of periodontal diseases.

Key words: Ozone, Bio-oxidative, Triatomic oxygen

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Introduction

The word ozone comes from the Greek "ozein" meaning odorant.[1] Ozone also known as triatomic oxygen and trioxygen is a naturally occurring compound consisting of three oxygen atoms.[2] Ozone therapy can be defined as a versatile bio-oxidative therapy in which oxygen/ozone is administered via gas or dissolved in water or oil base to obtain therapeutic benefits. Ozone therapy was accepted as an alternative medicine in the USA from 1880 and has been used for over 130 years in twenty countries throughout the world. Ozone can decarboxylate this acid to acetic acid.[3]

The first application of ozone in medical field seems to have been for treating aseous, post-traumatic gangrene in German soldiers during the 1st world war (Bocci V 2004).[4] It is also known that ozone can kill bacteria by rupturing their cell membranes within a few seconds. In medicine and dentistry, ozone is used as a powerful sterilizing agent either in the gaseous or aqueous phase, as it successfully kills bacteria, fungi and viruses. Ozone has been found to have a bactericidal effect, particularly in staphylococcal, streptococcal and other infections. Ozone has powerful microbicidal properties, however, this action not only affects micro-organisms but also all the other living systems. Ozone's concentration in the blood is very important and high levels can be very cytotoxic producing even haemolysis.

It is one of the most important gas in the stratosphere formed as a result of combination of three oxygen atoms on exposure to ultra violet rays.[5] It is also formed by the action lightening discharges and also has the capacity to absorb harmful UV rays.[6] There are 3 different systems of generating Ozone gas[7,8]

1. Ultra violet system produces in low concentrations of Ozone used in esthetics, saunas, air purification.
2. Cold plasma system used in air and water purification.
3. Corona discharge system produces high concentration of Ozone.

Historical aspects

The best technology for producing ozone gas was designed and built by Nikola Tesla in the 1920's. Heads of leading medical institutions in the U.S. contributed to a 1929 book "Ozone and Its Therapeutic Actions" describing the treatment of 114 diseases using ozone. Medical ozone, has been around for over 150 years and is used to treat infections, wounds, and multiple diseases. Ozone has been used to disinfect drinking water since before the turn of the last century. A text on medical ozone therapy was published by Dr. Charles J. Kenworth in 1885. In 1785, Van Marum noticed that air near his electrostatic machine acquired a characteristic odor when electric sparks were passed. However, it was not until 1932 that ozone was seriously studied by the scientific community, when ozonated water was used as a disinfectant by Dr. E.A. Fisch,[9] a Swiss Dentist. Fisch had the first idea to use ozone as either a gas or ozonated water in his practice. At the time, ozone therapy was difficult and limited due to the lack of ozone resistant materials, such as Nylon, Dacron, and Teflon, until 1950 when ozoneresistant materials were manufactured.

Mechanism of action

There are several potential actions of Ozone, which are applied in the clinical practice of dentistry and medicine, such as antimicrobial (bactericidal, viricidal and fungicidal), anti inflammatory, immunostimulating, antihypoxic and detoxicating, biosynthetic, (activation of the metabolism of carbohydrates, proteins, lipids) bio energetics, hemostatic etc. Ozone has been shown to possess unique properties and has potential applications to the clinical practice of dentistry and periodontics. An ozone application of 10 – 20 second has been reported to eliminate more than 99% of the microorganisms found in the dental caries and associated biofilms – and a 40 second treatment time covers all eventualities (Baysan & Lynch 2001).[10] It was reported that ozone at low concentration of 0.1 ppm, is sufficient to inactivate bacterial cells including their spores. The physio-chemical properties of ozone are accredited for its application in Periodontics.

Its known actions on human body are antimicrobial, analgesic, immunostimulating, antihypoxic and biosynthetic. Destruction of bacterial cell membrane, intercellular leakage and cell lysis was observed.[11] Ozone in high concentration is known to cause

immune depressive effect whereas in low concentration it is immune stimulating in nature.[12]

Goals of ozone therapy

The salient goals of ozone therapy include the following: inactivation and elimination of pathogens like bacteria, viruses, yeast fungus and protozoa; purification of blood and lymph; reduction of inflammation and pain; improvement of circulation; improvement of brain function and memory; and simulation of the humoral anti-oxidant system.[13-15]

Indications of ozone therapy in periodontics

The use of ozone has been proposed in dentistry because of its antimicrobial, disinfectant and healing properties. The effect of Ozone water on oral microorganisms and dental plaque were studied. Ozone was found to considerably inactivate microorganisms causing periodontitis and antifungal effect was observed when compared to chlorhexidine, but did not show any antiviral effect.[16,17] There is reduction in the plaque index, gingival index and bleeding index by using ozone irrigation when compared to chlorhexidine[18] In implant dentistry, the use of ozone is currently being investigated for the decontamination of the implant surface in Peri-implant therapy.[19]

Ozone therapy presents great advantages when used as an adjunct to conventional treatments.

Anti Microbial Properties

Ebensberger et al studied the effect of irrigation with ozonated water in periodontal ligament cells from freshly extracted erupting third molars. irrigation with isotonic sterile saline served as control group. Samples were studied immunohistochemically. it is found that teeth irrigated with ozone had a higher number of proliferating cell nuclear antigen(PCNA) than the control group. However, the difference was not statistically significant. Therefore they concluded that non isotonic ozone water not only helps in mechanically cleaning it doesnot have effect on periodontal cells[20]

Antibacterial Effect of Ozone on Plaque Biofilm

Periodontal disease are caused primarily by plaque biofilm. Ozone might be useful to control oral infectious microorganisms in dental plaque. The antimicrobial property of ozone is not only effective in reducing the number of cariogenic bacteria, but also causes significant reduction in the micro organisms present in the root canal. However it was not successful in completely eliminating these bacterias embedded in the biofilm.[21,22]

Wound Healing

Filippi found that application of ozonized water on daily basis can accelerate the wound healing process in first two post operative days in oral mucosa.[23]

Periimplantitis

Study by Karapetian et al treatment with ozonated water was found that the most effective bacterial reduction than compared to conventional and surgical procedures.[24] For the prevention of periimplantitis an adequate and steady plaque control regimen must be ensured. Ozone, a powerful antimicrobial kills the microorganisms causing periimplantitis. In addition ozone shows a positive wound healing effect due to the increase of tissue circulation. Gasiform ozone or ozonized water shows an increased healing compared to wound healing without ozone therapy.[25]

Contraindication

Pregnancy, Glucose 6 phosphate dehydrogenase deficiency, severe anemia, Ozone allergy, recent myocardial infarction, severe myasthenia, hyperthyroidism, hemorrhage, from any organ, acute alcohol intoxication.[26] ozone can be deleterious to the lungs and other organs but well calibrated doses can be therapeutically used in various conditions without any toxicity or side effects. (Bocci V et al., 2009).[27] The European Cooperation of Medical Ozone Societies warns that direct intravenous injections of ozone/oxygen gas should not be practiced due to the possible risk of air embolism.

Conclusion

The ozone therapy has been more beneficial than present conventional therapeutic modalities that follow a minimally invasive and conservative application to dental treatment. ozone therapy has great potential in the treatment of various conditions encountered in dental practice. The versatility of ozone therapy, its unique properties, absence of side effects or adverse reactions were responsible for its wide spread use. Scientific research suggests that ozone therapy has great potential in treatment of various conditions in dental problems and to inactivate viruses, fungi and bacteria. Further research is needed to standardise indication and treatment procedures.

References

1. Gupta G, Mansi B. Ozone therapy in periodontics. Journal of Medicine and Life 2012;5:59-67.
2. Stopka P. Ozon. Progresdent 2003; 6: 8-11.
3. Bocci V. Ozone as Janus: this controversial gas can be either toxic or medically useful. Mediators Inflamm. 2004;13:3-11.
4. Bocci V. Ozone as Janus: this controversial gas can be either toxic or medically useful Mediators of Inflammation 2004; 13:3
5. Grootveld, Baysan A, Siddiqui N, Sim J, Silwood C, Lynch E, editor, Ozone the revolution in dentistry, London, Quintessence Publishing Co, 2004,23-30.
6. Gupta G, Mansi B, Ozone therapy in periodontics, Journal of medicine and life, 5,2012,59-67.
7. Bocci1 V, Zanardi I, Michaeli D, Travagli V (2009) Mechanisms of action and chemical biological interactions between ozone and body compartments: A critical appraisal of the different administration routes. Current drug therapy.
8. Bocci V, Zanardi I, Travagli V (2011) Oxygen/ozone as a medical gas mixture. A critical evaluation of the various methods clarifies positive and negative aspects. Medical Gas Research 1: 6.
9. Fish E. Apparatus for the production and use of ozone in therapeutics. United States Patent 2,054,367. September 15, 1936.
10. Baysan A, Lynch E, Reversal of primary root caries using Dentrifices containing 5000 and 1100 ppm flouride caries Res 2001;35:41-46
11. Thonomsub B, Anupunpisit V, Chanphetch S, Watchrachaipong T, Poonkhum R, Srisukonth C. Effects of ozone treatment on cell growth and ultrastructural changes in bacteria, J Gen Appl Microbiol,48,2002,193-9.
12. Baysan A,Lynch E, Reversal of primary root caries using Dentrifices containing 5000 and 1100 ppm flouride caries Res 001;35:41-46
13. Gupta G, Mansi B. Ozone therapy in periodontics. Journal of Medicine and Life 2012;5:59-67.
14. Srikanth A, Sathish M, Harsha AVS Application of ozone in the treatment of periodontal disease. J Pharm Bioallied Sci 2013;5:S89-94.
15. Benita P. Ozone therapy – a new approach in periodontal management. IOSR Journal of Dental and Medical Sciences 2014;13:20-4.

16. Ebensberger U, Pohl Y, Filippi A (2002) PCNA-expression of cementoblasts and fibroblasts on the root surface after extraoral rinsing for decontamination. Dent Traumatol 18: 262-266.
17. Kshitish D, Laxman VK (2010) The use of ozonated water and 0.2% chlorhexidine in the treatment of periodontitis patients: a clinical and microbiologic study. Indian J Dent Res 21: 341-348.
18. Kshitish D, Laxman VK (2010) The use of ozonated water and 0.2% chlorhexidine in the treatment of periodontitis patients: a clinical and microbiologic study. Indian J Dent Res 21: 341-348.
19. Srikanth A, Sathish M, Harsha AVS. Application of ozone in the treatment of periodontal disease. J Pharm Bioallied Sci 2013;5:S89-94.
20. Ebensberger U, Pohl Y, Fillipi A, PCNA expression of cementoblasts and fibroblast on the root surface after extra oral rinsing for decontamination, Dental traumatology,18,2002,262.
21. Polydorou O, Halili A, Wittmer A, Pelz K, Hahn P. The antibacterial effect of gas ozone after 2 months of in vitro evaluation. Clin Oral Investig 2011 Feb 18. [Epub ahead of print].
22. Johanson E, Claeson R, VanDijken JW. Antibacterial effect of ozone on cariogenic bacterial species. J Dent 2009; 37: 449- 453.
23. Fillipi A. The influence of ozonised water on the epithelial wound healing process in the oral cavity, Clinic of oral surgery, University of Basel, Switzerland.
24. Karapetian Ve, Neugebauer J, Clausnitzer CE, Zoller JE, Comparison of different Periimplantitis Treatment methods.
25. Karapetian VE, Lowden E and Zöller JE. Die Verwendung von Ozon in der Periimplantitistherapie - Klinische Studie.*ZWR* (The Use of Ozone in Periimplantitis-Treatment) – Das Deutsche Zahnärzteblatt 2007; 116: 214-218.
26. Nogales CG, Ferrari PH, Kantorovich EO, Lage-Marques JL (2008) Ozone therapy in medicine and dentistry. J Contemp Dent Pract 9: 75-84.
27. Bocci V. Ozone as Janus: this controversial gas can be either toxic or medically useful. of Inflammation 2004; 13:3.

Review Article

Journal of Oral and Dental Health

Composites - Newer Materials on the Horizon: A Review

Abstract

During the last few years, great effort has been put into improving handling characteristics, mechanical and adhesive properties of resin composites. Modern composite resins provide an excellent alternative to traditional restorations. No other class of materials has promised and delivered such a wide range of restorative options to clinicians. Because of their development, pedodontists can implement preventive and minimally invasive techniques, a prospect previously desired but never truly attained. Even more important, patients can retain their teeth longer, with a more esthetic appearance, resulting in a healthier, more self- confident population.

Key words: Restorative materials, Resins, Filled, Unfilled

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Introduction

The ultimate goal of dental restorative materials is to replace the biological, functional and esthetic properties of healthy tooth structure. Dental amalgam and gold alloys, which have a long record of clinical success, have been used as dental restorative materials for more than 100 years, especially in posterior teeth; however these metallic restorations are not esthetic. Tooth colored restorative materials have been used to replace missing tooth structure and to modify tooth color and contour, thus enhancing facial esthetics.

Composite resins which were originally introduced were called unfilled resins and were based on methyl methacrylate system. Light- activated resin composites, introduced in 1970s, revolutionized clinical dentistry by maximizing working time and minimizing setting time. Ultraviolet cured resins were developed first which were replaced by visible light cured composites. Over the last few years, composite restorations and adhesive techniques have become the foundation of modern restorative dentistry.[1]

During the last few years, great effort has been put into improving handling characteristics, mechanical and adhesive properties of resin composites. Highly filled hybrid and packable resin composites, fiber-reinforced composites and ormocers have been introduced in the dental market with high expectancy.[2]

Historical background

Prior to 1900 many items classified as "plastic" materials were developed from natural resins or exudates and tissues from plants, animals and insects.[3]

The period from 1910 to 1950 is referred as the age of thermoplastics.[3]

Sevitron, the first tooth- colored direct filling material for anterior teeth using the sulfinic acid system: was produced by LD Caulk in 1950.[3]

1956---> Dr Bowen used heat- cured epoxy composites as indirect restorations with good initial results.[3]

1962---> Dr Rafael Bowen introduced Bis- GMA which is also known as Bowen's resin. Replacing epoxy groups with methacrylate groups enabled Bowen to use conventional methods to polymerize the new compound (bis-GMA), and the first successful monomer system for composites was born.[4]

Bowen and Cleek invented barium glass fillers in 1969.[5]

The first use of composite in paste/liquid form was developed by Robert Chang in 1969 and Henry Lee in 1970. Lee's development went on to commercialization and was known as Adaptic, a paste/paste material.

Photopolymerized composite system was developed by Michael Buonocore in 1970 and was introduced in 1971 by LD Caulk. The advantage of such polymerization method was that it provided the dentist with "command cure". The first product using UV light to cure composites was the Nuva System developed by LD Caulk.[3]

1978---> visible light curing composite were developed.[6]

1970s to early 1980--->microfilled composites.[6]

Bowen invented strontium glass filler in 1980 (United states patent no. 4,215,033, July 29, 1980).[5]

1987--> heat- treated composite inlay/onlay was developed by Wendt. He demonstrated in his in vitro study that heat treating at 250°c for seven to eight minutes substantially improved hardness and wear resistance of the resins.[7]

1992---> William et al classified composites according to particle size and correlated the mean particle size to Young's modulus.[8]

Since then there has been an ongoing process of improvement in the properties of composite resins.

Newer Trends

Giomer

Giomer restoratives are touted as the true hybridization of glass ionomer and resin composite. They have the properties of fluoride

release and the fluoride recharge of glass ionomer cements along with excellent esthetics, easy polishability and strength of resin composites.[9]

The composition of giomers is based on PRG (pre-reacted glass ionomer) technology. This technology involves the pre- reaction of fluoro-aluminosilicate glass fillers with polyacrylic acid forming a stable phase of glass ionomer described as "wet siliceous hydrogel". The resulting glass ionomer is then freeze- dried, milled, silane- treated and ground to form the PRG fillers. These fillers are then incorporated into a resin matrix. The final product is composed of a stable phase of glass ionomer suspended in resin matrix. It is supposed that the presence of a pre-reacted hydrogel is responsible for the high levels of fluoride release and the recharge of giomers.[9]

PRG- technology is classified into two categories:

F-PRG (full reaction type), where the entire filler particle is attacked by polyacrylic acid.

An example of full reaction type giomer is Reactmer (Shofu Dental Corporation, Osaka Japan). Its indication is limited to cervical cavities.

S-PRG (surface reaction type), where only the surface of glass filler is attacked by polyacrylic acid and a glass core remains. The surface reaction type is exemplified by Beautifil (Shofu Dental Corporation Osaka Japan).

Yap AUJ (2002) stated that fluoride release of giomer was significantly greater than compomer, Resin- modified glass ionomer, conventional glass ionomer at day seven but it became significantly lower at day 28 due to the diminishing fluoride. This short coming may, however, be overcome by fluoride "recharging" using topical fluorides.[10]

Compomers

The name compomer means that the material possess a combination of the characteristics of both composites and glass ionomers but it actually shows minimal glass ionomer reaction. In fact, a more preferred nomenclature of "polyacid- modified resin composites" has been suggested but is less widely accepted.[11]

The first compomer was introduced in 1993 and was produced with trade name of Dyract.[12]

Dyract consist of two resins forming the matrix of the final paste. The urethane dimehtacrylate (UDMA) monomer and TCB resin (butane tetracarboxylic acid backbone with a polymerizablehydrothylmethacrylate (HEMA) side chain). The resultant new monomer contains two methacrylate groups as well as two carboxyl groups.

In F200 compomer restorative, the resin matrix is composed of three monomers: thedimethacrylatefunctionaloligomer(CDMAoligomer) derived from citric acid, the hydroxypropylenedimethacrylate which is commonly known as glyceryl dimethacrlate (GDMA) and a high molecular mass hydrophilic polymer.

Compomers contain acid- decomposable aluminosilicate glass and acidic, polymerizable monomers substituting the polyalkenoic acid polymers and they are one-component materials that do not require mixing, in contrast to glass ionomer and resin- modified glass ionomer cements.[13]

Of equal importance for the final properties of the resin system is the reactive silicate glass filler.

The finely mixed glass, with a mean particle size of 2.5μm, accounts for 72% of the composition and also contains 15% of fluoride.

There are two stages of setting reaction-

The Ist stage is the dominant free radical polymerization identical with that occurring in resin composite. After the initial set, the polymerized bulk begins to absorb water in the moist environment of the mouth. The acidic conditions by virtue of the carboxyl group on the TCB molecules, cause metal cations to be liberated from the reactive silicate glass, which eventually leads to the formation of hydrogels in the resin structure of the compomer, although the rigidity of the set material at this stage means that the extent to which such a reaction can occur is limited. This additional acid- base reaction results in further cross- linkages of the entire matrix.

