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Yogesh Kumar Gupta India

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Editorial

MEDICAL CARE

Medical care is integral part of our life and health, but the waste generated from medical activities has emerged as an issue of major concern not only for hospitals, nursing home authorities but also to the environment. As per WHO; 85% of hospital wastes are actually non-hazardous, whereas 10% are infectious and 5% are noninfectious but they are included in hazardous wastes.

A major issue related to current biomedical waste management in many hospitals is that the implementation of Bio-Waste regulation policy is unsatisfactory. Lack of segregation practices, results in mixing of hospital wastes with general waste making the whole waste stream hazardous. Inadequate Bio-Medical waste management thus will cause environmental pollution, unpleasant smell, growth and multiplication of vectors like insects, rodents and worms and may lead to the transmission of diseases like typhoid, cholera, hepatitis and AIDS through injuries from syringes and needles contaminated with infectious agent.The Bio Medical Waste scattered in and around the hospitals invites flies, insects, rodents, cats and dogs that are responsible for the spread of communication disease like plague and rabies. Rag pickers in the hospital, sorting out the garbage are at a risk of getting tetanus and HIV infections. It becomes primary responsibility of Health administrators to manage hospital waste in most safe and eco-friendly manner.

The Government of India (notification, 1998) specifies that Hospital Waste Management is a part of hospital hygiene and maintenance activities. This involves management or range of activities, such as collection, transportation, operation or treatment of processing systems, and disposal of wastes.

The segregation of waste at source is the key step and reduction, reuse and recycling should be considered in proper perspectives. We need to consider innovative and radical measures to clean up the distressing picture of lack of civic concern on the part of hospitals and slackness in government implementation of bare minimum of rules, as waste generation particularly biomedical waste imposes increasing direct and indirect costs on society. The challenge before us, therefore, is to scientifically manage growing quantities of biomedical waste that go beyond past practices. If we want to protect our environment and health of community, we must sensitize ourselves to this important issue not only in the interest of health managers but also in the interest of community.

Happy reading!

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EFFECT ON THE MARGINAL GAP OF COMPLETE CROWNS MADE BY USING CASTING RINGS OF DIFFERENT METALS- A SCANNING ELECTRON MICROSCOPIC STUDY

Singh Rajsandeep, Mittal Kanta

ABSTRACT

Aims: Aim of the study was to evaluate and compare the marginal accuracy of complete crowns obtained by using casting rings of different metals namely copper, brass, iron and stainless steel.

Materials and Methods: Ten typodont mandibular right first molar tooth analogs were prepared for complete crowns. Impression of each prepared tooth was taken and poured using type IV die stone. To obtain forty wax patterns, on each stone die, four wax patterns were fabricated with blue inlay wax and divided into four groups; Group I , II , III, IV.

Group I , II , III, IV, Wax Patterns were invested in copper, brass, iron and stainless steel casting rings respectively by using phosphate bonded investment. Conventional lost wax technique was used to fabricate complete crowns.

Ni-Cr base metal alloy was used to fabricate castings. The castings were placed on their respective dies and viewed under scanning electric microscope (SEM) for marginal gap.

Results: Mean of the marginal gap is highest for castings made with iron casting rings followed by stainless steel, copper and minimum for brassring castings.

Conclusions: Group II castings made by using brass rings had the least marginal gap followed by group I, IV and III groupcastings made by using copper, stainless steel and iron casting rings respectively.

Keywords: Casting rings, coefficient of thermal expansion, scanning electron microscope

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INTRODUCTION

An accurate marginal and internal fit of fixed dental prosthesis[1](FDPs) is a critical issue for long-term clinical success. Clinically acceptable gap size includes a wide range of values. It starts at the recommended reference of about 50 μm and reaches to about 120 μm.[2]

Marginal discrepancies may create a space between the tooth and the restoration. The luting agent is exposed to saliva in the oral cavity and dissolves gradually with an enlargement of this space. A minimal marginal gap prevents gingivitis, the dissolution of luting agent, secondary caries, and marginal discoloration. An ideal internal fit improves mechanical properties, such as retention, strength, and resistance. Horizontal plane inaccuracies may cause an occlusal displacement of the FPDs.[3]

Casting is one of the extremely demanding processes in dentistry. Virtually all the castings are done using an adaptation of lost wax technique. Achieving a casting with accurate fitting and less surface roughness has been one of the most difficult tasks, which are the important criteria affecting the casting fit.

The final fit of a casting depends on a balancing out of expansions and contractions which occur during its construction. The major dimensional changes involved are the casting shrinkage of the alloy which should be compensated for by the setting expansion, thermal expansion and inversion of the investment.

The material is also able to undergo hygroscopic expansion if placed in contact with moisture during setting. The use of colloidal solution of silica instead of water for mixing with the powder has the dual effect of increasing the setting expansion and strengthening the set material. On heating the investment prior to casting, mould enlargement occurs by both thermal expansion and inversion of the silica. Thermal expansion is greater for the colloidal silica-mixed materials than for the water-mixed materials.

Consideration of the relatively large casting shrinkages which can occur with some base-metal alloys in comparison with the compensating expansions possible with the investments may suggest that ideal compensation is not always possible.[4,5]

Different authors have studied the effect of using different methods and materials on the marginal gap of crowns which included using different preparation design, impression materials, different die materials, different wax separators, different materials and methods for pattern fabrication, investment storage conditions, accelerated burnout, dry and wet liners or no liners at all, ringless casting, laser sintering, galvano

copings, CAD-CAM etc.

During burnout, walls of the metal ring put restriction on the expansion of the investment. As the thermal expansion of different metals varies with the rise of temperature, so considering this fact, four different metallic casting rings (copper, brass, iron & stainless steel) were used in this study to assess their effect on the expansion of the investment and subsequently on the marginal accuracy of complete crowns.

AIMS AND OBJECTIVES

The aims and objectives of this study are:

1. The purpose of this study is to evaluate and compare the marginal accuracy of complete crowns made by using different types of metallic casting rings. Marginal accuracy is paramount for long evity and success of the restoration. Since the amount of marginal gap is often used to quantify marginal accuracy. This study aims to relate the effect of the varying composition of the casting ring on the marginal accuracy by measuring the marginal gap under a scanning electron microscope.

MATERIALS AND METHODS

The effect on the marginal gap of complete crowns, obtained by using different metal rings namely copper, brass, iron and stainless steel was assessed in this study. This study was conducted on 40 specimens, divided into four groups with ten specimens in each group.

Preparation of typodont teeth -

Ten typodont right mandibular first molar tooth analogs of the same mould and make were selected. These teeth were prepared for complete crowns. A shoulder finish line of 1mm width around the circumference of the tooth was made. (photograph-1)

Preparation of the stone dies -

An impression of each prepared tooth was made using a custom tray fabricated with self-cured resin material and vinyl polysiloxane rubber base impression materials using a two-step putty wash technique. Type IV die stone (Ultrarock, Kalabhai) was mixed according to the manufacturer's instructions (20 ml/100 gm mechanical mix for 30 sec.) and poured into the impressions. Ten type IV stone dies were obtained by taking impressions from each prepared tooth.