Fluoride is released but at a lower degree than that released by glass ionomer or resin- modified glass ionomer cements.[13]

Nanocomposites

Nanotechnology also known as molecular nanotechnology or molecular engineering is the production of functional materials and structures in the range of 0.1 to 100 nanometers.

Nanofiller particles

It consist of two types of nanofiller particles: nanomeric or NM particles and nanoclusters or NCs.

The NM are monodisperse nonaggregated silica nanoparticles. Their size range from 20 to 75nm in diameter. Silica particles are treated with 3-methacryloxypropyltrimethoxysilane or MPTS. MPTS is a bifunctional material also known as coupling agent, contains a silica ester function on one end for bonding to inorganic surface and methacrylate group on the other end to make the filler compatible with the resin before curing to prevent agglomeration or aggregation.

NC are of two types: the first type consist of primary particle size of ranging from 2 to 20nm while the spheroidal agglomerated particles have a broad size distribution with an average particle size of 0.6 μm. the second type consist of 75nm primary particle size and broad secondary particle size distribution with a average 0.6μm.

The use of spheroidal NC fillers with their broad particle distribution enable to obtain high filler loading, desirable handling characteristics and physical properties comparable with those of commercial hybrid composites. Nanocomposites also offer advantages in optical properties. NM- particle materials, the size of the particles is far below the wavelength of light, making them unmeasurable by the refractive index. When light comes in, long wavelength light passes directly through and materials show high translucency.[14]

Ormocers

It was introduced under the name Admira.Ormocers, has been developed since 1991.Ormocer means organically modified ceramics, it is formed as follows:

Starting from an alkoxysilane functionalized with polymerizable group, hydrolysis and condensation led to an oligomeric Si-O-Si nano-structure. These oligomers replace the conventional monomers in composite. In a second step, a three dimensional network is formed by polymerization of the functional groups. Ormocer are characterized by this novel inorganic- organic copolymers in the formulation that allows the modification of mechanical parameters over a wide range. The aim of this monomer system was to reduce

the polymerization shrinkage, what allows improving marginal adaptation.[15]

A considerable widening of the adjustable properties is obtained through the possible incorporation of different fillers in the Ormocer composite (up to 67 vol %)

The Ormocer based composites possess a modified organic matrix, formed by monomers with a single polymerizable end. The other end is formed by an alkoxy group, resulting in an inorganic area, bonded to other monomers by a chemical reaction of condensation, converting the monomer precursors in a polymeric inorganic condensate, via sol-gel processing, creating a complex structure with the formation of the Si-O-Si chain in the inorganic area of the polymer. The combination of this organic-inorganic matrix and filler particles in high concentrations (superior to 67%vol) would generally provide physical and mechanical properties superior to those of conventional composites, advantageous to the Ormocer based composite.

However, this modification of the matrix could bring the disadvantage of a larger surface roughness of the Ormocer composite when compared to the conventional materials, due to the characteristic of its organic-inorganic resin matrix. The largest roughness is responsible for an undesirable loss of esthetics of the restoration, due to the loss of surface gloss and biological disadvantages, causing dental plaque accumulation and increasing the risks of occurrence of caries and periodontal inflammation.[16]

Fiber Reinforced Composite

An effective means of improving the mechanical performance of a composite is to incorporate fibers into the matrix for reinforcement. These fiber-reinforced composite have been produced by incorporating various fibers into resin matrix. Glass fibers have drawn the most attention due to their esthetic qualities and easy manipulation.[17]

Composite materials can be either particle reinforced (random or preferred orientation) or fiber/whisker reinforced (single or multi-layered, continuous or discontinuous fiber, random or preferred orientation). The term continuous fibers was used to describe fibers that were either aligned or in mesh or other forms, and that extended continuously through a major portion of the composite specimen. Continuous fibers were differentiated from chopped fibers and whiskers in that chopped fibers and whiskers were discontinuously distributed in the matrix and that each fiber or whisker was much shorter than the dimensions of the composite specimen. Continuous fibers were used in the reinforcement of denture base resins, bridges, splints, retainers, orthodontic arch wires, fixed prosthodontic appliances and fixed partial dentures. However, continuous fibers have not been used for the reinforcement of direct- filling tooth cavity restorations.[18]

Different types of material have been used to reinforce composite they include:-

(1) Glass fibers consisting of glass interlaced filaments, improve the impact strength of composite materials, but do not easily stick to a resinous matrix.[19]
(2) Carbon fibers prevent fatigue fracture and strengthen composite materials, but they have a dark color, which is esthetically undesirable.
(3) Kevlar fibers made of an aromatic polyamide, are the evolution of nylon polyamide.
(4) Vectran fibers are synthetic fibers of a new generation, made of aromatic polyesters.

Ribbond (Ribbond Inc., Seattle, Wash) is a reinforced ribbon made of ultrahigh molecular weight polyethylene fiber that has an ultrahigh modulus. Ribbondtriaxial consist of cold plasma-treated polyethylene fibers differing in their shape and thickness.[19] In the triaxial braid architecture, fibers are arranged in three directions: the axial yarns and the two braiding yarns are oriented at predetermined sets of angles (such as ± 30° and ± 45°). Triaxial braids increases the flexural characteristic of resin composites and provides a high level of fatigue resistance by isolating and arresting cracks.[20]

The ideal amount of fiber for superior wear resistance is between 2.0% and 7.6 wt% for matrix and fiber type/length. The relation between the wear resistance and fibers weight is not linear.[21]

In dentistry most common existing fiber reinforcement has been glass and carbon fiber bundles, impregnated or non-impreganted.

Conclusion

Modern composite resins have given a new face to esthetic dentistry. With the developmet of these adhesive resins, patients can retain their teeth longer and with more esthetic appearance.

References

1. Yap AUJ, Seneviratne C: Influence of light energy density on effectiveness of composite cure. Operative Dentistry 2001: 26: 460-466.
2. Dijken JWV, Gronberg KS: Fiber- reinforced packable resin composites in class II cavities. Journal Of Dentistry 2006: 34: 763-769.
3. Rueggeberg FA: From vulcanite to vinyl, a history of resins in restorative dentistry. The Journal of Prosthetic Dentistry 2001:87:364-379.
4. Dale A: Textbook of Esthetic Dentistry.
5. Willaim J. O'Brien: Dental Materials and their selection. Third edition.
6. Sturdevant'sArt and Science of Operative Dentistry. Fifth edition.
7. Aggarwal V, logani A, JainV, ShahN: Effect of cyclic loading on marginal adaptation and bond strength in direct vs indirect class II MO composite resin. Operative Dentistry 2008:33(5):587-592.
8. Kim KH, Ong JL,Okuno Osamu: The effect of filler loading and morphology on the mechanical properties of contemporary composites. J Prosthet Dent 2002: 87: 642-649.
9. Sunico MC, Shinkai K, Katoh Y: Two-year clinical performance of occlusal and cervical giomer restorations. Operative Dentistry2005: 30(3: 282-289.
10. Yap AUJ, Tham SY, Zhu LY, Lee HK; Short term fluoride release from various aesthetic restorative materials. Operative Dentistry 2002: 27: 259-265
11. Hasegawa T, Itoh K, Yukitani W, Wakumoto S, Hisamitsu H: Depth of cure and marginal adaptation to dentin of xenon lamp polymerized resin composites. Operative Dentistry 2001: 26: 585-590.
12. Turgut MD, Tekcicek M, Olmez S: Clinical evaluation of polyacid- modified resin composite under different conditioning methods in primary teeth. Operative Dentistry2004: 29(5): 515-523.
13. Demirci M, Ersev H, Ucok M: Clinical evaluation of a polyacid-modified resin composite(Dyract) in class III cavities: Three – year results. Operative Dentistry 2002; 27: 223-230.
14. Mitra SB, Wu D, Holmes BN: An application of nanotechnology in advanced dental materials. JADA2003:134; 1382-1390
15. Alonoso RCB, Cunha LG, Correr GM, Santos PH: Comparative evaluation of knoop hardness and depth of cure of Ormocer based resin composites. CiencOdontol Bras 2004: 7(1): 6-13.
16. Sikri V: Textbook of Operative Dentistry. Second edition.
17. Garoushi S, Lassila LVJ, Tezvergil A, Vallittu PK: Load bearing capacity of fibre-reinforced and particulate filler composite resin combination. Journal

Of Dentistry 2006:34:179-189.
18. Xu HHK, Schumacher GE, Eitchmiller FC, Peterson.C, Antonucci JM, Mueller HJ: Continuous-fiber perform reinforcement of dental resin composite restorations. Dental Materials 2003: 19: 523-530.
19. Arhun N, Arman A: Fiber-reinforced technology in multidisciplinary chairside approaches. Indian Journal Of Dental Research 2008: 19(3): 272-277.
20. Deliperi S: Direct fiber-reinforcedcomposite restoration in an endodontically treated molar: a three-year case reportclinical technique/ case report. Operative Dentistry2008:33(2):209-214.
21. Christensen GJ: Remaining challenges with class II resin- based composite restorations. *JADA* 2007: 138: 1487- 1489.

Review Article

Journal of Oral and Dental Health

LASERS in Periodontal Surgery: A Review

Abstract

The word LASER is an acronym for LIGHT AMPLIFICATION BY STIMULATED EMISSION OF RADIATION. The principle of LASER was first described by physicist Albert Einstein in 1917. Although the discovery of lasers and research into their applicability for dental use began in the 1960s, it was not until 1985 that the first documented use of a laser in periodontal surgery was published. Several advantages of using lasers in periodontal therapy include hemostasis, less postoperative swelling, a reduction in bacterial population at the surgical site, less need for suturing, faster healing, and less postoperative pain.

Key words: Dentistry, LASER, Periodontal surgery

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Introduction

In the past 100 years there has been extensive development of the mechanical cutting devices used in dentistry. The word LASER is an acronym for Light Amplification by Stimulated Emission of Radiation. The principle of the laser was the first known in 1917 when physicist Albert Einstein described the theory of stimulated emission.[1] However, while considerable progress has been made in this area of mechanical cutting, dental patients are still afraid of the noise and vibration produced by the mechanical action of the air turbine and ultrasonic scalers. From the end of the 20 century until now, there has been a continuous upsurge in the development of laser-based dental devices based on photomechanical interactions. Einstein's theories about the stimulated emission.[2] Since then, different lasers, such as diode, CO2, Nd: YAG, Er: YAG, and Er, Cr: YSGG have been developed and within a few years have been used in dentistry.[3,4]

The use of laser technology and its advancements in the field of medicine and dentistry playing a major role in patient care and well-being. All dental lasers exert their desired clinical effect on a patient's target tissue by a process called absorption.[5]

History of Dental Lasers

In 1960, Theodore Maiman was the first scientist who demonstrates the laser function and also developed a working laser device "known as ruby laser," made of aluminum oxide, that emitted a deep red-colored beam. Dental researchers began investigating lasers' potential and Stern and Sognnaes reported in 1965 that a ruby laser could vaporize enamel.[6] The thermal effects of continuous wave lasers at that time would damage the pulp.[7] The first laser that had truly both hard and soft tissue application was the CO2 laser, invented by Patel in 1964.[8]

Laser-tissue Interaction

The most desired interaction[9-11] is the absorption of the laser energy by the intended tissue. The largest absorption peak for water is just below 3000 nm, which is at the Er: YAG wavelength. Erbium is also well absorbed by hydroxyapatite. CO2 at 10,600 nm is well absorbed by water and has the greatest affinity for tooth structure.

Laser light has four types of interactions with the target tissue which depends on the optical properties of that tissue: Absorption, transmission of laser energy,reflection, scattering of the laser light.

Absorption

When the laser is applied to the tissue, there is the absorption of laser energy in the target tissue. CO2 laser having wavelength of 10,600 nm is well absorbed by water and penetrates only to a few microns of the target tissue's surface.[12] This wavelength provides enough depth to seal the damaged blood, lymphatic vessels and nerve endings resulting in good hemostasis and minimal post-operative morbidity.[13]

Transmission

This property depends on the wavelength of laser light used. Argon and diode laser light gets transmitted through water, whereas tissue fluids readily absorb the erbium family and CO2 at the outersurface so there is little energy transmitted to adjacent tissues.[14]

Scattering of the Laser Light

This property can cause unwanted damage as there is heat transfer to thetissue adjacent to the surgical site. However, a beam deflected in different directions facilitates the curing of the composite resin or when treating an aphthous ulcer.[15] The result of using the smaller spot greatly increases the heat transfer from the laser to the tissue and a corresponding increased heat absorption in that smaller area. This time can be regulated by the repetition rate of the pulsed laser emission mode as well.

Use of Lasers on Hard Tissues

Lasers for caries detection[16-20]

While laser fluorescence has demonstrated good sensitivity and excellent reproducibility for detecting caries, it is not able to quantify the extent of decay.

This diagnostic technology in which a Diagnodent, a 655 nm diode laser, aids in the detection of incipient caries is called laser-induced fluorescence. These porphyrins showed some fluorescence after excitation by red light. Although, the procedure is considered to be safe, further studies are required for explorations the beneficial effects of this innovative technology.[21-23]

Lasers for removal of carious lesions and cavity preparation

Laser systems can be used for effective caries removal and cavity preparation without significant thermal effects, collateral damage to tooth structure, or patient discomfort. The Er: YAG lasers are proven to be safe and effective in caries removal and cavity preparation in pediatric and adults patients without significant damage to tooth structure or patient discoEr-based laser system can achieve effective ablation at temperatures well below the melting and vapourization temperatures of enamel.[24-26]

Laser bleaching

In October 1998, the ADA Council[27] concluded that because of concerns regarding pulpal safety and a lack of controlled clinical studies, the CO2 laser could not be recommended for tooth-whitening applications. The objective of laser bleaching is to achieve the ultimate power bleaching process using the most efficient energy source while avoiding any adverse effects.

Use of Lasers on Soft Tissues

Laser curettage

Both the Nd: YAG and gallium-arsenide (or diode) lasers are promoted for curettage. A critical review of the best available evidence, however, strongly indicates that there is no added benefit to the patient when this procedure is performed after traditional mechanicalscaling and root planing.[28,29] Both the Nd: YAG and diode lasers are indicated for curettage. Laser assisted curettage significantly improves outcomes in mild to moderate periodontitis. The beneficial effects of these lasers are due to the bacterial properties particularly against periodontal pathogens such as *A. actinomycetemcomitans* and *P. gingivalis*. Er: YAG laser posses suitable characteristics for various surgical and non-surgical procedures but randomized controlled clinical trials have to be encouraged to confirmits status as an adjunct or alternative to convectional periodontal therapy.

Limitations of Lasers

- It requires additional training and education for various clinical applications and types of lasers.
- High cost required to purchase equipment, implement technology and invest in required education.
- More than one laser may be needed since different wavelengths are required for various procedures.

Advantages

Because of photo-physical characteristics of lasers,laser inradiation exhibits strong ablation, hemostasis, detoxification nad bactericidal effects on human body. These effects could be beneficial during periodontal treatment, specially for the fine cutting of soft tissue as well as in the debriment of diseased tissue.

Disadvantages

First the high financial cost of a laser apparatus is a significant barrier for laser utilization by periodontal practisioners. Second each laser has different characteristics because of different wavelengths. It is difficult for the users to learn all aspects of the techniques and precautions required for the newer technologies.im proper irradiation of teeth abd periodontal pockets by lasers can damage the tooth and root surfaces as well as the attachments apparatus at the bottom of the pocket. Damage to the underlying bone and dental pulp should also be considered.[30,31]

Conclusion

Plaque and calculus removable, coagulation, faster tissue ablation and healing, no or minimal pain,no or few sutures, instant sterilization, little tissue shrinkage and de pigmentation are main factors favouring laser application in periodontics. Laser technology has been widely used in dentistry. When used efficacely and ethically, lasers have been an essential tool in many dental treatments.laser can also proved to be blessing in disguise if not used safely and properly. Aaraaon rose says, in rite light at rite time everything is extra ordinary.

References

1. Aoki A, Sasaki KM, Watanabe H, Ishikawa I. Lasers in nonsurgical periodontal therapy. Periodontol 2000 2004;36:59-97.
2. Maiman TH. Stimulated optical radiation in ruby. Nature 1960;187: 493-4.
3. Goldman L, Hornby P, Meyer R, Goldman B. Impact of the laser on dental caries. Nature 1964; 203: 417.
4. Stern RH, Sognnaes RF. Laser beam effect on dental hard tissues. J South Calif Dent Assoc. 1965 Jan;33:17-9.
5. Niemz M. Laser tissue interactions, ed. 2. Berlin, Germany: Springer;2002.
6. Stern RH, Sognnaes RF. Laser Effect on Dental Hard Tissues. A Preliminary Report. J South Calif Dent Assoc. 1965 Jan;33:17-9.
7. Adrian JC, Bernier JL, Sprague WG. Laser and the dental pulp. J Am Dent Assoc. 1971 Jul;83(1):113-7.
8. Yamamoto H, Sato K. Prevention of dental caries by acoustooptically Q-switched Nd: YAG laser irradiation. J Dent Res 1980;59:137.
9. Frank F. Laser light and tissue biophysical aspects of medial laser application. SPIE Lasers Med 1989;1353:37-45
10. Dederich D. Laser tissue interaction. Alpha Omegan 1991;84:33-6.
11. Dederich DN. Laser/tissue interaction: what happens to laser light when it strikes tissue? JADA 1993;124(2):57-61
12. Coluzzi DJ. Fundamentals of dental lasers: Science and instruments. Dent Clin North Am 2004;48:751-70, v.
13. Coluzzi DJ. Fundamentals of dental lasers: Science and instruments. Dent Clin North Am 2004;48:751-70, v.
14. Coluzzi DJ. Fundamentals of dental lasers: Science and instruments. Dent Clin North Am 2004;48:751-70, v.
15. Coluzzi DJ. Fundamentals of dental lasers: Science and instruments. Dent Clin North Am 2004;48:751-70, v
16. Coluzzi DJ. Fundamentals of dental lasers: Science and instruments. Dent Clin North Am 2004;48:751-70, v
17. El-Housseiny AA, Jamjoum H. Evaluation of visual, explorer, and a laser device for detection of early occlusal caries. J Clin Pediatr Dent 2001;26(1):41-8
18. Tam LE, McComb D. Diagnosis of occlusal caries, part II: recent diagnostic technologies. J Can Dent Assoc 2001;67:459-63.
19. Lussi A, Megert B, Longbottom C, Reich E, Francescut P. Clinical performance of a laser fluorescence device for detection of occlusal caries lesions. Eur J Oral Sci 2001;109(1):14-9.
20. Shi XQ, Welander U, Angmar-Mansson B. Occlusal caries detection with KaVo DIAGNOdent and radiography: an in vitro comparison. Caries Res 2000;34(2):151-8.
21. Lennon AM, Buchalla W, Switalski L, Stookey GK. Residual caries detection using visible fluorescence. Caries Res 2002;36:315-9
22. El-Housseiny AA, Jamjoum H. Evaluation of visual, explorer, and a laser device for detection of early occlusal caries. J Clin Pediatr Dent 2001;26:41-8.
23. Tam LE, McComb D. Diagnosis of occlusal caries: Part II. Recent diagnostic technologies. J Can Dent Assoc 2001;67:459-63.
24. Lussi A, Megert B, Longbottom C, Reich E, Francescut P. Clinical performance of a laser fl uorescence device for detection of occlusal

caries lesions. Eur J Oral Sci 2001;109:14-9.
25. Louw NP, Pameijer CH, Ackermann WD, et al. Pulp histology after Er: YAG laser cavity preparation in subhuman primates: a pilot study. SADJ 2002;57:313-7.
26. Takamori K. A histopathological and immunohistochemical study of dental pulp and pulpal nerve fibers in rats after the cavity preparation using Er: YAG laser. J Endod 2000;26(2):95-9.
27. Takamori K, Furukawa H, Morikawa Y, Katayama T, Watanabe S. Basic study on vibrations during tooth preparations caused by high speed drilling and Er: YAG laser irradiation. Lasers Surg Med 2003;32(1):25-31.
28. ADA Council on Scientific Affairs. Laser-assisted bleaching: an update. JADA 1998;129:1484-7.
29. Dederich DN, Drury GI. Laser curettage: where do we stand? J Calif Dent Assoc 2002;30:376-82.
30. American Academy of Periodontology. Statement regarding gingival curettage. J Periodontol 2002;73:1229-30.
31. Application of Laser in Periodontics: A New Approach in Periodontal Treatment Dr. Dae- hyun Lee, The Hongkong Medical Diary, Vol:12:No:10 Oct 2007.

Review Article

Journal of Oral and Dental Health

Etiological and Predisposing Factors for Dentin Hypersensitivity: An Overview

Abstract

There are potentially numerous and varied etiological and predisposing factors to dentine hypersensitivity. Certainly, no prime cause can be identified. By definition, dentine hypersensitivity may arise as a result of loss of enamel and or root surface denudation with exposure of underlying dentine. Enamel loss as a part of tooth wear may result from attrition, abrasion or erosionfollowed by the constant action of acids, which keep the tubules open on the dentin surface, or because the root surface has been denuded due to loss of structures such as cementum, which is easily removed by brushing or periodontal treatment, or more commonly, by the association of two or more of these factors. This article aims tooverview the various etiological and predisposing factors of dentin hypersensitivity.

Key words: Tooth wear, Enamel, Dentin, Periodontal ligament, Hypersensitivity

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Introduction

Tooth wear has usually been divided into attrition, erosion and abrasion, in reality Dentine Hypersensitivity is due to a combination of these but often with differing proportional effects. The various factors involved either act as predisposing or as etiological factors. One problem of dentine Hypersensitivity surveysis the definition of the condition and parameter ofmeasure. The value of surveys comes into questionwhen one wants to know the progress of Dentin hypersensitivity, since the data is a cumulative record. It is here wherelongitudinal studies play a vital role in describing thedisease process. Unfortunately, these studies are rarelargely because wear occurs slowly.[1]

Gingival Recession

Gingival recession and subsequent root surface exposure allow more rapid and extensive exposure of dentinal tubules because the cementum layer overlying the root surface is thin and easily removed. Gingival recession, as with dentine hypersensitivity, has been described as an enigma, having what appears to be a multifactorial aetiology. Tooth brushing has long been implicated in gingival recession on buccal surfaces and is a frequent finding in subjects with a high standard of oral hygiene or with a history of hard toothbrush use. Also recession increases with increasing brushing frequency. Gingival recession is frequently cited to result from periodontal treatment particularly surgery as is dentine hypersensitivity.[1]

Corrosion

Tooth surface loss caused by chemical and electro chemical action is termed "corrosion". There are both endogenous and exogenous source of corrosion. Endogenous source of corrosion is bulimia which produces a unique pattern of enamel loss. The corrosion called "perimolysis" is most marked on the palatal surface of maxillary anterior teeth and in most severe cases buccal surfaces of posterior teeth. The pattern is consistent with the head's position while vomiting. The forcefully directed movement of the vomitus, which has a mean ph of 3.8 determines the site and extent of dental corrosion. A special pattern of surface loss also is observed in patients with gastro esophageal reflux disease, or GERD. However the movement of gastric acid juice in GERD as compared with that in bulimia is slower, less forced, more prolonged, more pervasive and more likely to inter mingle the acid with food especially when the condition is "silent" and unknown to the patient. The enamel appears thin and translucent, enamel is lost on the posterior occlusal and anterior palatal surfaces; depression or concavities occur at the cervical areas of upper anterior teeth, "cupped" or invaginated areas develop where dentine has been exposed on the occlusal surfaces of posterior teeth because of wear. This dentinal cupping results from the joint digestive action of hydrochloric acid and the proteolysis enzyme pepsin that is contained in gastric juices. Atypical sites of corrosion may occur at locations where the gastric reflux fluid pools, especially while the patient is asleep. When the dentist finds evidence of gastric reflux referral to a gastroenterologist for evaluation and control is indicated.[2]

Gingival crevicular fluid has been shown to be acidic and may be corrosive when in contact with the teeth in the cervical region. Any food substance caused with a critical pH less than 5.5 can become a corrodent and demeneralize teeth. Acidulated carbonate soft drinks have become a major component of many diets, particularly among adolescents and young children. The corrosive potential of an acidic

drink does not depend exclusively on its Ph value, but also is strongly influenced by its buffering capacity, the chelating properties of the acid and by the frequency and duration of the acid.[2]

Alcohol abuse has been reported to cause a high incidence of corrosion,owing to the chronic regurgitation and vomiting that stems from the gastritis associated with the alcohol abuse. Occupational tooth corrosion can occur during exposure to industrial gases that containhydrochloric or sulfuric acids as well as acids used in plating and galvanizing and in the manufacture of batteries and soft drinks.[3]

Attrition

The term attrition is derived from the Latin verb attritumwhich describes the action of rubbing against something. Dental attrition is defined as the physiologicwearing of teeth resulting from tooth to tooth contact as in mastication. This is an age-relatedprocess that can occur at the incisal or occlusal surfacesand sometimes on the proximal surfaces.Clinically, the first manifestation is the appearance ofa small polished facet on a cusp tip or ridge or an incisaledge. Severe attrition may lead to dentinal exposure, which may increase the rate of wear.Tooth wear occurs at an ultrastructural level andcan be caused by direct contact between surfaces orthe action of an intervening. Attrition may behastened by a coarse diet and abrasive dust. Silica particlesto be abrasive in tobacco chewing and some parafunctional habits (bruxism and clenching)may also contribute to attrition. The prevalenceof dental attrition was not associated with thepresence or absence of temporomandibular jointsyrnptomatology. While a certain amount of attrition isphysiologic, excessive destruction of tooth structure isnot physiologic.[4]

Abrasion

Abrasion is defined as the wear of teeth caused by objects other than another tooth, examples include toothbrush/toothpaste abrasion and the variety of facets which can be caused by pipe smoking or other similar habits.

Traumatic brushing due to the poor position of vestibularized teeth makes them more subject to brushing trauma, or by excessive force or even lack of brushing, with consequent accumulation of dental plaque, causing gingival inflammation which may lead to periodontal complications and migration of the gingiva in the apical direction, exposing the cementum and then the root dentine.

In the 6,000-year history of 'oral hygiene products', today's toothpastes and toothbrushes are relatively recent introductions and dateback to the early 20th century. Previous toothpastes/ toothpowders could variably be described as revolting, highly abrasive, erosive and even potentially toxic.[4] Modern toothbrushes and toothpaste formulations have in place, or in development, national and, more importantly, international standards, which primarily relate to potential safety issues. Most relevant here is the abrasivity of toothpastes.[5] By definition, tooth- pastes contain abrasive agents, the role of which is to remove stains and other superficial deposits from the tooth surface. Different formulations contain different abrasive agents, some being more abrasive than others. Relative Dentine Abrasivity (RDA) is a numeric scale, which indicates the degree of abrasivity, and is useful for comparison between different pastes. A higher RDA value indicates a greater abrasive formula. The allowed pH range for toothpastes (pH 4-10) could be a cause for concern for tooth wear due to acid erosion but virtually all products world-wide are above a pH which might cause demineralization (pH 5.5 for enamel, pH 6.5 for dentine), or the contained fluoride balances the low pH effect.

A study by Frandsen (1986) explains excessive zeal in performing oral hygiene procedures is also pointed out as being responsible for the appearance of pain. Tooth brushing with toothpaste has been stated as the most common oral hygiene habit practiced by persons living in developed countries.[6]

A study by Adams D, Addy M (1992)explainstypical toothbrush abrasion lesions are side dependent, for example being greater on the left-side in right-handed people. The buccal cervical areas of the teeth are the sites of predilection. Furthermore, canines and premolars are most affected because of their position within the dental arch where they receive the most attention during toothcleaning. The toothbrush itself has little or no effects on dental hard tissues. Even toothpaste on a toothbrush alone causes almost no enamel abrasion and only clinically insignificant effects on dentine. However when combined with erosive agents tissue loss from tooth brushing with toothpaste is increased enormously. Little is known about abrasion from chewing: the crushing of bones between the teethand chewing tobacco were believed to lead to abrasion of teeth. It may also be caused by gingival recession which occurs with aging, chronic periodontal disease and patients deleterious habits.The dentin exposure may result in anatomic characteristics in the area of the enamel/cementum junction and/or enamel, or cementum loss due to one or more of the following processes.[7]

A study by Addy et al (2002) explains toothbrushes alone produce essentially no wear of enamel. Toothbrushes alone over extended periods of use, measured in years, cause minute amounts of dentine wear, which may be restricted to the smear layer. The smear layer is an artificial surface structure that is formed when dentine is abraded or cut. The layer is about one micron thick and made up of collagen and hydroxyapatite from the native dentine. The smear layer covers the underlying dentine and occludes the tubules. Tooth brushing with tooth-paste in the absence of acid causes little or no wear of enamel because, with the exception of the rarely used non-hydrated alumina, contained abrasives are softer than enamel.[8]

To conclude, tooth brushing with toothpaste will still have little or no effect on enamel, but abrasion of dentine can reach pathological proportions. It must be emphasized that these conclusions are at best drawn from studies in vitro, there are a few in situ, and at worst from case or anecdotal reports. Un-fortunately, studies in vivo that investigate toothpaste abrasion alone would be difficult, perhaps impossible, to design. The overall conclusion therefore must be that if toothpaste abrasion were the only wear process ongoing in the mouth, in normal use, it would have no clinical significance, except potentially to open dentinal tubules. Abrasion by toothpaste, however, is not the only wear process and teeth are exposed to wear by attrition and erosion. It is unlikely that attrition and tooth brushing with toothpaste would co-operate to cause tooth wear except where attrition has exposed dentine, which is subsequently brushed. Abrasion, on the other hand, does have the potential to enhance tooth wear due to acid erosion

Erosion

The term erosion is derived from the Latin verb erosum (to corrode) which describes the process ofgradual destruction of a surface, usually by a chemical or electrolytic process. Dental erosion is defined as the loss of tooth structure by a non bacterial chemical process. Erosion may be by either extrinsic or intrinsic acids-Extrinsic erosion can

be subdivided into dietary and environmental, while intrinsic erosion is the result of exposure of teeth to gastric juice. Dietary erosion may result from foods or drinks containing acids such as citrus fruits, pickled food, fruit juices, carbonated drinks, wines and ciders. A recent publication showed that a raw food diet bears an increased risk of dental erosion compared to conventional nutrition. Beverages such as red and white wine, citrus fruit juices, apple juice, and yoghurt were capable of rapidly dissolving the dentine smear layer within a few minutes. Perhaps surprisingly, a carbonated cola drink was considerably less erosive.[4]

Vitamin C (ascorbic acid), which is considered a healthy additive in many drinks, has been implicated in dental erosion. In addition citric acid, found in many drinks, has the potential to both demineralisedental hard tissues and chelate calcium. Industrial erosion results from occupational exposure to acids or acidic vapour, such as, workers in battery manufacture and wine tasters. Other extrinsic sources of erosion have been reported, including swimmers who trained in poorly maintained pools with water at pH 2.7. Improper use of bleaching agents particularly delivered in night guards is another risk factor for erosion of enamel and dentine and has been implicated in the development of dentine hypersensitivity. Some mouthrinses have low pH values and have the potential to dissolve the smear layer and thereby expose dentinal tubules; an effect enhanced by post treatment brushing. Intrinsic erosion may result from gastric reflux as in patients with hiatus hernia, chronic alcoholism and eating disorders. When erosion is caused by gastric regurgitation, the palatal aspects of the upper incisors and the occlusal and buccal aspects of lower posterior teeth are primarily affected.[4]

There are two types of erosive lesions found using the scanning electron microscope (SEM). The active lesion shows distinctly etched enamel prisms resemblinga honeycomb, while latent or inactive erosionsare faint with unrecognizable characteristics. Further ultra-structural studies have demonstrated irregularpatterns of enamel dissolution. As the lesionprogresses to dentin, the first area to be affected is peritubular dentin. Dentinal tubules then become enlarged, affecting intertubular areas as well. Rapidprocesses may lead to sensitive teeth, while slowerprogression may be asymptomatic.[4]

The solubility of enamel is pH dependent, and the rateat which apatite precipitates depends on certain factors, such as calcium binding in saliva. Saliva containscalcium and phosphate ions and exists in a supersaturatedstate at neutral pH with respect to enamel hydroxyapatite. As the pH of saliva decreases, it crossesthe saturation line at a point known as the critical pH.Since the critical pH of enamel is approximately 5.5,any solution with a lower pH may cause erosion, particularlyif the attack is lengthy and intermittent overtime.[4]

In advanced cases, restorations may project above occlusal surfaces and cusps of posterior teeth {and incisal edges of anterior teeth) exhibitingconcavities known as "cupping.Erosion associated withdiet may be evident on labial surfaces of maxillary anteriorteeth and present as' scooped-out "depressions".[9]

Abfraction

The cervical stress lesions have been hypothesized as an aetiological factor in tooth wear. The process is thought to involve eccentric occlusal loading leading to cusp flexure. This in turn leads to compressive and tensile stresses at the cervical fulcrum area of the tooth with the resultant weakening of the cervical tooth structure. The process may be co-destructive rather than directly causal whereby abrasion and or erosive processes are potentiated. It is difficult to diagnose such lesions properly, but generally, in cases where a deep V-shaped cervical notch is present or when cervical restorations are repeatedly lost, the practitioner should look for wear facets or other signs of occlusal trauma.[4]

In 1991, Grippo coined the term "abfraction" as a newclassification of cervical lesions caused by biomechanical loading forces, to distinguish it from erosion and abrasion. During eccentric loading, flexing stresses throughout the tooth produce tension on one side and compression on the other inthe area of the fulcra, generally located at or near the CEJ. Non-carious cervical lesions are more commonly associated with the loss of enamel; exposure of dentin occurs much less frequently, ranging between 2 and 6%.[10]

Combined Mechanism of Tooth Wear

Attriton-abfraction

Attrition - abfraction is the joint action of stress and friction when teeth are in tooth to tooth contact, as in bruxism or repetitive clenching.[11]

Abrasion-abfraction

Abrasion - abfraction is the loss of tooth substance caused by friction from an external material on an area in which stress concentration due to loading forces may cause tooth substance to break away. Such a synergistic tooth destructive effect may be observed cervically when tooth brushing abrasion exacerbates abfraction to produce wedge shaped lesions. The critical roles of both tooth brushing abrasion and occlusal loading of an anatomically vulnerable zone may be one reason why such lesions are limited almost exclusively to the buccal and labial cervical areas of teeth.[11]

Corrosion –abfraction

Corrosion –abfraction is the loss of tooth substance due to the synergistic action of a chemical corrodent on areas of stress concentration. This physio chemical mechanism may occur as a result of either sustained or cyclic loading or leads to static stress corrosion or cyclic stress corrosion.[11]

Static stress corrosion

Static stress corrosion is the loss of tooth structure due to the action of a corrodent on an area of sustained stress. This may occur during clenching. Static stress corrosion may be observed as demineralization that occurs around orthodontic appliances in the presence of corrodent.[11]

Cyclic (fatigue) stress corrosion

Cyclic stress corrosion is the loss of tooth substance due to the action of corrodent in an area of concentrated stress during cyclic loading. This combination of mechanism could occur during mastication, as seen among patients who engage in fruit mulling as dentinal invaginations, but is seen most strikingly among patients who brux in the presence of endogenous(for example, GERD) or exogenous(carbonated soft drinks) corrodents. In such situations, tooth substance may be lost rapidly and extensively.[11]

Attrition-corrosion

Attrition corrosion is the loss of tooth substance due to the action of a corrodent in areas in which tooth to tooth wear occurs. This

process may lead to a loss of vertical dimensions, especially in patients with GERD or gastric irritation.[12]

Abrasion-corrosion

Abrasion corrosion is the synergistic activity of corrosion and friction from an external material. This could occur from the frictional effects of a tooth brush on the superficially softened surface of a tooth that has been demineralised by a corrosive agent. Teeth that are out of occlusion could be affected by this mechanism and develop cervical lesions, since they frequently extrude, thus exposing the vulnerable dentin. Similarly gingival recession may expose the cementum and dentin to this odontolytic process.[11]

Low Level of Oral Hygiene

Patients with a low level of oral hygiene have a high degree of periodontal tissue destruction, loss of supporting bone tissue and root exposure. Root exposure is related to DH and it can be aggravated by the action of acids secreted by bacteria capable of opening the dentinal tubules even further.[11]