Wax pattern fabrication -

On each die, die spacer was applied 1 mm short of the finish line. The stone dies were lubricated with a die lubricant (sigmadent). On each stone die, four wax patterns were made using blue inlay wax (BEGO) extending upto the finish line and divided into four groups; Group I, II, III, IV. Thickness of wax patterns were regularized by using a wax measuring gauge to 1mm thickness all around. Excess wax was removed from the margins with a sharp carver with minimal pressure. Margin of each wax pattern was refined with the use of a magnifying lens and immediately invested to minimize distortion. In this way, total 40 wax patterns were made, with 10 wax patterns in each group. (photograph 2)

Investing the wax pattern -

Four different metallic casting rings (3.5×5.5 cm. dimension) made of copper, brass, iron and stainless steel were used to invest the wax patterns. (photograph 3). Group I, II, III, IV wax patterns were invested in copper, brass, iron and stainless steel casting rings respectively. Each wax pattern was invested separately. A straight flared sprue was attached at an angle to the proximal aspect of the wax pattern. The casting ring was lined with wet cellulose asbestos free ring liner, 3 mm short of the free end of the ring. The wax pattern with the sprue former was removed from the die, centered and carefully luted to the crucible former with wax. It was then sprayed with a debubblizer.For investing the patterns, a phosphate bonded investment Deguvest Impact (Degudent, Dentsply, USA) with an expansion liquid was used.

Wax elimination -

The investing rings were allowed to bench set for an hour before burnout. Wax elimination was done after one hour, using the lost wax technique in a muffle furnace at 900°C for one hour.

Casting -

All castings were made in Induction casting machine with Ni-Cr alloy. The rings were bench cooled at room temperature for one hour and castings were recovered. The sprues were cut with carborundum disc. After washing and cleaning, the fitting surface of the castings were examined for micro-nodules. Castings having more than 1 internal nodule or with nodules on the margins were rejected. Single nodule of 0.25 µm diameter or less was removed with a round bur and castings with nodule >0.25 µm diameter were rejected. The castings were then placed on their respective dies using firm finger pressure.

SEM analysis -

Before viewing under a scanning electron microscope, (SEM) the castings with dies were mounted on metal stubs and were sputter coated with gold ions in a sputter chamber. The prepared specimen was mounted in the scanning electron microscope (photograph 4) before sealing the vacuum chamber. The marginal gaps along the cast crown margins at the stone die-casting interface were viewed and measured at fifteen randomly spaced points around the circumference under scanning electron microscope (SEM). (photograph 5-8)

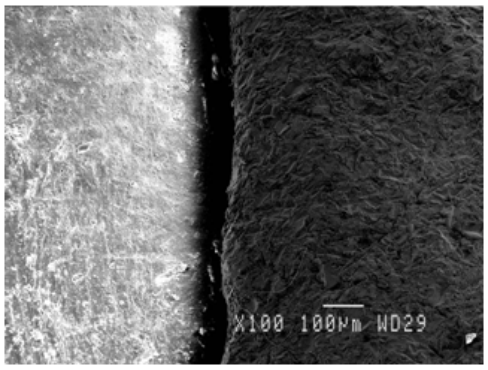
The data soobtained were tabulated, compiled and put to statistical analysis.

PHOTOGRAPH 1: The prepared typodont mandibular first molar

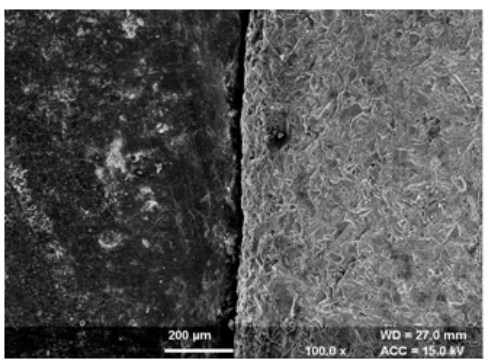
PHOTOGRAPH 2: Wax pattern

PHOTOGRAPH 3: The casting rings used in the study

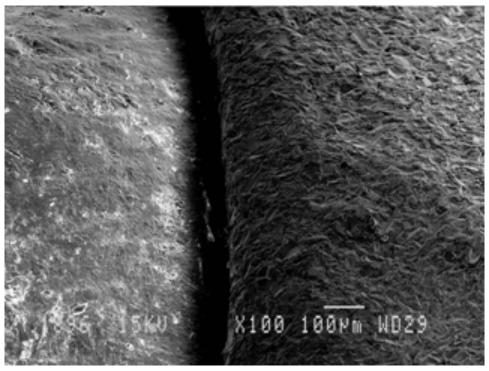
PHOTOGRAPH 4: Mounting of the specimen before sealing the vacuum chamber



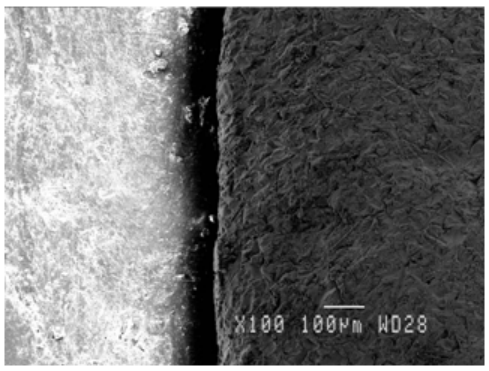
PHOTOGRAPH 5: Marginal gap of the casting made using copper ring- scanning electron microscope (SEM)view



PHOTOGRAPH 6: Marginal gap of the casting made using brass ring-SEM view



PHOTOGRAPH 7: Marginal gap of the casting made using iron ring- SEM view



PHOTOGRAPH 8: Marginal gap of the casting made using stainless ring-SEM view

OBSERVATIONS AND RESULTS

The present study was conducted to evaluate and compare the effect of using casting rings made of different metals on the marginal gap of complete cast crowns. This study was conducted on 40 specimens, divided into groups I, II, III, IV with 10 specimens in each group. To obtain these 40 specimens, ten typodont mandibular right first molar tooth analogs were prepared for complete crowns. Impression of each prepared tooth was taken and poured using type IV die stone. Four wax patterns were fabricated with blue inlay wax on each stone die and divided into groups I, II, III, IV respectively. These wax patterns were invested using phosphate bonded investment. For groups I, II, III, IV copper, brass, iron and stainless steel casting rings were used respectively. The patterns were cast in Ni-Cr base metal. The castings were placed on their respective dies and viewed under a scanning electron microscope for marginal gap at 15 random points around the dies' circumference. The data so obtained was tabulated, compiled and put to statistical analysis.

Statistical analysis:-

The arithmetic mean, standard deviation, and standard error, were calculated for each of the four groups.

ANOVA was carried out to test the significance in difference of marginal gap values in the four groups. The ANOVA table revealed (Table II) that there was a significant difference between the marginal gap values of the four groups.