Periodontal Therapy

Periodontal therapy has been associated with Dentine hypersensitivity due to the exposure of dentinal tubules after the removal of supra and/or sub gingival calculi. Another factor is the removal of dental cementum which covers the root or the root dentin itself during periodontal scraping.Scaling and root planning removes the outer layer of hypermineralized dentine and thus leaves the surface expose to the effect of hydrodynamic phenomena. Surgical periodontal treatment, similarly, usually involves complete debridement of root surface. Post operative recession of soft tissue further exposes the dentinal tubules. Patient inability to maintain plaque control in the healing phase further complicates the problem, as plaque and acid production due to plaque accumulation could act as a noxious stimuli and cause dehydration and lead to fluid movement across the dentinal tubule. Instrumentation of the root creates an outer contiguous smear layer covering the instrumented surface as well as pushing debris into the dentin tubules for several micrometer. The smear layer thus is a natural iatrogenic yet transient treatment to dentin hypersensitivity. Removal of the outer smear layer and smear plugs with acids permits an increased in outward fluid flow and thus increase the patient postoperative dentine hypersensitivity[12]

Physiological Causes

The increase in the number of teeth with root exposure is evident, as age advances. Dental extrusion, in the absence of an antagonist tooth, results in root exposure, which may lead to Dentine hypersensitivity. It mostly affects individuals at the end of their third decade of life, causing patients great discomfort. In some cases, it may lead to emotional alterations and behavior changes.[13]

Role of Dental Plaque

Plaque control plays a key role in reducing the patency ofdentinal tubules and may therefore actually promote thenatural repair of Dentine hypersensitivity. It is this removal of plaque, by eithermechanical (toothbrushing) or chemical means, that hasbeen found to reduce the diameter of dentinal tubules andtherefore helps to alleviate Dentine hypersensitivity. Dental professionals musttherefore promote this message of maintaining good oralhygiene to patients with Dentine hypersensitivity. Plaque accumulation on root surfaces can lead to demineralization of the root surface, which in turn leads to the opening of the dentinal tubules, and therefore to pain.Patients with poor plaque control on the root surfaces report more problems with Dentine hypersensitivity.[13]

Bleaching Sensitivity

Another chemical factor that can trigger tooth sensitivitysimilar to DS is the effect of bleaching agents, which cause bleaching sensitivity. Sensitivity often occurs during both in-office and at-home tooth whitening treatments, and has been considered to be the most common complication of at-home tray treatments. The problem will commonly manifest itself as generalised hypersensitivity to cold stimuli, but often also occurs as a spontaneous sharp pain, sometimes limited to one or a few teeth. The cause of the sensitivity experienced during whitening treatments is considered to be multifactorial - involving acidic pH, dentinal fluid outflow caused by osmotic stimuli and penetration of peroxides through enamel and dentine. The latter supposedly results in a reversible pulpal irritation. Pain needs to be prevented and treated to avoid negative effects on treatment compliance. Pre-existing dentine hypersensitivity is considered one of the best predictors of post-whitening hypersensitivity, and the use of classic desensitising agents applied topically, has proven effective in managing the pain. Patients undergoing tooth-whitening procedures can be offered an in-office dentine hypersensitivity treatment, as well as preventive advice and instruction on the daily use of home dentine hypersensitivity products.[13]

Restorative Sensitivity

Restorative sensitivityis triggered following placement of a restoration for several possible reasons: certain amalgams having a history of 24-48 hours sensitivity due to shrinkage, rather than the usual expansion, during setting; contamination ofcomposites during placement or improper etchingof the tooth on composites, which results in microleakage;improper tooth-drying technique; incorrectpreparation of glass ionomer or zinc phosphatecements; general pulpal insult from cavitypreparation technique; thermal or occlusal causes;galvanic reaction to dissimilar metals that creates asudden shock or 'tin foil' taste in the mouth.[12]

Medication Sensitivity

Medication sensitivity is caused due to medications that dry the mouth (e.g. antihistamines, high blood pressure medication), thereby compromising the protective effects of saliva and aggravating diet-related trauma or proliferating plaque. Even a reduction in salivary flow due to ageing or medications can lower the pH of the saliva below the level at which caries occurs (6.0-6.8 for Dentine caries; <5.5 for enamel caries) and increase erosive lesions to exposed dentine.[12]

Summary

Dentinal hypersensitivity is a common problem among many dental patients. The patient plays a role in this process since their daily habits could be one the etiological or predisposing factors which is a part of levels of prevention. The initial etiology of dentinal hypersensitivity, in the majority of cases is gingival recession with the exposure of dentinal tubules. Once the tubules are exposed the patient is

susceptible to pain in response to thermal, tactile, or osmotic stimuli. Desensitizing treatments should be delivered systematically. Prevention of dentin hypersensitivity could be the initial approach which can be further followed by professional treatments

References

1. Watson P J C. Gingival recession. J Dent 1984; 12: 29–35.
2. Karger: dental erosion from digestion to therapy. karger: dental erosion from digestion to therapy. Karger Medical and Scientific Publishers 2006:219-225
3. Shafer WG, Hine MK, Levy BM. A Textbook of Oral Pathology, Ed 4. Philadelphia' Saunders. 1983:318-323.
4. Regezi JA, Sciuhha.Oral Pathology Clinical Pathologic Correlations, Ed 3. Philadelphia: Saunders. 1999:459-460.
5. Fischman S. Oral hygiene products: how far have we come in 6000 years? Periodontology 2000;15: 7-14.
6. International Standards Organisation (Dentistry): Toothpaste Requirements - test methods and marking.(ISO 11609), Switzerland, 1995.
7. Frandsen A. Mechanical oral hygiene practices. In Löe H, Kleinman, DV (eds) Dental Plaque Control Measures and Oral Hygiene Practices. Oxford: IRL Press;1986: 93-116
8. Adams D, Addy M, Absi EG. Abrasive and chemical effects of dentifrices. In: Embery G, Rolla G, editors. Clinical and biological aspects of dentifrices. Oxford: Oxford University Press; 1992: 345–55.
9. Addy M, Hughes J, Pickles M et al. Development of a method in situ to study toothpaste abrasion of dentine: comparison of 2 products. JClinPeriodontol 2002;29: 896-900.
10. Imfcid T. Dental erosion. Definition, classification and links. EurJOralSd 1996;104;151-155.
11. Grippo JO: Abfractions: A new classification of hard tissue lesions of teeth. J Esthet Dent 1991;3(1):14-19.
12. Addy M Etiological and clinical implications of dentine hypersensitivity. Dent clin North Am 1990:34(3)503-514.
13. Pour M, Bhat M, Bissada N. Clinical evaluation of two potassium nitrate toothpastes for the treatment of dental hypersensitivity. Periodontal Case Reports 1984; 6: 25-30.

Review Article

Journal of Oral and Dental Health

Red Proportion – The Modern Concept in Smile Designing

Abstract

Smile is the cynosures of one attractiveness, where anterior teeth primarily the maxillary anterior teeth - as a component, play very vital role. Clinicians must determine tooth shape while replacing or restoring the missing or damaged anterior teeth. There is a need to create a harmonious proportion between the widths of maxillary anterior teeth when restoring or replacing them. This determination of anterior tooth proportion seems to be a challenge to the dentist. Different proportions has been laid in the past like golden proportions, golden mean methods that relate the relative widths of the maxillary anterior teeth with patients smiles but the recent introduction of red proportion seems to have an universal application and user friendly in smile designing since it suits the individual patient face, bone structure and general and physical type. The RED proportion is an objective method that may serve as a foundation when evaluating and designing smiles.

Key words: Red Proportion, Modern Concept, Smile Designing

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Introduction

Smile is the cynosures of one attractiveness, where anterior teeth primarily the maxillary anterior teeth - as a component, play very vital role. Clinicians must determine tooth shape while replacing or restoring the missing or damaged anterior teeth. There is a need to create a harmonious proportion between the widths of maxillary anterior teeth when restoring or replacing them. This determination of anterior tooth proportion seems to be a challenge to the dentist. Different proportions has been laid in the past like golden proportions, golden mean methods that relate the relative widths of the maxillary anterior teeth with patients smiles but the recent introduction of red proportion seems to have an universal application and user friendly in smile designing since it suits the individual patient face, bone structure and general and physical type.[1-3]

Tooth Proportion Theories

The golden proportion was formulated as one of Euclid's elements and was used extensively in Greek architecture. Kepler called it the "Divine Proportion". Mark Barr called the ratio "PHI". Lombardi and later Levin proposed the application of Golden Proportion in dentistry.

The Golden Proportion states that the width the maxillary lateral incisors should be 62 % of width of maxillary central incisors, the width of maxillary canine should be 62 % of the width of resulting lateral incisors. (62% proportion comes from the Golden Proportion of 0.618).

The use of Golden Proportion in smile designing usually makes the lateral incisors appearance too narrow, the resulting canine is not prevalent enough and the central incisors are dominant occupying 50 % of the inter-canine width.

Theory of golden mean given by Snow states that the width of each maxillary central incisors should be 25 %, each maxillary lateral incisor should be 15 % and of each maxillary canine should be 10 % of the of total frontal view width from distal of maxillary canine of one side to distal of maxillary canine on contra-lateral side (Figures 1 and 2).

The preston proportion was defined as the average maxillary anterior tooth width proportions reported to occur in North American patients in which the maxillary lateral incisor was 66 % of the frontal view width of maxillary central and maxillary canine was 84 % of frontal view width of resulting maxillary lateral incisor.

The Recurrent Esthetic Dental (RED) Proportion proposed by Ward gives the flexibility to change the proportions of the teeth to suit the individual patient face, bone structure and general and physical body type. It states that the proportion of successive width of maxillary teeth as viewed from front should remain constant progressing distally Generally the values used are between 60 – 80 %, a 70 % RED Proportion is preferred for normal height teeth (Figure 3).

Once the ideal size of the maxillary central incisors has been calculated, the width of the central incisor is multiplied by the desired Red proportion to determine the frontal view width of the lateral incisor. The resulting lateral incisor width is multiplied by the same Red Proportion to yield the desired frontal view width of canine.[4-5]

Facial image view evaluation (five)

The use of photograph to evaluate and measure the relative tooth dimensions of a smile is facial image view evaluation. A full smile photograph (1:2 magnifications) parallel to the facial surface of anterior teeth was exposed and the widths and heights of maxillary

anterior teeth on photograph was measured. The dimensions of anterior tooth measured on cast was divided by the dimensions measured on photograph to compute a conversion factor. The photographic measurements were multiplied by the conversion factor to determine the actual facial view tooth dimension. From these values the width to height ratios of maxillary central incisors and the proportions between the successive facial view widths of the anterior teeth were calculated. Generally all applications of RED proportion use the five view

A Mathematical formula has been derived that calculates the width of the maxillary central incisor for any Red Proportion, given a fixed inter-canine frontal view width.

Figure 1: Golden proportion

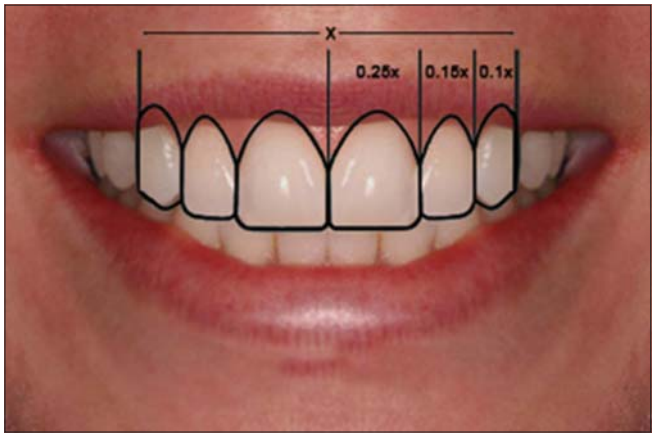

Figure 2: Golden mean

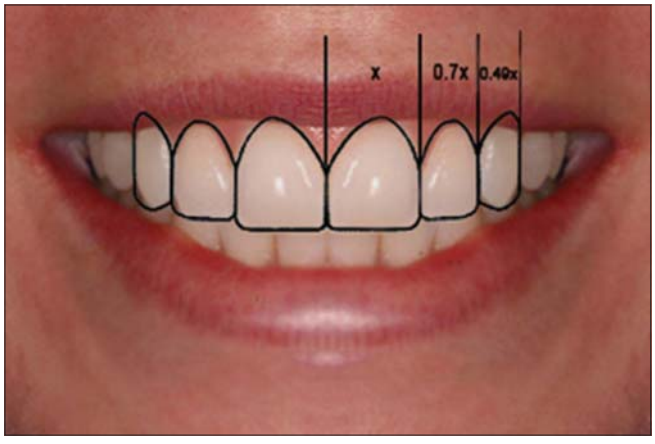

Figure 3: Red proportion

Frontal view width of the anterior 6 teeth)/2(1+RED+RED2) = Width of central incisor.

(Red is expresses in decimal less than 1).

The Height now can be determined by the formula;

Width of central incisors/width to height ratio = Height of central incisor.

(The width to height ratio should be expresses as a decimal < 1).

Results of many surveys done worldwide favored the smile with an 80 % Red Proportion when viewing very short teeth, 70 % Red proportion when viewing normal length teeth and the smile with Golden Proportion i.e. 62 % Red when viewing very tall teeth. The Golden Proportion is one of many Red Proportion that may be used. Smile that maintained the 75-78 % width to height ratio was preferred. More width to height ratio (85 %) gives a square shaped teeth while a lesser ratio (65 %) produce anterior tooth with tall appearance.[6-8]

With normal-length maxillary central incisors, the frontal view inter-canine width of the anterior 6 teeth is measured and divided by 4.4 to calculate the ideal width of the maxillary central incisor. (4.4 comes from $2(1+RED+RED^2)$ i.e. $2(1+0.7+0.7^2)$. The width of the central incisor is then multiplied by 70% (the RED proportion in the table recommended for normal-length teeth) to determine the width of the lateral incisor. The width of the lateral incisor is

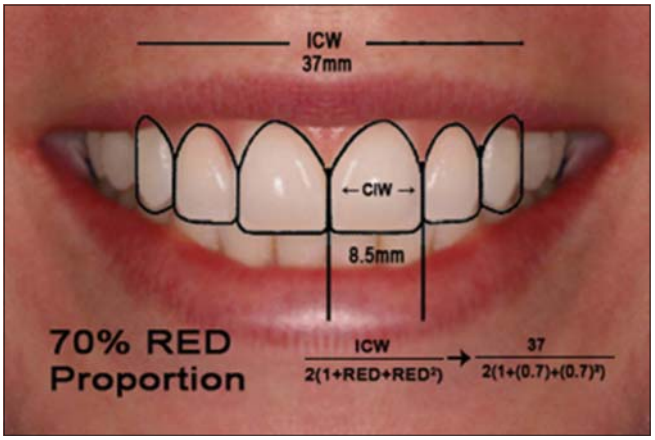

Figure 4: Calculating the width of maxillary central incisor

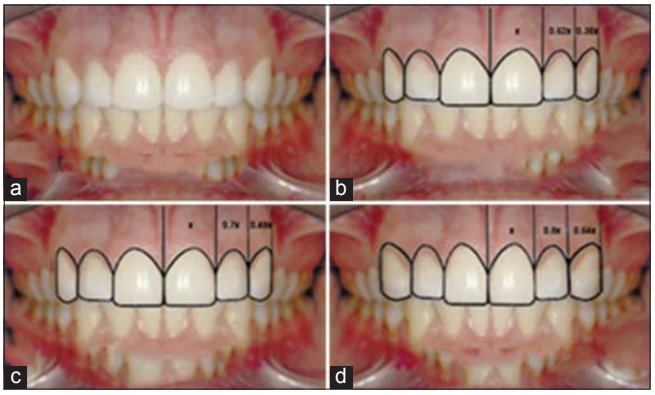

Figure 5: The normal image manipulated to generate four types of tooth proportions. (a) Normal or unaltered; (b) golden proportion or 62%; (c) 70% proportion; (d) 80% proportion

Table 1: Calculating red and anterior total widths from intercanine width (ICW) with different tooth heights

Tooth height	Desired red proportion	Intercanine divisors. Central incisor width	Lateral incisor width	Canine width
Very tall	62 %	ICW/4	CIW*0.62	LIW*0.62
Tall	66 %	ICW/4.2	CIW*0.66	LIW*0.66
Normal	70 %	ICW/4.4	CIW*0.7	LIW*0.7
Short	75 %	ICW/4.6	CIW*0.75	LIW*0.75
Very short	80 %	ICW/4.8	CIW*0.8	LIW*0.8

multiplied by 70% to determine the facial view width of the canine (Figure 4).

With very tall teeth, the frontal view inter-canine width of the anterior 6 teeth is divided by 4.0 (the rounded value in the table for very tall-length teeth) to calculate the ideal width of the central incisor, and the 62% RED proportion (as recommended by the table) is used to calculate the frontal view widths of the lateral incisor and canine teeth. With very short teeth the frontal view inter-canine width of the anterior 6 teeth is divided by 4.8 (the rounded value in the table for very short-length teeth) to calculate the ideal width of the central incisor, and the 80% RED proportion (as recommended by the table) is used to calculate the frontal view widths of the lateral incisor and canine teeth (Figure 5).

So it appears that the taller the central incisors, the wider the size of preferred central and smaller the desired Red proportion, since the taller maxillary centrals must be wider to maintain the favored width to height ratio. The result is more dominant maxillary central incisors. So Golden Proportion (62 % RED) is often used when designing for tall models (Table 1).

Conclusion

The RED proportion is an objective method that may serve as a foundation when evaluating and designing smiles.

References

1. Ward DH. Proportional smile design using the RED proportion. Dent Clin North Am 2001;45:143-54.
2. Lombardi RE. The principles of visual perception and their clinical application to denture esthetics. J Prosthet Dent 1973;29:358-82.
3. Levin EI. Dental esthetics and the golden proportion. J Prosthet Dent 1978;40:244-52.
4. Mahshid M, Khoshvaghti A, Varshosaz M, Vallaei N. Evaluation of "golden proportion" in individuals with esthetic smile. J Esthet Restor Dent 2004;16:185-92.
5. Rosenstiel SF, Ward DH, Rashid RG. Dentists' preferences of anterior tooth proportion - A web-based study. J Prosthodont 2000;9:123-36.
7. Daniel H. Ward. Using the RED Proportion to Engineer the Perfect Smile. Dentistry today.com.may 2008
8. Hasanreisoglu U, Berksun S, Aras K, Arslan I. An analysis of maxillary anterior teeth: facial and dental proportions J Prosthet Dent 2005;94:530-8.

Review Article

Journal of Oral and Dental Health

Supernumerary Teeth: A Review Article

Abstract

A supernumerary tooth (ST) is defined as any tooth or odontogenic structure that is formed from tooth germ in excess of usual number for any given region of the dental arch. They may be single or multiple and unilateral or bilateral in distribution and can occur in any region of the dental arch. These may occur in primary and permanent dentition. Supernumerary teeth are more frequent in males. They are classified based on form, morphology, location and occurrence. Several hypotheses have been proposed to explain the occurrence of ST. However, combination of environmental and genetic factors has been proposed. This article presents an overview of the clinical problems associated with supernumerary teeth and includes a discussion of the classification, diagnosis and management of this difficult clinical entity.

Key words: Supernumerary tooth, Odontogenic, Dental arch, Morphology, Genetic

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Introduction

Supernumerary tooth (ST) is defined as "any tooth or odontogenic structure that is formed from tooth germ in excess of usual number for any given region of the dental arch".[1] They may be unilateral or bilateral and single or multiple, in distribution, can occur in any part of the tooth bearing areas in both dental arches, and found in both primary and permanent dentition. Cases involving one or two supernumerary teeth most commonly involve the anterior maxilla, followed by the mandibular premolar region.[2] When multiple supernumerary teeth are present (>five), the most common site affected is the mandibular premolar region. The prevalence of supernumerary teeth ranges from 0.5%-3.8% in permanent dentition and from 0.3%-1.9% in primary dentition. The sex distribution of supernumerary teeth in primary dentition appears equal, whereas supernumeraries in permanent dentition occur more frequently in boys than girls.[3] The exact etiology of supernumerary teeth is unknown however several theories have been postulated to explain their presence: The phylogenetic theory as a regression to the anthropoids whose dental had more teeth, the autonomic recessive inheritance or linked to the x chromosome, an abnormal reaction to a local traumatic episode, environmental factors, dichotomy of the tooth germ and the theory of hyperactivity of the dental lamina, are the most accepted.[4] Supernumerary teeth are less common in the deciduous dentition with a reported incidence of 0.3 per cent to 1.7 per cent of the population. Possible explanations for the less frequent reporting of deciduous supernumerary teeth include less detection by parents, as the spacing frequently encountered in the deciduous dentition may be utilized to allow the supernumerary tooth or teeth to erupt with reasonable alignment. Also many children have an initial dental examination following eruption of the permanent anterior teeth so anterior deciduous supernumerary teeth which have erupted and exfoliated normally would not be detected.[5]

Effects of supernumerary teeth on the developing dentition vary. There may be no effect with the supernumerary tooth or teeth discovered either as a chance radiographic finding or following their eruption. Crowding may be evident due to an increased number of erupted teeth. Failure of eruption of adjacent permanent teeth is the most frequent occurrence and occurs in 30 to 60 per cent of cases. The supernumerary or adjacent teeth may be displaced and ectopic eruption of either is not uncommon. Supernumerary teeth may also cause diastemata, root resorption of adjacent teeth, malformation of adjacent teeth such as dilacerations and loss of vitality of adjacent teeth.[6]

Prevalence

Multiple supernumerary teeth are rare in individuals with no other associated diseases or syndromes.[4] The conditions commonly associated with an increased prevalence of supernumerary teeth include cleft lip and palate, cleidocranial dysplasia and Gardner syndrome. Supernumerary teeth associated with cleft lip and palate result from fragmentation of the dental lamina during cleft formation. The frequency of supernumerary permanent teeth in the cleft area in children with unilateral cleft lip or palate or both was found to be 22.2%. The frequency of supernumeraries in patients with cleidocranial dysplasia ranged from 22% in the maxillary incisor region to 5% in the molar region.[6] While there is no significant sex distribution in primary supernumerary teeth, males are affected approximately twice as frequently as females in the permanent dentition. While there is no significant sex distribution in primary supernumerary teeth, males are affected approximately twice as frequently as females in the permanent dentition.[7]

Classification

Supernumerary teeth have been classified mainly based on their morphology, location, form, and number. Mitchell[8] classified ST based on form- conical, tuberculate, supplemental, and odontoma, and based on location- mesiodens, paramolar and distomolar. Scheiner and Sampson[9] classified ST based on form- conical, tuberculate, supplemental and odontoma and based on location- mesiodens, paramolar,distomolar, and parapremolars (Figure 1). The mesiodens is located between the two central incisors and these are mostly in conical shape. Distomolars are located distally to the third molar, while paramolars are located palatally or labially next to a molar.

However, ST classified based on morphology (conical, tuberculate, supplemental, and odontomes), location (mesiodens, paramolar, distomolar, and parapremolar), position (buccal, palatal, and transverse), orientation (vertical or normal, inverted, transverse, or horizontal). Yusof[10] reported that 60.9% occurred in the mandible and among these 44.8% in the mandibular premolar region. Apart from the mesiodens, the majority of ST are reported in the maxillary incisor region (51.5%). In primary dentition, lateral incisor region is a common site of ST occurrence. A slight difference in the occurrence of ST in permanent dentition is relative frequency of difference in the literature. Shapira and Kuftinec[11] reported the order of frequency as being maxillary central incisors,molars,andpremolars, followed by lateral incisors and canines. Single ST occurs in 76 to 86% of cases, double ST in 12 to 23% of cases and multiple ST in less than 1%.

Problems Associated with Supernumerary Teeth

Displacement

Displacement of the crowns of the incisor teeth is a common feature in the majority of cases associated with delayed eruption.[12] The degree of displacement may vary from a mild rotation to complete displacement.

Pathology

Dentigerous cyst formation is another problem that may be associated with supernumerary teeth. Primosch reported an enlarged follicular sac in 30% of cases, but histological evidence of cyst formation was found in only 4 to 9% of cases.[13] Resorption of roots adjacent to a supernumerary may occur but it is extremely rare.

Failure of eruption

The presence of a supernumerary tooth is the most common cause for the failure of eruption of a maxillary central incisor. It may also cause retention of the primary incisor. The problem is usually noticed with the eruption of the maxillary lateral incisors together with the failure of eruption of one or both central incisors. Supernumerary teeth in other locations may also cause failure of eruption of adjacent teeth.

Crowding

Erupted supplemental teeth most often cause crowding. A supplemental lateral incisor may cause crowding in the upper anterior region. The problem may be resolved by extracting the most displaced or deformed tooth.

Alveolar bone grafting

Supernumerary teeth may compromise secondary alveolar bone grafting in patients with cleft lip and palate. Erupted supernumeraries are usually removed and the socket site allowed to heal prior to bone grafting. Unerupted supernumeraries in the cleft site are generally removed at the time of bone grafting.

Cyst formation

It has been reported that cyst formation due to ST was observed in 11% of the cases where dentigerous cyst is common type.

Root abnormalities

Dilaceration is a developmental anomaly in the tooth shape and its structure, which may happen as sharp bending of the tooth in either the crown or the root portion. Loss of tooth vitality has been reported in rare conditions.

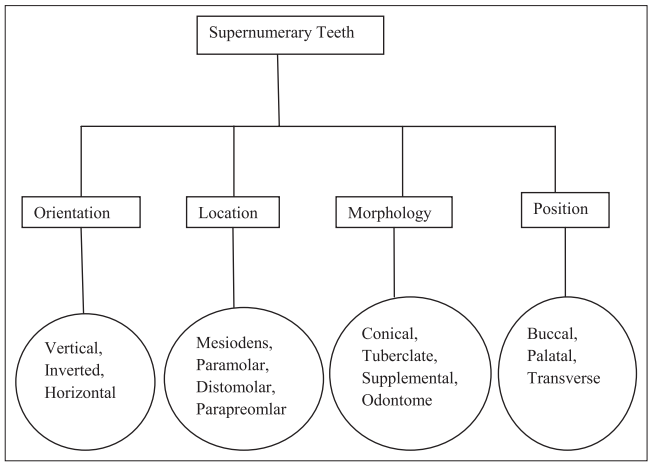

Figure 1: Classification of supernumerary teeth

Asymptomatic

Occasionally, supernumerary teeth are not associated with any adverse effects and may be detected as a chance finding during radiographic examination.

Diagnosis

It is essential to identify the presence of ST clinically and radiographically before a definitive diagnosis and management. Clinical complications such as midline diastema, displacement, delayed or failure of eruption, rotations, and impaction of teeth might leave a way of identification of ST. Identification and localization of ST are essential for the management if surgical intervention is needed. It has been reported that panoramic radiographs alone are not useful for the identification of ST. It has also been reported that combination of radiographs is necessary inlocalization of ST. Vertical tube shift and horizontal tube shift techniques are commonly used techniques for localization of ST.

Management of supernumeraries

Controversy exists regarding the optimal treatment of delayed eruption due to supernumerary involvement. The options include removal of the supernumerary only, removal of the supernumerary and orthodontic treatment to re-establish sufficient space for the delayed tooth, with or without surgical exposure of the unerupted tooth at the time of supernumerary tooth removal. Spontaneous eruption following supernumerary removal is suggested to be in the range of 54 per cent to 75 percent. DiBiase[14] suggests that most teeth experiencing delayed eruption will spontaneously erupt within 18 months of supernumerary removal alone, providing the delayed tooth is not excessively displaced. Mitchell and Bennett[15] studied spontaneous eruption following supernumerary removal only. Ninety-six patients with 120 teeth exhibiting delayed eruption were studied. They found that 78 per cent spontaneously erupted with a median time for eruption of 16 months. Only 14 per cent required a second operation to expose the delayed tooth and this procedure was performed at a median time of 30 months following supernumerary removal. If adequate space was available, or was created early, the median time for spontaneous eruption was reduced. Timing of surgical removal of supernumerary teeth has also been contentious. Hogstrum and Andersson[16] suggested two alternatives exist. The first option involves removal of the supernumerary as soon as it has been diagnosed. This could create dental phobia problems for a

young child and has been said to cause devitalization or deformation of adjacent teeth. Secondly, the supernumerary could be left until root development of the adjacent teeth is complete. The potential disadvantages associated with this deferred surgical plan include; loss of eruptive force of adjacent teeth, loss of space and crowding of the affected arch, and possible midline shifts.

Conclusions

Supernumerary teeth are extra to normal complement in both dentitions. Males are predominantly affected by ST, which is common in permanent dentition**.** Supernumerary teeth may occur unilaterally or bilaterally, single or multiple, and at any region of the dental arch**.** It is important as a pediatric dentist to take appropriate measures at early ages in order to prevent or reduce orthodontic problems that could occur if the supernumerary teeth are not noticed. Early diagnosis and removal of supernumerary teeth allow to avoid or reduce possible complications.

References

1. R. S. Omer, R. P. Anthonappa, and N.M. King, "Determination of the optimum time for surgical removal of unerupted anterior supernumerary teeth," Pediatric Dentistry, vol. 32, no. 1, pp. 14–20, 2010.
2. Mitchell L. Supernumerary teeth. Dent Update 1989;16:65-9.
3. Brook AH. Dental anomalies of number, form and size: their prevalence in British schoolchildren. Journal of International Association of Dentistry for Children. 1974; 5: 37-53.
4. Rao PV, Chidzonga MM. Supernumerary teeth: literature review.Cent Afr J Med. 2001;47:22-6.
5. Taylor GS. Characteristics of supernumerary teeth in the primary and permanent dentitions. Dent Pract Dent Rec 1972;22:203-8.
6. Hogstrum A, Andersson L. Complications related to surgical removal of anterior supernumerary teeth in children. J Dent Child 1987;54:341-3.
7. Kinirons MJ. Unerupted premaxillary supernumerary teeth. A study of their occurrence in males and females. Br Dent J1982; 153:110.
8. Mitchell, "Supernumerary teeth," Dental update, vol. 16, no.2, pp. 65-68, 1989.
9. M. A. Scheiner and W. J. Sampson, "Supernumerary teeth: a review of the literature and four case reports," Australian Dental. Journal, vol. 42, pp. 160–165, 1997.
10. W. Z. Yusof, "Non-syndrome multiple supernumerary teeth: literature review," Journal of Canadian Dental Association, vol.56, no. 2, pp. 147-149, 1990.
11. Y. Shapira and M. M. Kuftinec, "Multiple supernumerary teeth: report of two cases," American Journal of Dentistry, vol. 2, no. 1,pp. 28-30, 1989.
12. Howard RD. The unerupted incisor. A study of the postoperative eruptive history of incisors delayed in their eruption by supernumerary teeth. Dent Pract Dent Rec1967; 17:332-41.
13. Howard RD. The unerupted incisor. A study of the postoperative eruptive history of incisors delayed in their eruption by supernumerary teeth. Dent Pract Dent Rec1967; 17:332-41.
14. DiBiase D. The effects of variations in tooth morphology and position on eruption. Dent Pract 1971;22:95-108.
15. Mitchell L, Bennett TG. Supernumerary teeth causing delayed eruption – a retrospective study. Br J Orthod 1992;19:41-6.
16. Hogstrum A, Andersson L. Complications related to surgical removal of anterior supernumerary teeth in children. J Dent Child 1987;54:341-3.

Review Article

Journal of Oral and Dental Health

Botulinum Toxin Type A (Botox) for the Neuromuscular Correction of Excessive Gingival Display on Smiling (Gummy Smile) – A Review

Abstract

Gummy smile is an esthetic problem for some patients and a frequent finding that can occur as a result of various intraoral or extraoral etiologies. One cause of excessive gingival display is the muscular capacity to raise the upper lip higher than average. Botulinum toxin type A (BTX-A) (Botox; Allergan, Irvine, Calif) has been studied since the late 1970s for the treatment of several conditions associated with excessive muscle contraction. Smile esthetics has become a major concern among patients and orthodontists. This article describes the efficient and alternative treatment option for the correction of gummy smile due to hyperfunction of the upper lip elevators muscles (levator labii superioris, alaquae nasii, levator anguli oris and the zygomaticus muscles).

Key words: Botulinum Toxin Type A, Gummy Smile, Upper Lip Elevators

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Introduction

An excessive display of gingival tissue on smiling, usually referred to as a "gummy smile," is often esthetically displeasing.[1,2] Several etiologic factors have been proposed in the literature; these include skeletal, Unigingival, and muscular factors that may occur alone or in combination.[2,3] The aesthetics of the smile are influenced by 3 components: teeth, gums, and lips. An attractive smile depends on the proper proportion and arrangement of these 3 elements. The upper lip should symmetrically expose up to 2-3 mm of the gum and the gum line must follow the contour of the upper lip.[2] The 2-3 mm of gingival exposure is acceptable and it gives the youth appearance, especially in females.[2] The exposure of more than 3 mm of the gum during the smile is known as gingival or gummy smile. Hulsey noted that the most attractive smiles were those in which the upper lip rested at the height of the gingival margin of the maxillary incisor.[4] Rosemarie Mazzuco et al., classified gummy smile into anterior, posterior, mixed, or asymmetric, based on the excessive contraction of muscles involved.[5] Gummy smile is an esthetic problem for some patients and a frequent finding that can occur as a result of various intraoral or extraoral etiologies.[2,4] Hyperfunction of the upper lip elevators muscles (levator labii superioris, alaquae nasii, levator anguli oris and the zygomaticus muscles) can all play a major aetiological role in gummy smile. Thus, concise evaluation of etiology and diagnosis and implementation of treatment plan had imporatant role in treatment outcome.

Treatment Options and Alternatives

There are number of different treatment methods described in literature for the treatment of gummy smile. These includes both surgical and non-surgical options including the Le Fort 1 osteotomy, crown lengthening procedure, maxillary incisor intrusion, self-curing silicon implants injected at the anterior nasal spine and finally myectomy and partial resection of the levator labii superioris or muscle repositioning. If a gummy smile is characterized by overgrowth of anterior vertical maxillary excess, the outcome may not always be successful with conventional orthodontic therapy alone. In such cases, surgical therapy, such as that provided by a Le Fort impaction or maxillary gingivectomies, are often chosen to gain a good smile.[3-5]

However, if the patients are unwilling to undergo surgical treatment, an alternative method must be considered to treat the gummy smile. Miniplates and miniscrews are now frequently used for establishing absolute anchorage for orthodontic tooth movement. It involves the minor surgical procedure and it had possible post-operative complications such as pain, swelling and infection nerve or root damage, surgical/orthodontic relapse.

A non-surgical alternative for reducing the excessive gingiva display may therefore offer a desirable treatment option for number of selected patients. Botulinum Toxin, 'Botox" have been used in medicine since the 1970s for treating excessive muscular contraction as seen in strabismus, cerebral palsy and in dentistry for treating the

facial pain and headache.[5,6] Since 1987 its use has been increased dramatically in cosmetic treatment of overactive facial muscles which causes wrinkles.

Historical Background and Pharmacological Action

Botulism was originally called 'sausage poisoning' because it occurred after ingestion of poorly prepared blood sausage. Clostridium botulinum was first identified in 1897, in Belgium, by Professor Emile van Ermengem. In the same year, an antiserum for botulism was made.[7,8] Justinus Kerner (1786-1862) was the first to describe the features of botulism. Dr Alan Scott, an ophthalmologist from the Smith-Kettlewell Eye Research Foundation, performed the first clinical tests on humans in 1978. Dr Michael Kane, a plastic surgeon has been performing Botulinum toxin injections for excessive gingival show since 1992.[9,10]

The toxin is produced by the Gram-negative anaerobic bacterium Clostridium botulinum.[7] It is harvested from a culture medium after fermentation of a toxin-producing strain of C. botulinum, which lyses and liberates the toxin into the culture. The toxin is then extracted, precipitated, purified, and finally crystallized with ammonium sulfate. In this form, BTX-A should be stored in a refrigerator but not frozen. BTX-A should be diluted with preservative free saline and the preparation used within 4 hours of reconstitution.[11,12] The seven distinct serotypes, A, B, C, D, E, F and G, differ in their potency, duration of action, and cellular target sites.[13,14] BTX-A is marketed worldwide under the name Botox® (Allergan Inc, Irvine, CA, USA), and in Europe as Dysport® (Speywood Pharmaceuticals Ltd, Maidenhead, UK). Botox® has been approved by the US Food and Drug Administration (FDA) for the treatment of strabismus, blepharospasm,[15] focal spasms including hemifacial spasm,[16] cosmetically for the facial glabellar lines,[17] and more recently for the treatment of cervical dystonia[18] and axillary hyperhydrosis. BTX-B has been approved by the FDA for the treatment of cervical dystonia, and will be marketed under the name Myobloc® in the United States and Neurobloc® in Europe (Solstice Neurosciences Inc, South San Francisco, CA, USA).[14-18]

BTX, a natural protein, is one of the most potent biological substances known. The toxin inhibits the release of acetylcholine (ACH), a neurotransmitter responsible for the activation of muscle contraction and glandular secretion.[7,10] Administration of the toxin results in a reduction of tone in the injected muscle. Some nerve terminals are not affected by the toxin, allowing the injected dystonic muscle to contract, but with less force. This weakness allows for improved posture and function of the hypertonic muscle. The degree of weakening depends on the dose, and the duration of weakness is further dependent on the serotype of BTX employed. The action of Botulinum toxin at the neuromuscular junction is to interrupt transmission and in effect to denervate muscle. This chemodenervation effect persists for weeks to months.[5] The duration of effect may depend on serotype.