A multiple comparison post hoc test using Bonferroni's method (Table III) was carried out to verify the significance of difference between the marginal gap values between the four groups.

Table I-Oneway

Descriptives

MARGINAL GAP

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Group I	10	98.6556	2.14914	.67962	97.1182	100.1930	95.09	100.93
Group II	10	90.6161	2.90415	.91837	88.5386	92.6937	83.81	93.92
Group III	10	127.1018	4.09619	1.29533	124.1716	130.0321	118.91	131.37
Group IV	10	104.1234	2.11627	.66922	102.6095	105.6373	100.36	106.06
Total	40	105.1243	14.02582	2.21768	100.6386	109.6099	83.81	131.37

From the above table it is clear that mean of marginal gap is highest for castings made using iron rings and minimum for those made using brass rings.

Table II

ANOVA

MARGINAL GAP

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7363.433	3	2454.478	286.151	<.001**
Within Groups	308.792	36	8.578		
Total	7672.225	39			

From the above table, it is clear that there was a highly significant difference between the marginal gap values of the castings made using the four different metallic casting rings.

*(significant) **(Highly significant)

Table-III

Post Hoc TestsMultiple Comparisons

Dependent Variable: MARGINAL GAP (Bonferroni)

(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
copper	Brass	8.03947(*)	1.30978	<.001**	4.3826	11.6963
	Iron	-28.44620(*)	1.30978	<.001**	-32.1031	-24.7893
	Stainless Steel	-5.46781(*)	1.30978	.001**	-9.1247	-1.8110
Brass	copper	-8.03947(*)	1.30978	<.001**	-11.6963	-4.3826
	Iron	-36.48567(*)	1.30978	<.001**	-40.1425	-32.8288
	Stainless Steel	-13.50728(*)	1.30978	<.001**	-17.1641	-9.8504
Iron	Brass	36.48567(*)	1.30978	<.001**	32.8288	40.1425
	copper	28.44620(*)	1.30978	<.001**	24.7893	32.1031
	Stainless Steel	22.97838(*)	1.30978	<.001**	19.3215	26.6352
Stainless steel	Brass	13.50728(*)	1.30978	<.001**	9.8504	17.1641
	copper	5.46781(*)	1.30978	.001**	1.8110	9.1247
	Iron	-22.97838(*)	1.30978	<.001**	-26.6352	-19.3215

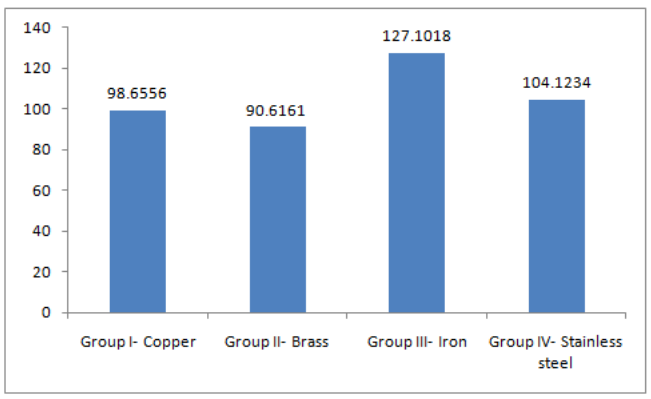
* The mean difference is significant at the .05 level.

was carried out to verify the significance of difference between the marginal gap values in the various groups. The test revealed that there are highly statistically significant difference ofmarginal gap values between the casting obtained in the four groups using different metal casting rings.

*(Significant)**(Highly significant)

The data obtained was also plotted graphically.

Bar diagram showing the comparison of the means of the marginal gap values obtained for each group



The term marginal gap does not have a single definition. An important approach to this problem was provided by Holmes et al, who established several gap definitions according to the contour differences between the crown and tooth margin. According to their classification, a suitable definition for the minimum gap width is the external marginal gap, "the perpendicular measurement from the internal surface of the casting to the axial wall of the preparation is called the internal gap, and the same measurement at the margin is called the marginal gap." The actual maximum gap width, called the absolute marginal discrepancy, was defined as "the angular combination of the marginal gap and the extension error (overextension or underextension)." However, in practice it is almost impossible to describe a certain gap by only one definition, due to morphologic aberrations, rounded margins, or defects. This is one of the main reasons for the large amount of variation commonly reported among investigators. The discussion regarding the upper bound for the so-called clinically acceptable gap size includes a wide range of values. It starts at the recommended reference of about 50 µm and reaches to about 120 µm.[2]

Researchers used different experimental setups and measured the marginal gaps under different conditions. Clinically, several factors such as tooth preparation, impression technique, and cementation methodology can complicate the testing process and deviate from the ideal situation, making in vivo measurements more difficult than in vitro ones. Also, in vitro studies offer standardized and optimized conditions in the experimental performance, which may not be possible to achieve in vivo.[6]

Casting is one of the most widely used methods for the fabrication of dental restorations outside the mouth. **Taggart** first described the lost wax casting process in dentistry in 1907 and observed that the resultant restorations were undersized.

The accuracy of fit of a cast restoration is affected by the quality of the preparation (undercuts, taper of the preparation), the impression, the working cast, the quality of the wax that is used for wax pattern fabrication, spruing, investing the wax pattern and casting procedure. Investing the wax pattern and casting them is the most critical step. The materials (wax, investment, alloy, metal casting ring) involved in the lost-wax casting process undergo shrinkage or expansion, which can result in the final restorations being under or oversized. The accuracy of the fit of a casting depends primarily on the ability of the investment material to compensate on the shrinkage of the alloy which occurs on cooling.[5]

At this last step, it is essential to achieve compensation for the shrinkage of the solidifying alloy by investment expansion. Traditionally, steel rings have been most frequently used for investing and casting dental restorations. Although, it produces clinically acceptable results, yet these steel casting rings are rigid and tend to restrict the setting expansion of investments in the radial direction. The solid metal ring confines and restricts the lateral expansion of the investment, causing a negative pressure, which in turn reduces the mold cavity. Additionally, the thermal expansion of the metal ring is less than that of the investment. This causes a further constraint on the thermal expansion of the investment during high-temperature casting. Lack of this

compensation by the investment, coupled with the solidification shrinkage of alloy, would lead to undersized castings with increased vertical marginal gaps. The above problems can be partially overcome with the use of a ring liner. The liner provides the needed resilience against the rigid metal ring and permits setting and thermal expansion of investment, allowing mold cavity enlargement. However, expansion provided by the liner still remains anisotropic in nature, with the axial component being greater than the lateral/radial component.[4]

Use of a ring-less system will eliminate all these variables as discussed above and it will be easier to produce more accurate castings. Still other alternative to stainless steel rings, ring liners, ringless system with greater thermal expansion in both lateral and axial direction must be investigated to increase our casting precision. So in this study specially made rings of brass, copper, iron and stainless steel with different coefficient of thermal expansion were used for investing the wax pattern with the thought that they might have effect on the expansion of the investment and hence, on the marginal gap. Different metallic casting rings with different coefficient of thermal expansion serves as a rigid container and at the same time high coefficient of thermal expansion of metal might modify the restrictive effect on the thermal expansion of the phosphate bonded investment.[7]

This study was conducted on 40 specimens, divided into 4 groups with 10 specimens in each group. To obtain these 40 specimens, ten typodont mandibular right first molar tooth analogs were prepared for complete crowns.