Injection Technique

The procedure was performed by a Dermatologist who was also a Botox certified physician. Botulinum toxin type-A was diluted according to manufacturer's recommendations to provide 2.5 units per 0.1ml by adding 4.0 ml normal saline solution to 100 units of vacuum-dried Clostridium botulinum toxin type-A.[5] Under sterile conditions, 2.5 units were then injected at 2 sites per side in both overlapping points of the right and left levator labii superioris alaeque nasi, levator labii superioris and zygomaticus minor and levator labii superioris muscle sites (Figure 1). The sites for injection were determined to ensure accurate locations of the muscle. This was carried out by asking the patient to smile and simultaneously palpate the muscles on contraction. The electromyographic guidance was used.[6] No local anaesthesia was administered. After injecting 1.25U Botulinm toxin on both the side, reduction in excessive gingival display was noticed with maximum effect following 2 weeks. Gingival display gradually increased from 2 weeks post injection through 24 weeks, but, at 24 weeks, average gingival display still had not returned to baseline values.[5,6,13] Pre-treatment and post-treatment photographs are shown in Figure 2.

Indications and Contraindications

Indications

- The neuromuscular correction of excessive gingival display on smiling (gummy smile) (injecting levator anguli oris alaeque nasi)[5,6]
- Extracapsular myogenic pain caused by masticatory muscle hypertonicity[19,20]
- Adaptation to rapid change in vertical dimension associated with oral prostheses
- Elimination of bruxism[21]
- Masseter hypertrophy[18]

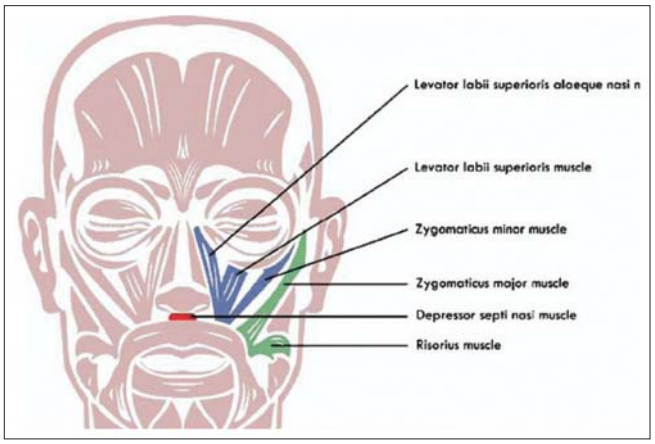

Figure 1: Musculature of the face: Pinpointing sites (Yonsei point) for injection

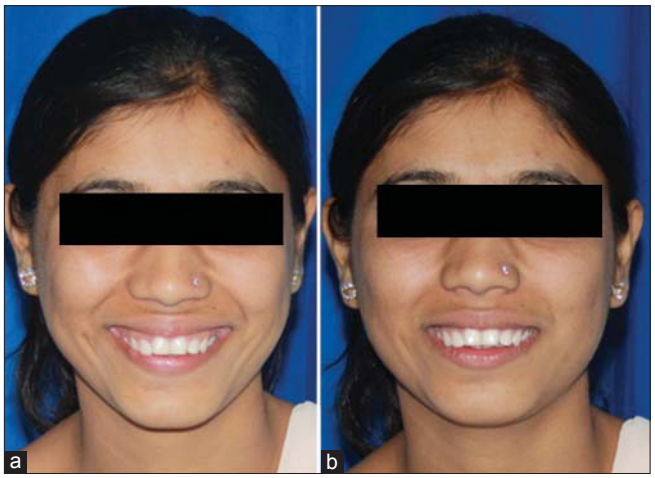

Figure 2: Pre-treatment and Post-treatment photographs

- Increased success with immediate loaded implants[22]
- Sialorrhoea associated with stroke or Parkinson's disease
- After trauma to oral tissues

No absolute contraindications to the use of BTX-A are known. Relative contraindications for clinical application of BTX are pregnancy and lactation, neuromuscular disease (e.g. myasthenia gravis, Eaton-Lambert syndrome), motor neuron disease, and concurrent use of aminoglycosides.[10,12]

When should Botox® Cosmetic be avoided?

- If you have any infection present in the treatment area
- If you have had an allergic reaction to any other botulinum toxin product in the past
- If you are allergic to any of the ingredients in BOTOX® Cosmetic
- Active ingredient: botulinum toxin type A
- Inactive ingredients: human albumin and sodium chloride
- If you have a breathing, swallowing, or bleeding problem
- If you recently had surgery on your face
- If you are pregnant or are breast-feeding
- If you have a neuromuscular disorders such as ALS, myasthenia gravis, or Lambert-Eaton syndrome.
- Individuals with these disorders may be at an increased risk of serious side effects and are not good candidates for Botox® Cosmetic injections (Figure 2).

Conclusion

Injection with Botox-A is better alternative for the patients not willing for surgical or fixed orthodontic treatment. Botulinum toxin type A (Botox) provides effective, minimally invasive, temporary treatment of gummy smile for patients with hypermobile upper lip which can be repeated if patient is satisfied with achieved aesthetic improvement.

References

1. Polo M. Botulinum toxin type A in the treatment of excessive gingival display, Am J Orthod Dentofacial Orthop, 2005; 127:214-8.
2. Garber DA, Salama MA. The aesthetic smile: diagnosis and treatment. Periodontol 2000. 1996;11:18–28.
3. Redlich M, Mazor Z, Brezniak N. Severe high Angle Class II Division 1 malocclusion with vertical maxillary excess and gummy smile: a case report. Am J Orthod. 1999;116: 317–320.
4. Hulsey CM. An esthetic evaluation of lip-teeth relationships present in the smile. Am J Orthod. Dentofacial Orthop.1970; 57 (2):132 -144.
5. Mazzuco and Hexsel: Gummy smile and botulinum toxin: A new approach based on the gingival exposure area. J AM Acad Dermatol, vol 63, no 6, 1042-1051
6. Klein AW, Mantell A. Electromyographic guidance in injecting botulinum toxin. Dermatol Surg. 1998;24:1184–1186.
7. Textbook of microbiology, seventh edition-2005,reprint, Ananthnarayan and paniker.
8. E. van Ergmengem. 1897. Über einen neuen anaeroben Bacillus und seine Beziehungen Zum Botulismus. Zentralbl. Hyg. Infektionskr. 26:1–8.
9. Frank J. Erbguth. From poison to remedy: the chequered history of botulinum toxin Journal of neural transmission (2008) 115: 559–565
10. Rosales RL, Bigalke H, Dressler D. Pharmacology of botulinum toxin: differences between type A preparations. Eur J Neurol. 2006;13(suppl 1):2–10.
11. Simonetta Moreau M, Cauhepe C, Magues JP, Senard JM. A double-blind, randomized, comparative study of Dysport vs. Botox in primary palmar hyperhidrosis. Br J Dermatol. 2003; 149:1041–1045
12. Benedetto AV. The cosmetic uses of botulinum toxin type A. Int J Dermatol 1999;38:641-55.
13. Binder WJ, Blitzer A, Brin MF. Treatment of hyperfunctional lines of the face with botulinum toxin A. Dermatol Surg 1998;24:1198-205.
14. Clinical use of botulinum toxin. NIH Consens Statement Online 1990;8:1-20.
15. Jankovic J, Brin MF. Therapeutic uses of botulinum toxin. N Engl J Med 1991;324:1186–94.
16. Brashear A, Gordon MF, Elovic E, Kassicieh VD, Marciniak C, Do M, et al; Botox Post-Stroke Spasticity Study Group. Intramuscular injection of botulinum toxin for the treatment of wrist and finger spasticity after a stroke. N Engl J Med 2002;347:395–400.
17. Binder WJ, Brin MF, Blitzer A, Schoenrock LD, Pogoda JM. Botulinum toxin type A (BOTOX) for treatment of migraine headaches: an open-label study. Otolaryngol Head Neck Surg 2000;123:669–76.
18. Brashear A. The botulinum toxins in the treatment of cervical dystonia. Semin Neurol 2001;21:85–90.
19. Sandler PJ, Alsayer F, Davies SJ. Botox: A possible new treatment for gummy smile. V J Orthod, 2007, 20;7(4):30-4.
20. Patel DP, Mehta F, Thakkar SA, Suthar JR, Verma S. Botulinum toxin type A (Botox) for the neuromuscular correction of excessive gingival display on smiling (gummy smile) Indian J Basic Appl Med Res 2014;3(3):237-44.
21. Tan EK, Jankovic J. Treating severe bruxism with botulinum toxin. J Am Dent Assoc 2000;131:211-6.
22. Nayyar P, Kumar P, Nayyar PV, Singh A. Botox: Broadening the horizon of Dentistry. J Clin Diagn Res 2014; 8(12):ZE25-ZE29.

Lingual Hematoma- After Thrombolytic Therapy – A Case Report

Abstract

There are case reports of spontaneous sublingual and lingual hematomas in the elderly population related to severe hypertension or an anticoagulation therapy. Spontaneous lingual hematoma is a rare entity in patients without risk factors for bleeding. We present the case of 72 year old male with diabetes mellitus, hypertension suffered from acute myocardial attack followed by thrombolytic therapy with streptokinase. This person developed lingual hematoma which was treated with local therapy.

Key words: Spontaneous bleeding, Lingual hematoma, Risk factors

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Introduction

Thrombolysis with the help of tissue plasminogen activators (tPAs) such as Streptokinase is accepted treatment for selected cases of acute ischemic cerebrovascular events, such as myocardial infarction, pulmonary embolism, portal vein thrombosis, and deep venous thrombosis.[1] These thombolytic agents have non selective capacity of lysing clots throughout the vascular system which leads to complications like hematoma formation. Hematoma is defined as localized collection of blood in the tissue spaces.[2] It can manifest as a swelling, ecchymosis or as petechiae. Hematoma is an entity associated with trauma. Hematoma can occur spontaneously in patients undergoing thrombolytic or anticoagulant therapy. With thrombolytic therapy rate of occurrence of lingual hematoma is rare which should be tackled carefully to avoid risk airway obstruction which can lead to life threatening condition. Here we present case of patient who had attack of myocardial infarction followed by throbolysis by streptokinase. Patient developed lingual hematoma which was treated carefully to prevent further complications.

Case report

A 72-year-old male patient presented to the emergency department (ED) with severe retrosternal chest pain, which progressed over time. Patient also had history of blood pressure and diabetes. At the time of admission patient's blood pressure was 180/100 mm of Hg. Patient's oxygen saturation was 76% and pulse was 110. Electrocardiogram revealed ST-segment elevation in leads D2, D3, aVF, and V4–V6 depression and ST depression at D1, aVL, and V1–V3. A bolus of streptokinase was administered and infusion was started within 2 hours following the onset of symptoms. Patient was also administrated with aspirin and low molecular weight heparin. After one day of thrombolytic therapy, intraoral inspection revealed red and bluish submucosal hematoma involving the floor of the mouth and ventral lingual surface bilaterally causing difficulty in speech and swallowing (as in Figure 1). Low molecular weight heparin infusion was discontinued and fresh frozen plasma was administered. Ice pack was applied over the region of hematoma. The lingual hematoma resolved slowly over period for 3 days.

Discussion

Increased bleeding tendency is a prime concern in any patient. Any minor irritation can lead to massive bleeding in patients who have undergone thrombo-embolisation procedure. Lingual hematoma without traumatic event is a rare entity, and is thought to happen due to aneurysm changes in the facial or lingual arteries. Patients with diabetes mellitus, arterial hypertension, anticoagulation treatment induced by heparin or thrombolytic therapy with streptokinase

Figure 1: Sublingual haematoma

have an increased risk of rupture of these aneurysms.[3] Sublingual hematoma is also known as pseudo-Ludwig phenomenon, and has a potential risk of upper airway obstruction[1]

Problems associated with lingual hematomas are an airway obstruction sore throat followed by dysphasia, hoarseness, drooling or difficult for breathing.[3]

In the present case all the blood parameters were found to be within normal limits, and no evidence was found for presence of any irritating factor that might have caused the intraoral swelling. In this case patient had developed lingual hematoma after infusion of streptokinase and anticoagulant therphy.

Streptokinase is a protein produced by Beta-hemolytic streptococci as a component of that organism tissue destroying machinery. It is not fibrin specific. Streptokinase activates adjacent plasminogen by forming a non-covalent SK-plasminogen activator complex. These complex dissolute clots which are formed.[4]

Initially, it is important to assess, and if necessary secure, the airway. Sore throat seemed to be an early symptom commonly in all cases, followed by dysphagia, hoarseness, drooling, or respiratory distress. Surgical drainage of the hematoma is generally not advised and it should be maintained conservatively. In this patient lingual hematoma is managed by stopping the anticoagulants followed by application of ice pack. Within the duration of 7 days lingual hematoma was resolved.

Conclusion

We would like to conclude that oropharyngeal examination is a very important after administration of thrombolytic therapy to avoid potentially life-threatening complication, as well as continued attention to the ABCs (airway, breathing, and circulation) during and after administration of the thrombolytic agent to prevent worsening condition of patient.

References

1. Muhlis Bal, Yavuz Atar, Ziya Salturk. Lingual Haematoma due to Tenecteplase in a Patient with Acute Myocardial Infarction Case Reports in Otolaryngology: Volume 2013.
2. Dr. Manjunath Reddy, Dr. Sharanabasappa Japatti, Dr. Anuradha Bhatsange. Intraoral Hematoma Formation Following Infusion Of Streptokinase In The Treatment Of Myocardial Infarction: NJIRM 2014; Vol. 5(2). March-April
3. Pinilla Urraca, and Roldan Fidalgo. Spontaneous Lingual Hematoma: A Rare Entity: Volume 2: 1 – 2015.
4. Tripathi KD. Drugs Affecting Coagulation And Bleeding And Thrombosis. In: Essentials Of Medical Pharmacology 5th ed. Jaypee Brothers;2003:569-570.

Periapical Surgery with Retrograde MTA Placement: A Case Report

Abstract

Mineral Trioxide Aggregate (MTA) was introduced as an alternative to traditional materials for the repair of root perforations, pulp-capping and as a retrograde root filling due to its superior biocompatibilty and ability to seal the root canal system. The use of MTA as a root-end filling material was identified because the material is a hydraulic cement that sets in the presence of water. The main aim of an ideal retrograde filling material is to seal the pathways of communication between surrounding tissues and the root canal system. This material allows normal healing response due to the formation of new cementum and bone. Calcium and phosphorus are the main ions detected under the electron probe micro analysis of the MTA powder.

Key words: Apexification, Mineral trioxide aggregate (MTA), Periapical surgery, Root resorption

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Introduction

Mineral trioxide aggregate (MTA) was introduced as modified Portland cement by Torabinejad in 1995. It was originally available as grey MTA, which got later modified as white MTA for esthetic reason. White MTA has decreased amount of iron upto 90 %, aluminium and magnesium oxide, a smaller particle size and a higher pH.

Recently an innovative material MTA+ was introduced by Cerkamed Medical Company. This Improved version of MTA has the convergence of four additional features i.e. nano-particle size, lowest level of heat of hydration, superior crushing strength of the material and an increased bactericidal property.

These added attributes have improved the basic properties of the MTA rendering it more strong and easy to handle.

Indications of MTA+

MTA+ is an innovative material which has ensuing applications in Endodontics.

1. Furcation and perforation repair
2. Repair of internal and external root resorption
3. As root end filling material
4. To preserve the pulp vitality
5. For apexification procedure.

Important properties of MTA+

1. Smaller particle size: Expedites penetration of calcium ions to the demineralized tissue and also facilitates packing material in the application site. Homogeneousness and phasing of the material moderates setting time, and augments the sealing ability.
2. Lowest heat of hydration: Succours to reduce stresses and augments the strength of the set material. The value of heat of hydration generated during binding with water affects the build-up of heat which in turn may cause a difference in the stress of the materials and diminishes the strength of the set material.
3. Best crushing strength: In Accordance with ISO 3107 standard the crushing strength of pridentine should be sustained at 35Mpa. This makes material packing easy with improved strength. MTA+ has 10% higher crushing strength.
4. High content of calcium ions: Makes material with better bacteriostatic and remineralizing properties. Silicon-calcium compounds benefit to rebuild hard tissue after perforation and intra canal resorption. High pH value gives MTA+ more antibacterial properties with the pH ranging from 12.61 to 12.54 at final set.
5. Setting time of MTA+ cement is about 3 hours.

Vascular Effects of MTA

The effect of MTA on vascular tissues was evaluated from two different models. One investigation evaluated the effect of MTA on microcirculation which was held on rabbit ear chamber. This investigation showed that after placement of MTA for 4 weeks, microcirculation was completely restored, and new vessels were formed. Another investigation carried out was a rat aortic ring model that simulated the pulpal vessels' smooth muscle contraction.

These studies concluded that MTA induces vessel contraction in a dose-dependent manner Com.

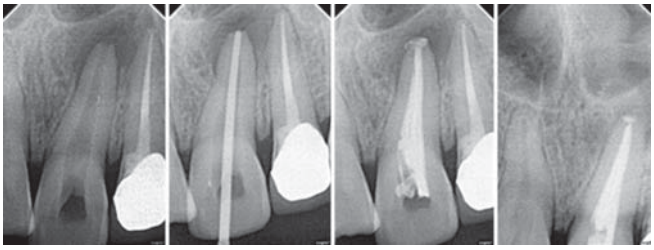
Techniques

Handling MTA+ got much easier with axillary instruments. Block matrix MTA+ is intended to form a portion of prepared MTA+ and simplifies placement it in the fraction of the tooth or root canal, has grooves marked with diameters from 0.7mm to 1mm. A Sterile instrument is then used to lift the material from the mold. A stainless steel MTA+ carrier with handle and piston can also be used for this purpose, the inner diameter of the carrier is 0.8mm and 1.2 mm. This makes the complete progression from proportionating to carrying to compaction an easy process.