The impression of the prepared typodont teeth was taken in a special tray using a 2 step putty wash technique and poured with type IV die stone.

The stone dies were used to fabricate wax patterns of uniforn thickness and invested with phosphate bonded investment.

The castings were made using a Ni-Cr alloy. This base metal alloy is used because it has a higher yield strength, modulus of elasticity and low cost as documented by Tjan et al (1991).[8] The castings were placed on their respective dies and viewed for marginal gap under a scanning electron microscope (SEM). Measurements were made at fifteen random points around the circumference. The data so obtained was tabulated, compiled and put to statistical analysis.

The measurements made in the respective groups of this study, elucidate that there is definite difference in the marginal gaps of the castings obtained in the four groups and this difference is statistically significant.

The range of marginal gap for the castings is 95.09-100.93 µm, 83.81- 93.92 µm, 118.91-131.37 µm, and 100.36-106.06 µm for group I, II, III, IV respectively. The mean cumulative marginal gap of the castings in groups I, II, III, IV was 98.65 µm, 90.61 µm, 127.1 µm, 104.12 µm respectively (Table I). All results obtained were statistically significant. In the present study, the mean vertical gaps were larger for the castings made using iron and stainless steel than those for the castings made using brass and copper. This can be attributed to the varying radial expansion of the casting rings made with different metals of different coefficients of thermal expansion which modifies the restrictive effect of the metal ring on the thermal expansion of the investment material.

The results indicate that within the conditions of the study, the castings produced using brass rings had the minimum marginal gap followed by copper, stainless steel and iron rings. Pelopidas et al (2000)[4] and Prasad et al (2014)[5] have triedto increase the casting accuracy by using ringless casting technique. This technique allows uniform expansion of the investment. However, in the present study the varying thermal expansion of the casting rings has been shown to have a profound effect on the marginal gap of the castings. The coefficient of thermal expansion of copper, brass, iron and stainless steel are 16.8-18.4 (10^{-6} m/(m K), 20.2-21.2 (10^{-6} m/(m K), 10.1-11.7 (10^{-6} m/(m K), 10.5-11.5 (10^{-6} m/(m K) respectively.[9,10]

The main limitations of the present study include that the sample size was small, the study was conducted only on single unit wax patterns, the effect of porcelain firing was not accounted for and that a 2-D method of gap determination was done.

There are no previous studies available which examine the effect of using casting rings having different coefficients of

thermal expansion on the marginal gap of castings.

There was no literature available explaining the effect of using casting rings of different coefficient of thermal expansion on the marginal gap of castings. Further investigations are needed to consolidate the findings of this study.

CONCLUSIONS

The results of this study elucidate that:

1. The mean marginal gap of the castings made with copper, brass, iron and steel casting rings was, 98.65 µm, 90.61 µm, 127.1 µm, 104.12 µm respectively. All these results are statistically significant.

2. There are highly statistically significant differences in marginal gap of the four groups.

3. Group II castings, made by using brass casting rings had the least marginal gap followed by group I, IV and III using copper, stainless steel and iron respectively.

The present study has the following limitations:

1. The sample size was small.
2. The study was conducted only on single unit wax patterns.
3. The effect of porcelain firing was not accounted for.
4. A 2-D method of gap determination was done.

There are no previous studies available, which examine the effect of using casting rings having different coefficients of thermal expansion on the marginal gap of castings.

Within the certain limitations of this study, we can conclude that using a casting ring made of a material of a higher coefficient of thermal expansion can help in further compensating the solidification shrinkage of the alloy by allowing greater thermal expansion and thus getting more accurate castings. However, these findings need to be consolidated by further studies. It should be mentioned that though many authors recommend the ringless system to this effect, conventional metal ring investing technique is well documented and proven to give acceptable castings and should not be abandoned. More studies are needed to elucidate the effect of using casting rings made of metals with different coefficient of thermal expansion on the marginal gap of castings.

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Review Article

IMMEDIATE IMPLANT PLACEMENT PROTOCOL

Bathla Shalu Chandna, Fry Ramesh Ram, Goyal Kriti

ABSTRACT

The placement of immediate implants in different regions of the mouth usually possess a challenge in implant dentistry. There are certain conditions in which immediate placement is not recommended including osseous defects or acute infection. Knowledge of tooth anatomy guides us not only in proper preoperative treatment planning but also avoids the possible complications during immediate implantation. There are multiple techniques that practitioners can choose from when deciding to place immediate implants with immediate loading, all of which shorten the waiting period for osseo-integration providing more convenience to the patient and practitioners. Although the number of publications on this topic is constantly increasing, most of them report promising results to provide hope for a greater diffusion of the use of immediate implant placement with specific indications. Thus, this review article enumerates the technique variations that are used for immediate implants in different areas of the oral cavity.

Key words: Atraumatic extraction, extraction socket, immediate implantation

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INTRODUCTION

An immediate implant has been defined as an implant inserted right after tooth extraction at the same surgery.[1]Immediate implant technique was originally described for osseointegrated implants by Schulte et al.[2]The implant placement at the time of tooth extraction has several advantages: shortens treatment time due to fewer patient visits; helps to preserve vertical bone height enabling the placement of wider and longer implants; prevents alveolar ridge atrophy and gingival tissue collapse and recession; replicates the position of extracted tooth, thus minimizing the need of angled abutment.[3] Moreover, immediate implants placement is patient friendly as it allows the patient to leave the dental office with a fixed provisional on the same day. Immediate implantation is very demanding both in terms of surgically and prosthetically compared to conventional implant placement technique.[4]

There are certain indications and contraindications for immediate implant placement.]

INDICATIONS:

- Non restorable asymptomatic tooth
- Vertical root fracture
- Periodontally compromised tooth with deep probing depth without any active infection or purulent discharge
- Idiopathic root resorption, external or internal root resorption
- Adequate amount of bone volume apical to the extraction socket to support implant

CONTRAINDICATIONS:

- Signs of active infection such as purulent discharge, tenderness related to tooth planned for extraction
- Large osseous defect in the extraction socket
- Inadequate height or width of bone apical to extraction socket
- Poor quality of bone
- Inadequate marginal soft tissue around the socket
- Proximity of adjacent teeth
- Adverse location of vital structure like nerve or sinus
- Inability to attain a restoratively reasonable angulation and position of the implant.

ANATOMICAL AND CLINICAL CONSIDERATIONS OF IMMEDIATE IMPLANT PLACEMENT

Following factors determine the best clinical and aesthetic outcome for implants placed right after tooth extraction especially in the aesthetic area:[6]

Socket Type- The simple and clinically relevant classification for extraction socket morphology was given by Elian and Tarnow.[7]Type I- socket with intact buccal plate and soft tissue; Type II- socket with hard tissue loss and without soft tissue loss; Type III- both hard as well as soft tissue loss. For immediate implant placement in the anterior aesthetic zone, type I socket is the ideal one.