Case

A male patient aged 40 was referred to the clinic with swelling in relation to 21. Previous history of Trauma 10 years back with incomplete Root canal treatment. After meticulous cleaning and shaping the canal was left open for 24hrs for active drainage followed by Calcium hydroxide dressing for 10 days, this was followed by two dressings of Calciplast forte (Cerkamed) for 15 days each before each dressing copious irrigation was done with saline and Glco Chex 2% (Cerkamed). After two closed dressing there was still discharge from the canal (Weeping canal) and the case was considered for Apicoectomy.

A day prior to scheduled surgery obturation was done. On the day of surgery apical curettage with apical 2mm resection was done and MTA+ was retro-filled followed by bone graft and GTR membrane placement. Follow up was done till 3 and 6 months.



Discussion

Regeneration is the ideal desirable outcome for any restorative procedure. The last decade has seen a quest for a material that can regenerate odontogenic tissue successfully, both from a periodontal and endodontic aspect. MTA offers the option of a two-visit apexification procedure, whic have the benefit of better compliance and reduced number of radiographs over the multiple visit calcium hydroxide apexification, particularly in younger patients. With the limitations of materials which have been routinely used as retrograde filling materials, MTA has been used over the last 10 years as a suitable alternative to achieve a peri-radicular seal.

Conclusion

MTA+ is an innovative rebuilding material with significantly superior properties and decreased cost which can be used for a number of endodontic procedures. Introduction of MTA+ to endodontics can greatly enhance the success rate of the treatment and its cost effectiveness can concede it to be used by number of practitioners.

References

1. Andreason JO, M Torabinejad, R D Finkelman. Response of oral tissues to trauma in Anderason JO, Anderason FM Textbook and the color atlas of traumatic dental injuries to the teeth. Third edition, Munksgaard. Chapter 2, 77-133.
2. Etiology and pathogenesis of traumatic dental injuries. Scandinavian Journal of Dental Research. 1970; 78,329-342.
3. Andreason JO, Andreason FM. Luxation injuries in Textbook and the color atlas of traumatic dental injuries to the teeth. Third edition, Munksgaard. Chapter 9, 315-378.
4. Morse DR, Larnie J, Yesilsoy C. Apexification: review of the literature, Quintessence International.1990, 21(7), 589-596.
5. Granath LE. Nagra synpunkter pa behandlingen av traummatiserade incisiver parbn. Odontologisk Revy 1959,10, 272.
6. Mitchell OF, Shankwalker GB. Osteogenic potential of calcium hydroxide and other materials in soft tissue and bone wounds. Journal of Dental Research 1958;37; 1157 – 1163.
7. Mackie IC. Management and root canal treatment of non-vital immature permanent teeth. UK National Clinical Guidelines in Paediatric Dentistry. International Journal of Paediatric Dentistry.1998; 8, 289-293.
8. Foreman PC, Barnes IE. A review of calcium hydroxide. International Endodontic Journal 1990; 23, 283-297.
9. Vojinovic O. Influence of different endodontic methods of treatment upon the process of apical closure of immature pulpless teeth and the structure of the newly formed calcified tissue in the apical opening. Journal of Oral Rehab.1977, 4, 335-346.
10. Sheehy EC, Roberts GJ. Use of calcium hydroxide for apical barrier formation and healing in non-vital immature permanent teeth: a review. British Dental Journal.1997; 183 (7), 241-246.
11. Andreason JO, Farik B, Munksgaard EC. Long-term calcium hydroxide as a root canal dressing may increase risk of root fracture. Dental Traumatology, 2002; 18,134-137.
12. Lee SJ, Monsef, Torabinejad M. Sealing ability of a Mineral trioxide Aggregate for repair of lateral root perforations. Journal of Endodontics 1993; 19(11), 541-544.
13. Koh ET, Torabinejad M, Pittford TR, Brady K, McDonald F. Mineral trioxide aggregate stimulates a biological response in human osteoblasts. Journal of Biomedical Material Researchn1997; 37, 432-9.
14. Torabinejad M, Hong, McDonald F, Pittford TR. Physical and chemical properties of a new root-end filling material. Journal of Endodontics 1995; 21(7), 349-353.
15. Matt G, Thorpe J, Strother J, McClanahan. Comparative study of white and gray Mineral Trioxide aggregate (MTA) simulating a One-or Two-step apical barrier technique. Journal of f Endodontics 2004; 30(12), 876-79.
16. Camilleri J, Montein F, Papaioannous, McDonald F, Pitt Ford TR. Biocompatibility of two commercially available forms of mineral tri-oxide aggregrate. International Endodontic Journal 2004; 37,699-704.
17. Harty FJ, Parkins BJ, Wengraf AM. The success rate of apicoectomy, A retrospective study. British Dental Journal 1970; 129; 407-13.
18. Torabinejad M, Smith PW, Kettering J, Pittford TR. Comparative investigation of marginal adaptation of mineral trioxide aggregate and other commonly used root-end filling materials. Journal of Endodontics, 1995; 21(6): 295-299.
19. Fischer EJ, Arens DE, Miller CH. Bacterial leakage of mineral trioxide aggregate as compared with zinc-free amalgam, intermediate restorative material and super EBA as root-end filling material. Journal of Endodontics, 24(3), 176-9,1998.
20. Sluyk, Moon, Hartwell. Evaluation of setting properties and retention characteristics of mineral trioxide aggregate when used as a furcation repair material. Journal of Endodontics 1998; 24(11): 768-71.
21. Torabinejad M, ChanUi-Hong, Lee, Monsef, Pittford TR. Investigation of mineral trioxide aggregate for root end filling in dogs. Journal of Endodontics 1995; 21(12): 603-8.
22. Shabahang S, Torabinejad M, Boyne PP, Abedi H, Mc Millan P. Apexification of immature dog teeth using osteogenic protein- 1, calcium hydroxide, and mineral trioxide aggregate in dogs. Journal of Endodontics 1997; 23(4); 265.

23. Osorio R, Hefti, Vertuci,Shawley AL. Cytotoxicity of endodontic Osorio R, Hefti, Vertuci,Shawley AL. Cytotoxicity of endodontic materials. Journal of Endodontics 1998; 24(2), 91-6.
24. Torabinejad M, Chivian N. Clinical applications of mineral trioxide aggregate Journal of Endodontics 1999; 25(3): 197-205.
25. Royal college of Surgeons clinical guidelines on surgical endodontics. www.rcseng.ac.uk/dental/fds/pdf/surg_end_guideline.pdf
26. Main C, Mirzayan N, Shabahang S, Torabinejad M. Repair of root perforations using MTA: a long term study. Journal of Endodontics 2004; 30(2), 80-3.

Case Report

Journal of Oral and Dental Health

Pharyngeal Tooth: Ectopic Eruption of Impacted Mandibular Third Molar in Pharynx 4 Years After its Accidental Displacement: A Case Report

Abstract

Displacement of impacted third molars is an infrequent but rarely reported complication. It is recommended that, if such complication arise in general practice, the clinician should administer prophylactic broad spectrum antibiotics and should be managed with caution. Follow-up and management of such complication is mandatory to avoid further hazardous and high risk complications.

Key words: Lower third molar, Lateral pharyngeal space, Ectopic Eruption

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Introduction

Anderson defined impaction as the cessation of eruption of tooth due to clinical or radiologically detectable barrier in path of eruption or due to ectopic position of tooth. The causes of impacted third molars include inadequate space in the mandible to accommodate the erupting teeth. The indications for their removal include pain, pericoronitis, periodontal disease, caries, and cyst formation. The finding of impacted third molars accidentally displaced in tissue spaces is an infrequent event. Several cases of displaced teeth in facial spaces like maxillary sinus,[1,2] submandibular space,[3] infratemporal fossa[4] pterygomandibular space[5] and lateral pharyngeal space[6-10] are reported worldwide.[2] Lower third molars are more commonly displaced to one of anatomic spaces than other impacted teeth. Very few cases of displaced mandibular third molar and maxillary third molar in lateral pharyngeal space are reported in literature. Moreover ectopic pharyngeal eruption of displaced lower third molar in lateral pharyngeal space is not yet reported. This report highlights a case of pharyngeal eruption of impacted mandibular third molar 4 years after its accidental displacement into lateral pharyngeal space.

Report of case

A 28-year-old female patient was referred to department of oral and maxillofacial surgery in ACPM dental college by a general dental practitioner for unusual site of erupting tooth. Patient complained of irritation in her throat and difficulty in swallowing two days prior to patient's visit to our department. She noticed a tooth like structure in right side of her throat in the mirror and went to a general dentist who ultimately referred her to our clinic.

Patient's detailed past dental history revealed a dental extraction procedure performed in the lower right posterior region 4 years back. In her anamnesis, the patient went to a dentist due to pain in the lower right third molar region 4 years back. Following radiological and clinical evaluation the dentist decided to go for disimpaction of the right third molar. During the procedure, right third molar was elevated and was "lost" in tissue space accidentally. Patient was informed about the situation and antibiotic therapy was initiated. Patient was followed for 7 days and was asymptomatic. Later, she did not go for recall visit and was lost for follow-up. She was totally asymptomatic for almost 4 years.

On clinical examination, a fully developed tooth crown was seen projecting out from right lateral wall of pharynx, located in faucial pillars (Figure 1). There were no major signs of inflammation. The panoramic (Figure 2) and lateral cephalic (Figure 3) radiographic examination was planned to rule out any associated pathology. It did not reveal any obvious pathology or associated lesion.

The surgical removal of erupting third molar was planned with all necessary precautions under preventive antibiotic coverage. A throat pack was placed and a high suction evacuation was kept ready. Surface anaesthesia was achieved on right lateral wall of pharynx using lidocaine topical aerosol (Nummit Spray, ICPA, India). The tooth was held in medium sized artery forcep and removed carefully. The extraction site did not reveal any active bleeding. The extracted tooth had only one root with significant resorption of other root. (Figure 4) Patient was followed on the next day and after 7 days. Patient recovered uneventfully without any problem.

Discussion

The displacement of teeth in lateral pharyngeal space is an unusual complication reported in literature. A tooth displaced in this facial space is due to the risk factors such as anatomical factors such as distolingual angulation of the tooth, extreme thinness of the lingual cortex, excessive or uncontrolled force of elevation.[7,11] Other

Figure 1: Erupting third molar in right lateral wall of pharynx

Figure 3: Lateral cephalic view of the third molar

Figure 2: Panoramic view showing lower right third molar in ectopic position

Figure 4: Third molar after extraction

factors which may be responsible fore displacements are insufficient clinical and radiographic examination, extreme or uncontrolled strength practice, incorrect manipulation and lack of experience and inappropriate clinical and radiograhical case study. Lingually inclined teeth or deeply impacted mandibular third molar teeth may have a higher risk of being displaced into the lingual soft tissues because of functional movements of pharyngeal muscles. Recommendations differ amongst authors for the time of removal of such displaced tooth. Few suggest removal in the same surgical procedures while others suggest that the procedure should be performed weeks after the displacement to allow fibrous encapsulation of tooth as foreign body reaction.[6,11] The risks associated with later approach include foreign body reaction, migration of the tooth in deeper spaces and infection.[12] No one technique is uniformly applicable as there are differences in the direction of displacement, the size of fragment, delay in retrieval, and tissue reactions.[12] The presence of infection into lateral pharyngeal space can lead to serious complications such as thrombosis of internal jugular vein and erosion of carotid artery. Various surgical approaches for retrieval of the lower third molar from the lateral pharyngeal space (intraoral/extraoral) are recommended in the literature. Simple intraoral approach can be used in cases where the third molar is accessible but if tooth id displaced deep to medial pterygoid muscle or deep in soft tissue then extraoral approach is preffered.[10] Despite such long span of accident, the patient as reported in current case was completely asymptomatic for almost 4 years. Foreign body rejection phenomenon played important role in eruption of this tooth in throat. In our case we preferred intraoral approach because tooth was visible into oral cavity and it was superficially located. The exfoliating nature of displaced tooth through its direct intrapharyngeal eruption and external resorption of one of its roots suggest a low-grade foreign body reaction. Also, completely healed socket of displaced third molar without any remnant of root &/or associated lesion suggests long duration lapsed from its displacement and also it's "in toto" displacement (Figure 2).

Conclusion

Displacement in tissue space and aspiration of third molar are known complications. Such accidents are avoidable through appropriate preoperative clinical and radiographical case study and application of basic surgical principles. In case of such complications, immediate referral to oral and maxillofacial surgeon is recommended to avoid further hazardous complications. Current report described a case of ectopic pharyngeal eruption of displaced madibular third molar with its surgical management.

References

1. Peterson LJ, Ellis E, Hupp JR, Tucker MR (Ed.3). Contemporary Oral and Maxillofacial Surgery, ed 3. St Louis: Mosby, 1988:257-275.
2. Durmus E, Dolanmaz D, Kucukkolbsi H, Mutlu N. Accidental displacement of impacted maxillary and mandibular third molars. Quintessence Int. 2004;35:375-7.
3. Mellor TK, Finch LD. Displaced third molar. Oral Surg Oral Med Oral Pathol. 1987; 64:131.
4. Gulbrandsen SR, Jackson IT, Turlington EG. Recovery of a maxillary third molar from the infratemporal space via a hemicoronal approach. J Oral Maxillofac Surg. 1987;45:279-82.
5. Yeh CJ. A simple retrieval technique for accidentally displaced mandibular third molars. J Oral Maxillofac Surg. 2002; 60:836-7.
6. Esen E, Aydoğan LB, Akçali MC. Accidental displacement of an impacted mandibular third molar into the lateral pharyngeal space. J Oral MaxillofacJ Oral Maxillofac Surg. 2000; 58:96-7.
7. Ertas U, Yaruz MS, Tozoğlu S. Accidental third molar displacement into the lateral pharyngeal space. J Oral Maxillofac Surg. 2002; 60:1217.
8. Medeiros N, Gaffrée G. Accidental displacement of inferior third molar into the lateral pharyngeal space: case report. J Oral Maxillofac Surg. 2008;66:578-80
9. Bobo M, Werther JR. Self-induced displacement of a maxillary molar into the lateral pharyngeal space. Int J Oral Maxillofac Surg. 1998;27:38-9.
10. Lee D, Ishii S, Yakushiji N. Displacement of maxillary third molar into the lateral pharyngeal space. J Oral Maxillofac Surg. 2013; 71:1653-7.
11. Pedlar J. Crown of a tooth in the lateral pharyngeal space. Br Dent J. 1986; 161:335-6.
12. Huang IY, Wu CW, Worthington P. The displaced lower third molar: a literature review and suggestions for management. J Oral Maxillofac Surg. 2007; 65:1186-90

Clinical Spectrum with Report of a Giant Odontogenic Fibromyxoma of the Maxilla

Abstract

Odontogenic fibromyxomas are uncommon benign tumors of the jaws which show slow growth patterns with local aggressiveness and recurrences. They originate from odontogenic mesenchymal cells and simulate closely to that of dental papilla histologically. Painless slow-growing mass with considerable facial deformity often characterizes the tumor. This paper presents a huge maxillary odontogenic fibromyxoma in a fifty-two year female patient with duration of nine years with relevant clinicopathological parameters of the same.

Key words: Myxoma, Fibromyxoma, Maxilla

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Introduction

Odontogenic fibromyxomas are benign mesenchymal neoplasms that account for 1% to 3% of the jaw cyst and tumors.[1] The age distribution is broad and occurs frequently between 10 to 40 years. The mean age of occurance is 31 years with a definite female predilection.[1,2] The tumors characteristically present as asymptomatic jaw expansions with infiltrative patterns causing tooth displacement and gradual facial deformity. Their prevalence is more common in the tooth bearing areas of the jaws corroborating the fact that they arise from the mesenchyme of a developing tooth.[3] The mandible is more commonly affected than the maxilla with the classic radiological feature of a honeycombed appearance.[4] We report a case of large odontogenic fibromyxoma in the right maxilla with a prolonged duration which was misinterpreted as ameloblastoma.

Case report

A fifty-two year old female patient reported to our department with a painless huge swelling in the right half of the upper jaw for the last nine years. The patient hailing from a remote village took local remedies for years allowing the tumor gradually to attain the giant size. A provisional diagnosis of ameloblastoma was made due to its aggressive nature by a local health center and eventually referred to our department.

Extraorally there was right facial swelling involving the middle and lower third with normal skin covering and a mucosa covered tumor mass extruded from the right corner of the mouth. There was obliteration of the right nasolabial fold and the patient was literally unable to close the mouth for the popping out of the tumor (Figure 1). Intraorally the firm grayish-pink tumor mass showed expansion of the maxillary cortical plates with displacement of the regional teeth measuring 11cm x 9cm. Though little surface ulceration was noted the mass was predominantly nontender on palpation (Figure 2). Axial CT showed the expansive and osteolytic lesion destroying the buccal and palatal cortical plates involving the ipsilateral maxillay sinus and the nasal cavity (Figure 3).

Incisional biopsy was done under local anaesthesia with written consent from the patient. The specimen on histopathological evaluation revealed abuandant myxoid stroma with dense collagen fibers interspersed with stellate shaped cells (Figure 4). With the final diagnosis of odontogenic fibromyxoma surgical resection of the tumor was done under general anaesthesia. The patient is on follow up and reported to have a tumor free condition for the past ten months.