Gingival Biotype- Thin gingival biotype is when the probe is visible when placed in the sulcus and thick biotype is when the probe is not visible.[8] After implant placement in the esthetic zone, thin biotype predisposes individuals to marginal tissue recession and loss of papillae.[9]In the esthetic zone, if the gingival biotype is thin, the implant is placed more palatally and apically.

Implant Characteristics- Tapered, self-tapping, self-cutting with deeper threads at the apex implant is preferred for immediate implantation. At the centre of the implant thread should be shallowsquare and threads in the cervical area should be passive to avoid pressure on the crestal bone. Wider diameter implant minimizes the gap between the implant surface and socket wall, obturation the socket and eliminates the need for bone grafting. Roughened implant surface SLA surface should be preferred as it improves the bone implant contact percentage during initial bone healing.[10]

Implant Position- Following an extraction, implant positioning does not depend on the orientation of the root socket but rather on the 3D implant positioning (mesiodistal, faciolingually and cervico-incisal) that allows maximum primary stability and restorability.[11]Greater amount of bone resorption occurs in case the implant is placed closer to the buccal plate.[12,13]Placement of wider implant encroach the buccal plate resulting in additional bone loss as opposed to retaining bone. Implants placed too buccally manifest 3 times more recession than lingually placed

implants.[14]Placing narrower implant create a gap of more than 2 mm between the buccal plate and implant allowing greater bone fill after grafting. Greater bone fill, in turn allows greater soft tissue fill on the facial aspect and between the adjacent teeth and the implant. This is the reason why slightly narrower implant is placed 1mm subcrestally.[15]

Dual Zone Grafting-Dual-zone therapy refers to the placement of immediate implant flapless in the esthetic zone along with an abutment or provisional crown, and placement of bone graft in the buccal gap that extended coronally from the crest of the bone to the gingival margin. Recent literature indicates that dual zone grafting causes minimal amount of bone loss and recession.[16]

Immediate or Delayed provisional- There are multiple options for provisionalization of immediate loading single implants. Usually laboratory fabricates the abutment and provisional restoration preoperatively reducing the chairside time of the operator. Whichever restorative option is chosen for single immediate implant, the immediate loading aspect should be non-functional. Restored implant should be out of occlusion so as to not endure the force of the opposing dentition for 2 to 3 months, which allows maximum probability for successful osseointegration.[17]

IMMEDIATE IMPLANT PLACEMENT IN ANTERIOR REGION

Following are the steps for the immediate implantation in the anterior region/ esthetic zone:

1. Atraumatic extraction- To preserve the maximum amount of bone, teeth need to be removed atraumatically before immediate implantation. Start the extraction of a natural tooth with thin scalpel blade giving incision within the sulcus 360 degrees around the tooth, to dissect the connective tissue attachment fibres present above the bone.[18]Later on extraction is to be done with periotomes and luxators. In esthetic region, tooth should be extracted flapless i.e without elevating buccal flap to reduce recession.[12,19]
2. Debridement- Extraction socket has to be inspected for defect under magnification and illumination. It should be curetted well to remove any residual infection and granulation tissue. Socket is irrigated with antibiotic (inj Clindamycin 600mg) followed by 0.12% Chlorhexidine.
3. Drilling protocol- In maxillary anterior region, drilling should be done slightly palatal and not in the socket. Round bur is used to prepare the purchase point in the palatal wall. Alternatively side cutting drill is used. Initially the drill exit at the incisal edge and subsequentially drill is straightened to get palatal access hole and drill exit at the cingulum. It should be done 4 to 5mm beyond the socket. All the osteotomy drill should be used in the same direction and depth. Final drill should not contact the buccal plate. Jumping distance is kept purposefully to ensure bone grafting in the area. Bone tap is used to ensure pressure free placement of implant. It avoids slippage of implant in the extraction socket during placement.

   In mandibular anterior region, the osteotomy can be drilled straight down into the extraction socket. The cingulum of the adjacent teeth can act as a guide and provide a visual clue. Ideally the implant should tilt toward the cingulum of the maxillary opposing tooth.[20]
4. Implant placement- Root dimensions should be measured to select the implant of appropriate diameter and length. Tapered implants are preferred due to its excellent initial fixation. They require minimal drilling and achieve primary stability even in low density bone. Chances of buccal perforation are lesser with tapered implants. The only disadvantage with the tapered implant is of smaller surface area.
5. **3 D Implant placement**

   Mesiodistal- implants most oftenly placed in the middle of the space, with an equal amount of the interproximal bone towards each adjacent tooth i.e mid-distance between teeth was around 1.5 mm or more from adjacent CEJ of each tooth. Inter-implant distance should be 3mm. For central incisor implant placement, palatal flap should be reflected to probe the foramen. Placement of the implant in more distal position may require smaller diameter implant than usual to remain 1.5 mm from CEJ of the lateral incisor. Zenith of central incisor is not at the centre but slightly distal.[11]

   Faciolingual/faciopalatal- Minimum requirement of bone is 1.5 mm or more of bone on facial aspect and 0.5mm or more of bone on lingual aspect. For 4mm diameter implant, minimum of 6mm faciopalatal width of bone is required for central incisor and canine. Bone width of 5.5 mm is required for lateral incisor with 3.5mm implant diameter.

   Cervico-incisal– Implant should be 3 to 4mm apical to free gingival margin of adjacent teeth. Implant shoulder should be placed 1 to 2mm apical to the labial CEJ of adjacent teeth. If recession is there on adjoining teeth, using CEJ as a guide will provide a poor esthetic result. Specifically the coronal position of maxillary canines and central incisor is located 3 to 4 mm apical to the midpoint of the facial free gingival margin. In maxillary lateral incisor, the normal apical distance from free gingival margin is 2 to 3mm. Immediate implants should be placed 1mm subcrestally as viewed from the midpoint of labial plate.

6. **Dual technique of grafting-** Grafting is done in both zones i.e bone and soft tissue. Autograft, allograft, xenograft or synthetic bone graft can be used to graft both zones. Graft acts as a scaffold to maintain hard and soft tissue volume and also maintains blood clot. Slow-resorbing bone graft is preferred to fill the gap between the implant and the buccal plate to predictably preserve bone volume till new bone is not formed.[6] Grafting is done after provisional crown is ready. Screw retained prosthesis is recommended.
7. **Temporization-** Pre-existing positions of the gingival margin and papillae can be maintained by provisional crown supporting the gingival architecture. Insertion torque of 30 to 40 Ncm should be achieved when placing an implant if an abutment and a provisional crown are to be inserted.[21]The provisional prosthesis should not be in occlusion for single tooth replacements.
8. **Postoperative instructions and care-** Following postoperative instructions should be provided to the patient in both verbal and written form: Liquid diet for 2 days and then soft diet for one week. Antibiotics – Amoxicillin with clavunate potassium 625 mg BID for 10 days; Anti-inflammatory – Ibuprofen 600 mg QID for 3 days; 1.2% Chlorhexidine mouth 30 cc BID for 10 days. Avoid chewing on the side of the surgery, smoking, sucking liquid with straw and carbonated drinks. To avoid some bruising and facial swelling ask the patient to apply ice packs over face; 10 minutes on and 10 minutes off.

IMMEDIATE IMPLANT PLACEMENT IN POSTERIOR REGION

Atraumatic extraction is also advocated for immediate implantation in posterior region. In the maxillary first premolar region, buccal placement of implant in buccal socket should be avoided. If the furcation bone is thick, osteotomy can be initiated in furcation bone only relatively straight.Implant then should be directed at the buccal aspect of the lingual cusp of the mandibular premolar. Sometimes, the palatal root socket of a two-rooted premolar can be used as a site for osteotomy preparation and thus implant insertion.Prior to the extraction of maxillary molar the roots should be sectioned with burs to avoid fracture of the buccal bony plate and furcal bone.In molar region osteotomy in should be drilled in the furcation bone.[22]

The length of immediate implants in mandibular premolar region needs to be carefully assessed due to the location of the mental foramen. Therefore, it cannot be assumed that an implant can be placed that is as long as a bicuspid root. [23]During immediate implantation, an implant is usually placed in the furcation bone. When the bone is not thick enough to encompass the implant circumferentially then only the buccal and lingual aspect of the furcation bone stabilizes the implant. Alternately, the implant can also be placed into the mesial or distal alveolus, directing towards the center of the edentate area and buccal aspect of the lingual maxillary cusp.

COMPLICATIONS

Perforation of the buccal cortical plate- Preoperative clinical evaluation including periodontal probing, attachment levels measurement along with two- and three-dimensional radiographs should be done to prevent the perforation of the cortical plate.[24]

As thorough clinical examination determines the number of bony wall present, bone defects such as dehiscences and types of extraction defect. Atraumatic extraction avoids the perforation of buccal cortical plate.[25]

Once the extraction of a natural tooth is indicated, methods to maintain or obtain the needed surrounding hard and soft tissues are indicated. Soft tissue injury should be avoided as periosteum supplies more than 80% of the blood supply to cortical bone. This reduces the dimensional loss of the underlying cortical bone.[26]

For atraumatic extraction, carefully observe the crown and root anatomy, especially of multirooted teeth. If the roots of the tooth to be extracted are divergent, they should be sectioned and removed as individual units avoiding the fracture of roots or surrounding bone.[10,27]

Inability to achieve primary stability- Accurate assessment of primary stability is very important in the immediate implant placement.[28]

The common methods of measuring implant stability are Resonance frequency analysis (RFA) and insertion torque.[29] RFA values indicate the resistance to bending load while insertion torque values indicate the resistance to shear forces.[30]Overprepare the osteotomy length by extending the osteotomy 3 to 5 mm past the socket apex without encroaching on vital structures for primary stability during immediate implantation.

Underprepare the osteotomy width due to the relative absence of high density native bone as compared to a healed site. Immediate implantation can be simplified with the use of osteotomes as they cause radial bone compaction.

Deep implant placement-The major surgical and prosthetic complication associated with the immediate implantation is the deep implant placement. There is a surgical tendency to place the implant deep within the socket to engage more apical bone which leads to prosthetic difficulties in restoration and also prosthesis maintenance. Deep implant placement can make it difficult to remove excess cement when placing the definitive restoration due to increased sulcus depth. Deep implant placement can lead to compromised esthetics.[31]

The most demanding and critical step in anterior implant **esthetic is preservation of the papillae**. When an implant is placed in

subcrestal position the level of interproximal bone is not maintained and the support of papillary tissues is compromised. Deeper implant placement also leads to increased crown height causing reverse crown–implant ratio. Deeper implant placement can be avoided by the use of larger implant during immediate implantation.[32]

Angulation problem- Specifically in immediate implantation deviations from normal anatomy and cases of multiple implant placements can lead to implant malpositioning. The combined use of intraoperative radiograph and surgical template helps to place immediate implant more precisely in the mesiodistal, buccolingual and apicocoronal directions. Intraoperative imaging with force direction indicators in place is beneficial in evaluating current osteotomy development vs. planned locations. Poor angulation is easily managed with angulated abutment that reorients the screw access of the crown. Angulation problem can also be managed using cementable components.

Neurosensory Impairment- Immediate implant placement may lead to neurosensory impairment when placed in atrophic posterior mandible especially in mandibular premolar region due to encroachment of the anterior loop of mental nerve and inferior alveolar nerve.[32]

CONCLUSION

The success of immediate implant procedure relay mainly on proper indication, atraumatic extraction, and sufficient primary stability of the implant. Immediate implantation and temporization, reduces the treatment time and number of surgical procedures as compared to a delayed approach. With ongoing advances in implant technology and materials better literature has emerge to allow shorter time between the implant placement and its restoration.

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Review Article

AMNION MEMBRANE: A PROMISING ALLOGRAFT IN PERIODONTICS

Chandni, Kumar Vinit

ABSTRACT

Autograft tissue currently remains the gold standard in periodontal surgery for regeneration. But its use has certain drawbacks, its limited supply and increased patient morbidity. So it is not used in routine periodontal procedures. For these reasons, the dental profession continues to search for an effective and easy to use alternative. A novel allograft composed of amnion membrane has been recently used for periodontal regeneration. Amnion tissue contains growth factors that may aid in the formation of granulation tissue by stimulating fibroblast growth and neo-vascularization. The self adherent nature of the graft significantly reduces surgical time thus making the procedure easier to perform. It is an attractive option for multiple periodontal procedures.

Keywords: Allograft, amnion membrane

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INTRODUCTION

The word amnion is derived from a Greek name that suggests – as a membranous sac that contains the conceptus and the amniotic fluid. In primates, including humans, it is an adjustable biocontainer that provides the fetus a limited space to allow movements. The amnion is a metabolically active membrane that is involved in solute and water maintaining amniotic fluid homeostasis.