Discussion

Myxoma was first coined by Virchow in 1871 who described a group of tumors resembling histologically to the mucinous substance of the umbilical cord (3,5). According to the World Health Organization (WHO) 1992, it is 'a locally invasive neoplasm consisting of rounded and angular cells lying in an abundant mucoid stroma'.[5]

Fibromyxomas arise more commonly in the second and third decade of life with the average age of presentation being 31 years.[6] This intraosseous tumor has a higher frequency to affect the jaw bones and involvement of other bones of the skeleton is an extremely rare phenomenon.[7] According to many literatures they are more common in the premolar-molar region and rarely cross the midline.[8] Mandible is more commonly affected as compared to that of maxilla often with an associated unerupted or missing tooth. Maxillary tumors show higher aggressive characters as they spread through the maxillary sinus.[5,8,9]

Radiographically they produce multilocular or honeycombed radiolucencies with varying degrees of root resorption. Diagnostic dielemmas are encountered in such cases as they need to be differentiated from other multilocular lesions like ameloblastomas, central hemangiomas, central giant cell granulomas or odontogenic keratocysts.[1,5,8] Unilocular lesions are more common in the anterior part of the jaws.[5] Few reported cases highlighted a sunburst type of periosteal reaction. The infiltrative nature of the neoplasm is often depicted with bone erosion in the adjacent nasal cavity or orbital cavity for maxillary tumors.[2]

Figure 1: Extraoral view of the patient with the tumor mass causing inability to close the mouth

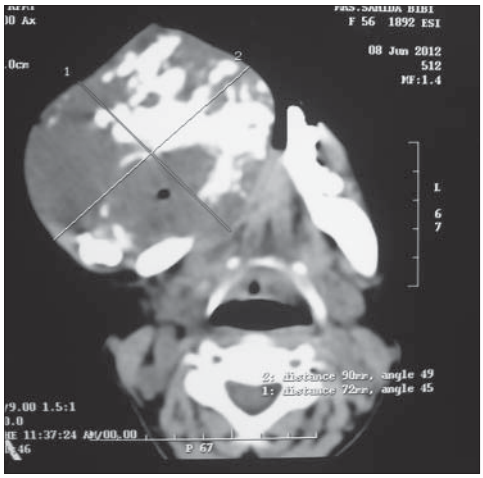

Figure 3: Axial CT view showing involvement of the maxillary sinus and the nasal cavity

Figure 2: Intraoral view of the tumor mass showing cortical plate expansion with regional tooth displacement

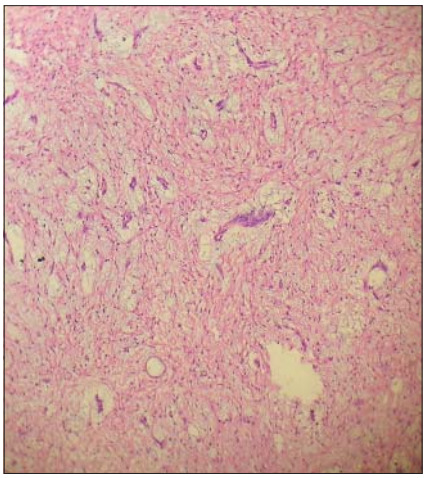

Figure 4: Photomicrograph showing the myxoid stroma with mature collagen fibers and interspersed stellate cells

Histologically fibromyxomas produce a bland appearance with a gelatinous texture showing sparse cellularity. Histogenetically they are thought to arise from the pluripotent mesenchymal stem cells of the primitive dental papilla or dental follicle.[1] The tumors are unencapsulated accounting to its infiltrative nature.[2] The myxoid stroma shows few stellate cells with ovoid hyperchromatic nuclei and long anastomosing cytoplasmic processes.[3] Immunohistochemically the cells show positivity to actin and vimentin similar to that of myofibroblast.[5,8] The stroma is rich in acid mucopolysaccharides like hyaloronic acid and chondroitin sulfate giving it the charactieistic gelatinous nature. Histological differential diagnoses include dental papilla or follicle, myxomatous degeneration in tumors like neurofibroma, osteosarcoma, mesenchymal chondrosarcoma, myxoid lipoma, myxoid liposarcoma myxoid fibrosarcoma etc.[3,4]

Fibromyxomas are radioresistant, leading to surgical methods as the preferred treatment modality.[9] The surgeries vary from local excision, curettage, enucleation to radical resection. Though it is a nonmetastatising tumor it has a higher recurrence rate (upto 25%). Recurrences commonly occur within the first two years of treatment highlighting the need for regular follow up of the patient in the initial stages.[5]

Conclusion

A longstanding case of fibromyxoma with extensive maxillary bone involvement is presented emphasizing on its characteristic clinical, radiological and histological parameters. The diagnostic challenges are highlighted to emphasize the fact that it often mimicks other benign neoplasms of the jaws which should be excluded categorically to render the correct treatment to the patient. As reported cases with recurrences are in fairly large numbers it may be considered that large tumors treated with resections should be reconstructed after proper follow up and the disease free period is satisfactory.

References

1. Ganiga Channaiah Shivakumar, Shivakumar Sahana. Fibromyxoma of the maxilla – a case report. Int J Oral-Med Sci 2010;9(1):36-4.
2. Pedro Infante-Cossío, Rafael Martínez-de-Fuentes, Alberto García-Perla-García, Emilio Jiménez-Castellanos. Myxofibroma of the maxilla. Reconstruction with iliac crest graft and dental implants after tumor resection. Med Oral Patol Oral Cir Bucal 2011;16(4):e532-6.
3. Vijayalakshmi D, Murali S, Sekar B. Odontogenic Myxoma- an unusual presentation. JIADS 2011;2:48-51.
4. Louis W. Schultz, Sunder J. Vazirani. Central odontogenic fibromyxoma of the mandible.O. S. O. M and O.P.1957;10:690-95.
5. Ishita Gupta, Vaishali Keluskar, Arvind Shetti. Odontogenic fibromyxoma

of left maxilla- a case report.J. Int Oral Health 2010;2:79-84.
6. Anupam Mishra, Naresh Bhatia, G.K. Shukla. Fibroimyxoma maxilla. Indian J of otolaryngology and head and neck surgery 2004;56:293-5.
7. Ramon E Barros, Francisco V. Dominguez, Romulo Luis Cabrini, Buenos Aires. Myxoma of the jaws. O.S. O. M. & O.P. 1969:27:225-36.
8. Bruno Ramos Chrcanovic, Márcio Bruno Figueiredo do Amaral, Helenice de Andrade Marigo, Belini Freire-Maia. An expanded odontogenic myxoma in maxilla. Stomatologija, Baltic Dental and Maxillofacial Journal 2010:12:122-8.
9. Joseph Bochetto, Frances Minkowitz, Stanley Minkowitz, Abraham Shulman, Brooklyn. Antral fibromyxoma presenting as a giant nasal polyp. O. S. O. M. & O. P. 1967:23:201-6.

Fracture Teeth Conservative Solution – Re-attachment!

Abstract

Crown fractures as a part of traumatic injuries are common among school children. They create serious functional, esthetic and psychological problems for both children and their parents. One of the options for managing coronal tooth fractures when the tooth fragment is available and there is no or minimal violation of the biological width is the reattachment of the dental fragment. Reattachment of fractured tooth fragments can provide good and long-lasting esthetics (because the tooth's original anatomic form, color, and surface texture are maintained). It also restores function, provides a positive psychological response, and is a relatively simple procedure. Patient cooperation and understanding of the limitations of the treatment is of utmost importance for good prognosis. In this case report the method of reattaching fractured incisors has been described. All the advantages and evidences described in the literature are discussed in order to give the clinician a good therapeutic approach.

Key words: Permanent teeth, Re-attachment, Crown fractures

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Introduction

The crown fracture is the most frequent dental traumatic injury and fall, fight, and vehicle accidents are the common causes of trauma, resulting in fracture of anterior teeth mostly the central incisor.[1] This is an agonizing experience for every individual which requires immediate attention, as because these fractures subsequently lead to esthetic, functional and phonetic problems. The present generation is very conscious about their appearance and demand for immediate treatment and aesthetic rehabilitation.[14]

Treatment approach depends on the type of fracture, location of tooth, type of occlusion and the prognosis. The conventional approach for rehabilitation of fractured anterior teeth include composite restoration, post supported prosthetic restoration and in some cases extraction and fixed prosthetics.[4] With the introduction of innovative techniques & technologically improved composite resins especially dual cured resins and dentin bonding agents, it has become possible to use the fractured segment of the tooth either as a temporary or permanent crown.[6] This technique can be applied to the fractures which include simple enamel-dentine portions and to the more complex situations in which the pulp and periodontium are involved. Chosack and Eildeman published the 1st case report on reattachment of a fractured incisor fragment in 1964.[15]

Eighty percent of traumatized incisors fracture in an oblique fashion from labial to lingual aspect with fracture line proceeding in a oblique direction.[9] Factors that influence the success of reattachment include the site of fracture, size of fractured remnants, periodontal status, pulpal involvement, maturity of the root formation, biological width invasion, occlusion, time material used for reattachment, use of post, and prognosis.[8]

Reattachment of fragment may offer following advantages:[12]

1. Better aesthetics and achievement of lifelike translucency
2. Incisal edge wear at a rate similar to that of the adjacent teeth
3. Replacement of fractured portion involving less time
4. A positive emotional and social response from the patient
5. Relatively inexpensive procedure.

Resin based restorative materials are frequently used in restoration of the fractured teeth. Because of the poor mechanical resistance of these materials, Tooth-colored fiber posts were introduced to strengthen resistance of composite resin, It has several advantages, such as esthetics, bond to tooth structure, have a modulus of elasticity similar to that of dentin, but still require dentin preparation to fit into the canal.[11]

The purpose of this article is to discuss the considerations for dental fragment reattachment technique without removing the fracture fragment from the rest of the tooth structure and to present a clinical case report of fracture involving enamel and dentin and pulp.

Case report

Twenty four years old male patient was referred to Dept of conservative dentistry, Mithila minority dental college & hospital, Darbhanga with broken maxillary right central incisor[11] due to trauma 6 hours back.

He had mild soft tissue injury. On examination it was found that there was complicated crown fracture or Ellis class III in relation to 11 (Figure 1). The fracture was oblique and the crown fragment was mobile but not totally separated from the rest of the tooth structure. Labially the fracture line was just above the gingival margin and clearly visible but on palatal aspect it was below the gingiva and attached with soft tissue. The tooth was tender on palpation and percussion.

Intraoral periapical radiograph of maxillary right central revealed radiolucent horizontal line at cervical one-third with respect to maxillary right central incisor (Figure 2). Since the fractured

portion had proper adaptation to the remaining fractured tooth part, decision was made to carry out single visit root canal treatment followed by immobilization of the fracture with fiber optic post and composite.

Local anaesthesia (xylocaine-2%, Astrazeneca pharma, India) was administered. A small groove was made on the labial aspect through the fracture line.The fracture fragment immobilized using glass ionomer cement (GC Corporation, Japan) (Figure 3).

Access cavity prepared from the palatal aspect using round bar. Working length determination done using no 25 k file. (Mani Inc, Utsomnia, Japan) (Figure 4). Root canal preparation done using rotary protaper file upto F2 (Dents ply, Maillefer) with periodic recapitulation and 3.2% sodium hypochlorite (Sterichem, India) irrigation. Apical 4 mm obturation done using F2 guttapercha (Dents ply, Maillefer) and AH-26 sealer. Radiograph was taken for the confirmation of the sectional obturation (Figure 5).

Post space preparation was done with paeso reamer and drill (Ivoclar Vivadent Inc, USA) corresponding to the post to be used. Fitness of the post checked in the root canal. Root canal was etched and the fiber optic post(FRC Postec plus, Ivoclar Vivadent, USA) was cemented into the canal using dual cure resin cement (Rely-X, 3M ESPE) (Figures 6 and 7).

The palatal access cavity was filled with a composite resin. On the labial surface groove was made along the fracture line with the fissure bur and restored with the composite resin (3M ESPE, Filtek Z350, USA)to mask the fractured line which also helps in reinforcing the fragment. Finishing and polishing was done using the composite finishing kit (Soflex, 3M ESPE) (Figure 8). Patient was advised analgesics. Tooth was kept under observation. Patient was recalled after one week,6 months and one year for evaluation. Periodontal status and reattachment were found to be satisfactory.

Discussion

The fracture of a tooth may be a most traumatic incident for a young patient, but it has been found that there is a positive emotional and social response from the patient when natural tooth structure and appearance is preserved. Coronal fractures must be approached in a methodical & clinically indicated manner to achieve a successful and durable final restoration.[2] The dentist plays an important role in the management of such cases and he has to take into consideration every possibility and select the best to save a tooth that has received trauma. The remarkable advancement of adhesive systems and resin composites has made reattachment of tooth fragments a procedure that is no longer a provisional restoration, but rather a permanent restorative treatment

Figure 1: Fracture of #11

Figure 3: Fracture part stabilization with GIC

Figure 2: IOPAR of #11

Figure 4: Working length of RCT #11

Figure 5: Post space preparation #11

Figure 7: IOPAR of after post placement #11

Figure 6: Fiber post has been attached on #11

Figure 8: Finishing and polishing of #11 with resin composite

offering a favorable prognosis. However, this technique can be used only when the intact tooth fragment is available & when a tooth has not sustained a luxation injury, this technique should be considered.[5]

The cases presented in this article were managed by simple reattachment procedure with intracanal anchorage but without removing the fracture fragment. Posts do not strengthen endodontically treated teeth, and their use is justified only for retention of the coronal restoration There were no concomitant alveolar bone injury and most importantly the fractured portion were in normal alignment with the rest of the tooth structure.[3]

So whenever there is availability of the fractured incisal segment reattachment is the most conservative treatment of choice. Studies have indicated that dentin- bonded resin post-core restorations provide significantly less resistance to failure than cemented custom cast posts and cores.[7] In addition, the fiber-reinforced posts can be used with minimal preparation because it uses the undercuts and surface irregularities to increase the surface area for bonding. Thus, it reduces the possibility of tooth fracture during function or traumatic injury.[8]

There are various advantages described by various authors for reattachment procedures:[11]

- Most rapid and conservative management
- Color match to the remaining tooth structure
- Wears off in similar proportion to adjacent/opposed teeth without trauma
- Economical, requires single visit
- Maintenance of original tooth contours and preservation of incisal translucency
- Positive emotional and social response from the patient There are also perceived disadvantages[13]
- Color changes of the bonded fragment
- Less esthetic result if the tooth fragment is dehydrated
- Need of continuous monitoring.

In a contemporary clinical study after 2 years of follow up of reattached fractured incisors of 11 children aged 8-13, the authors receive "satisfying" and "very satisfying" clinical and roentgen results concerning periodontal, pulpal, color harmony and occlusion.[10]

In another clinical investigation Cavallieri è Zerman[12] compare two different ways of treatment of crown fractures – direct adhesive build up and reattachment of tooth fragment After 5 years of follow up more stabile esthetic results are achieved at application of fragment reattachment. Another prospective investigation made upon 50 reattached incisor fragment shows 80% level of "survival" after 5 years. The authors use acid etching, internal V-shaped channels, bonding agents and photopolimerized resin.[13]

In the long term the tooth may develop a periapical lesion or get discolored. Apicoectomy and PFM restoration will have to be adopted should the need arise. Preparation of ceramic/porcelain fused to metal (PFM) restoration requires additional visits, tooth. Hence, we recommend that the original reattached fragment be allowed to continue as permanent restoration unless tooth exhibits color changes or there is subsequent trauma.[5] Re-attachment technique provides immediate esthetics and functional rehabilitation but follow-up must be done which include assessment of occlusion, periodontal health and subsequent traumatic force reduction. The reattachment of the crown fragment to a fractured tooth can be considered as a most conservative treatment and could be first choice for crown fractures of anterior teeth.

Conclusion

Crown fractures of the permanent teeth in schoolchildren are unique to a great extend and cannot be easily classified according to the way of reconstruction. Literally application of separate method is difficult and every clinician has to know a number of methods for reconstruction. Reattachment of tooth fragment is minimal invasive and esthetic method. The approach is conservative and that is way with great evidence for reconstruction of crown fractures. This method proposes to the dental clinicians' different opportunities for esthetic and functional restorations that are economically effective at the same time. Essential advantage of the reattached teeth is the fact that all the alternative methods as direct adhesive resin reconstruction, veneers and crowns can be performed in case of failure. Using the good experience of the published in the articles there are more often scientific reports of successfully followed up clinical cases of reattached fractured teeth without pulp involvement or endodontically treated teeth.

References

1. Sumedh S. Khare, Ruchi Arora, Vineet Dhar. Multidisciplinary treatment of complicated subgingivally fractured permanent central incisor- A Case Report JIOH, December 2010, Volume 2 (Issue 4) 101-04
2. Georgia V. Macedo, Patricia I. Diaz, Carlos Augusto DE O. Fernandes, Andre V. Ritter, Reattachment of Anterior Teeth Fragments: A Conservative Approach Journal compilation © 2008, blackwell publishing volume 20, number 1,5-18.
3. Olsburgh S, Jacoby T, Krejci I. Crown fractures in the permanent dentition: pulpal and restorative considerations. Dent Traumatol 2002;18(3):103-15.
4. Andreasen FM, Noren JG, Andreasen JO, et al. Long term survival of fragment bonding in the treatment of fractured crowns. Quintessence Int 1995; 26:669-81.
5. Diangelis AJ, Jungbluth M. Reattaching fractured tooth segments: an esthetic alternative. J Am Dent Assoc 1992; 123(8):58-63.
6. Ehrmann EH. Restoration of a fractured incisor with exposed pulp using original tooth fragment: report of case. J Am Dent Assoc 1989; 118(2):183-5.
7. Pradeep Kumar, Uma Maheswari Reattachment of anterior teeth fragment, an aesthetic alternative: Report of a case Journal of Oral Health Research, Volume 1, Issue 3, September 2010, 93-96.
8. El-Askary FS, Ghalab OH, Eldemerdash FH et al. Reattachment of a severely traumatized maxillary central incisor, one-year clinical evaluation: a case report. J Adhes Dent 2006;8(5):343-9.
9. Newton Fahl, Richard J. Simonsen Restorative Options for Traumatic Injuries to the Maxillary Anterior Arch Am J Esthet Dent 2011;1:108-136.
10. Chazine M, Sedda M, Ounsi HF, Paragliola R, Ferrari M, Grandini S. Evaluation of the fracture resistance of reattached incisal fragments using different materials and techniques. Dent Traumatol 2011; 27:15-18.
11. Dean JA, Avery DR, Swartz ML. Attachment of anterior tooth fragments. Pediatr Dent 1986; 19: 731-743.
12. Demarco FF, Fay R-M, Pinzon LM, et al. Fracture resistance of re- attached coronal fragments – influence of different adhesive materials and bevel preparation. Dent Traumatol 2004; 20: 157-163.
13. Macedo GV et al. Reattachment of anterior teeth fragments: a conservative approach. J Esthet Restor Dent. 2008;20(1):5-18.
14. Magne P, Douglas WH. Cumulative effects of successive restorative procedures on anterior crown flexure: intact versus veneered incisors. Quintessence Int 2000; 31:5-18.
15. Worthington RB, Murchinson DF, Vanderwalle KS. Incisor edge reattachment: The effect of preparation utilization and design. Quintessence Int 1999; 30: 637-645.

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