Human amniotic membrane allografts have been used for a variety of reconstructive surgical procedures since the early 1900s. Interest in utilization of amniotic membrane was in the early 1980's as a result of communicable diseases such as HIV/AIDS, Hepatitis, etc. In the late 1990's and early 2000's amnion re-appeared in cryopreserved form for the treatment of ophthalmic wounds. In 2007, the use of the amniotic membrane as an allograft accelerated because Surgical Biologics, a MiMedx Group Company, developed the PURION Process, which among other methods allowed the tissue to be dehydrated and sterilized.1 This produced an easy to use graft with room temperature storage and a five-year shelf life.[1,2] The importance of amniotic membrane lies in its ability to reduce inflammation and scarring, enhance epithelialization and wound healing and in its antimicrobial properties. The ability of processed dehydrated allograft amnion to self-adhere eliminates the need for sutures, making the procedure less technically demanding and significantly decreased surgical time.[3]

SOURCE OF AMNIOTIC MEMBRANE

Eligible amnion donors are living mothers who have delivered a live birth through C section. All tissues are recovered under full informed consent of the donor. Each donor must then answer a series of questions to ensure the donor has to place her at an increased risk for the transmission of infectious diseases.[4]

AMINOTIC MEMBRANE: PREPARATION, PROCESSING AND PRESERVATION

PREPARATION:

Fresh membrane is obtained from the placenta at the time of delivery, either vaginal or caesarian section. Robson and Krizekl rinsed the membrane in a 0.025% solution of sodium hypochlorite and stored at 4°C in sterile solution containing penicillin. They showed that membranes remained sterile for up to 6 weeks. Dinno et al. performed cultures to study the sterilization of amniotic membranes. Preservation with 1:40 dilution of sodium hypochlorite revealed no positive cultures until 30 days.[4]

PROCESSING:

For clinical use, amniotic membrane can be prepared in the following forms:[5]

· Fresh membrane

· Dried membrane

· Frozen membrane

· Freeze derived irradiated membrane

· Stabilized amniotic membrane

· Cryopreserved membrane.

PRESERVATION

Glycerol has been used as a cryoprotective agent for a long time. Because of its high osmotic pressure, it extracts interstitial water from the amniotic membrane. In this method, 80% glycerol is used for drying the amniotic membrane, which can thereafter be preserved at 4°C for a long time, although it loses some of its biologic properties. This type of preserved amnion is used for dressing burn wounds.[6,7]

CLINICAL APPLICATIONS OF HUMAN AMNION MEMBRANE

Human amnion has a long history of clinical applications.:

1. A biological dressing to heal skin wounds.
2. In the management of open wounds, the major goal is to obtain a clean and closed wound in the shortest time possible, thereby preventing fluid, heat, and nutrient loss as well as wound infection, pain, and decreased mobility.
3. Amniotic membranes are efficiently used as allografts for treating skin burns; open and non-healing ulcers; pressure sores; and surgical, infected, and traumatic wounds.[8,9]
4. An alternative treatment to manage wounds in the oral cavity, such as the tongue, buccal mucosa, vestibule, palatal mucosa, and floor of the mouth.
5. Its adhesive and tight contact with the injured surface promotes hemostasis and good pain relief due to exposition of nerve fibres. Good biocompatibility and mechanical properties such as permeability, stability, elasticity, flexibility, plasticity, and resorbability also make it a promising scaffolding material in tissue engineering as in cell adhesion.[9]
6. Anti-inflammatory and anti-scarring property of amniotic membrane have shown decreased necrosis and rapid healing of ulcers with herpes simplex virus (HSV), varicella zoster virus infected tissues, erythema multiforme major (Stevens–Johnson syndrome), and cervical necrotizing fasciitis.
7. The membrane is used for reconstruction of temporomandibular joint ankylosis because it prevents fibrosis and re-ankylosis when used as an inter-positional material.
8. A carrier for local delivery of various drugs such as antibiotic netilmycin (NTM) and antiviral drugs such as acyclovir (ACV) and trifluridine (TFU).
9. Amnion has been tried as a graft material after vestibuloplasty where it prevents secondary contraction after surgery and maintains postoperative vestibular depth.[10-16]

CURRENT CLINICAL USES OF AMNIOTIC TISSUE IN DENTISTRY

1. The laminin structure of amnion tissue is nearly identical to that of native human tissue such as oral mucosa. Reconstruction of a buccal mucosal defect after excision of speckled leukoplakia using the membrane has been reported with a promising result.[17]
2. Contemporary dental implant treatment recommends that at least 1 mm of bone surrounds all aspects of the implant fixture. To achieve such a goal, the concept of site preservation is frequently employed. A resorbable amnion membrane has recently been introduced as a new barrier for site preservation.[18]
3. Novel allograft composed of amnion tissue has recently been introduced for periodontal plastic surgery. Collected data and subjective observation by the authors indicate that the use of processed dehydrated allograft amnion provides good results in terms of root coverage, increased tissue thickness, and increased attached gingival tissue. Processed dehydrated allograft amnion demonstrated excellent esthetic results in terms of texture and color match without postoperative discomfort and adverse reactions.[19]
4. The allograft has been reported to treat Grade II furcation defects with DFDBA and xenograft by guided tissue regeneration.[20] Ambio5™, a 3rd generation amniotic membrane, was developed to further optimize and simplify amniotic membrane transplantation to yield a substantially thicker, more intact, and native amniotic membrane allograft. The ability to self-adhere makes processed dehydrated allograft amnion an attractive option for multiteeth procedures and recession defects in particularly posterior region. Processed dehydrated allograft amnion may provide an effective alternative to autograft tissue in the treatment of shallow-to-moderate Miller Class I and II recession defects.

The clinical usefulness of the hyperdry amniotic membrane as an intraoral wound-dressing material has been studied, and the results suggest that the hyper-dry amniotic membrane is biologically acceptable to oral wounds and could be a suitable clinical alternative for the repair of the oral mucosa.[21]

5. A successful closure of oronasal fistulas was observed in minipigs using interposed grafts of cryopreserved human amnion membrane, offering a simple and effective technique for tension-free closure of such fistulas.[22]

WOUND HEALING

The mechanisms involved in accelerated wound healing by amnion membrane can be divided as follows:

Immunomodulative and Immune privilege

Anti-microbial (broad spectrum effect against bacteria, fungi, protozoa and viruses)

Reduction of pain

Anti-scarring and anti-Inflammatory

Tissue reparative activities with enhanced bone remodeling, osteogenesis and chondrogenesis

Speed fibrogenesis and angiogenesis

Increased extracellular matrix deposition

Potent source of mesenchymal stem cells

1. IMMUNOMODULATIVE AND IMMUNE PRIVILEGE:

The membrane has a unique molecular surface architecture and biochemical properties that is derived from the layer of trophoblast cells which renders it insusceptible to maternal immune attack. These finding suggest that the amnion epithelial cells may be immunologically inert with reduced risk of rejection or immune reaction upon transplantation.[23,24]

2. ANTIMICROBIAL EFFECT

The anti-microbial activity of mesenchymal cells in the amnion helps to protect the wound from infection. It forms an early physiologic "seal" with the host tissue precluding bacterial contamination.[25] This tight adherence helps in restoring lymphatic integrity, protects circulating phagocytes from exposure and allows faster removal of surface debris and bacteria from the wound.[26]

3. REDUCTION OF PAIN

Amnion membrane has the unique ability to reduce the pain during the surgical procedure as it diminishes inflammation and provides a better state of hydration that soothes the wound bed to promote faster healing.[27] The soft mucoid lining of amniotic membrane also protects the exposed nerve endings from external irritant that help to decrease pain sensation by preventing nerve stimuli.

4. ANTI SCARRING AND ANTI INFLAMMATORY PROPERTIES

AM secretes vascular endothelial growth factor (VEGF), hepatocytes growth factor (HGF) that maintain a proper balance between TGF-1 and TGF-3 that prevents scarring.[28] AM down-regulates TGF-beta and its receptor expression by fibroblast that causes a reduced fibrosis at the site. This property helps to modulate the healing of a wound by promoting tissue reconstruction rather than promoting scar tissue formation by excessive fibrosis.[29]

5. INCREASE VASCULARIZATION OR REVASCULARIZATION

There is an enhanced induction of Vascular Endothelial Growth Factor (VEGF) both for VEGF receptors 1 and 2 by the cells of the amnion. Extensive neovascularization observed immediately after its application is attributed to the release of angiogenic factor like insulin derived growth factor (IGF) that promote granulation tissue formation and epithelialization.[30] It is used as a graft material in vestibuloplasty to promote faster healing.[31]

6. INCREASED EXTRACELLULAR MATRIX DEPOSITION

The ability of mesenchymal stem cells to accelerate the transition from the inflammatory to the proliferative phase is critical for treating chronic wounds with high levels of inflammation is an additional advantage of using the membrane.[32] Mesenchymal stem cell-conditioned medium acts as a chemoattractant for macrophages, endothelial cells, epidermal keratinocytes, and fibroblasts which accelerate wound closure.[33] All the above mentioned properties and inherent stem cell reservoirs makes amniotic membrane a novel material for accelerating wound

healing.

APPLICATION:

Before the membrane is applied, the wound should be prepared after thorough removal of granulation tissue. Membrane is applied with rough (chorionic) surface next to the wound. Care is taken to ensure no that there is no air bubbles trapped between the membrane and wound. Freeze dried irradiated membrane is also used as described above, but before application it is soaked in sterile saline for 1-2 minutes.

The physical nature of amnion, when it becomes hydrated, allows for less precise trimming of the membrane. Once hydrated, the membrane tightly adapts to the underlying bone graft and naturally self-adheres to the proximal bony walls. However, this same characteristic does not allow the membrane to provide any space maintenance capabilities and requires it to be placed directly over a bone replacement graft. The membrane's relative thinness (300 μm) and adaptability are two of its advantages when there is limited gingival tissue available to advance over the adapted membrane.

THE FUTURE OF AMNIOTIC TISSUE

The benefits of novel allograft include reduction of surgery time, improving patient outcomes with an affordable price tag. Amnion tissue has many potential uses across the field of medicine and dentistry. To treat gingival recession and a membrane barrier for guided bone and guided tissue regeneration, the technology has tremendous potential wherever there is mucosal tissue. Third generation amniotic membrane has been developed to further optimize and simplify amniotic membrane transplantation for ophthalmic and dental surgery as well.

CONCLUSION

So, the conclusion is the safety, logistical and surgical advantages of amnion membrane are vast. The clinical application of the membrane not only maintains the structural and anatomical configuration of regenerated tissues, but also contributes to the enhancement of healing through reduction of postoperative scarring and subsequent loss of function, providing a rich source of stem cells. Other properties of the membrane include anti inflammation, anti-fibrosis, anti-scarring, antimicrobial, low immunogenicity, and reasonable mechanical property, which are all important for use in tissue engineering. However, further research and long-term clinical trials investigating the full potential of this stem cell reservoir are still warranted to strengthen the fact that amniotic membrane is indeed a reservoir for regeneration.

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Review Article

BOTULINUM TOXIN- A REVIEW

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ABSTRACT

There are many medical and dental conditions which do not have complete treatment modalities in conventional ways. The botulinum toxin (BT) can be used as an alternative treatment modality working through chemo denervation method in many medical and dental conditions. Its indications are rapidly expanding, with ongoing trials for further applications. However, despite its clinical use, what BT specifically does in each condition is still not clear. The main aim of this review is to describe some of the unclear aspects of this potentially useful agent, with a focus on the current research in dentistry and explains the basic of botulinum toxin with its uses.

Keywords- Botox, botulinum toxin, chemo-denervation, temporo-mandibular disorders

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INTRODUCTION

Botulinum toxin (Botox) is a protease exotoxin produced by a gram-negative, rod-shaped, anaerobic, spore-forming, motile bacterium called clostridium botulinum. When released, it cause inactivity of muscles or glands by blocking the release of acetylcholine from cholinergic nerve endings. Although its effects are short-lived, varying the frequency and dosage of administration may alter them. There are eightserologically distinct botulinum neurotoxins;

type A (BTA) and B (BTB) are most commonly used in human medicine for the treatment of conditions such as dystonia, hyperhidrosis, strabismus, gustatory sweating syndrome, alleviation of pain, overactive bladder, achalasia and anal fissure.[1,2] The use of BTA in the orofacial region, such as mesenteric hypertrophy, Frey's syndrome, sialorrhoea, chronic facial pain and hemi-facial spasm has also been reported in literature.[3] Other uses of botulinum toxin are being explored including its use in cancer therapy.[4] Botox is a standout among the most powerful normally occurring organic toxins and in the past has been in charge of numerous inadvertent deaths before its disclosure in prescription. It was first used in medicine in 1980 to treat strabismus. Although in 1989, the cosmetic effects of Botox on wrinkles were noticed, it was only in 2002, that it gained global recognition as a potential cosmetic therapeutic agent after the approval from Food and Drug Administration (Lang, 2004).

As of late, the therapeutic uses of Botox have extended exponentially to incorporate an extensive variety of medical and surgical conditions. This has been helped by a more note worthy comprehension of its hidden physiology and in addition enhanced efficacy and safety. This review evaluates the evidence on Botox therapeutic use in dental and medical conditions.

HISTORY

Botulism is derived from the Latin word botulus, which means black sausage, and has been known as food poisoning caused by the ingestion of rotten meat. Botulinum toxin (BT), initially found in rotten sausage, induces food poisoning, which leads to mydriasis and skeletal muscle paralysis. This toxin was initially reported by Justinus Kerner in 1817, and the possibility of using it to relax the hyper activated motor system was subsequently reported.[5,6]Van Ermengem, a Belgian microbiologist, succeeded in isolating a pathogen from the feces of a patient who ingested rotten sausage in 1897,and named it Bacillus botulinus, which was renamed Clostridium botulinum in 1922. Further, the study was translated and published in English in 1979.[7]Schantzsucceeded in producing massive amounts of BT, and the discovery by Burgen that BT played a role in pre-synaptic acetylcholine inhibition in 1949 laid the foundation for the clinical application of this toxin.[8]

BT type A (BTA) was initially used by Scott in 1973 and became the first toxin to be adopted in medicine, with the approvalby the US Food and Drug Administration (FDA) in the treatment of adult strabismus and blepharospasm in 1989.[9-11]Subsequently, while treating a patient with blepharospasm using BTA, Caruthers and Caruthers serendipitously discovered that it reduced the appearance of wrinkles in the glabellar region.[12]They reported that this resulted from the relaxation of the muscles that control facial

expressions. Then, they found that it was alsoeffective on wrinkles around the eyes and the naso-labial folds. Since then, the scope of BT application has expanded to treatment of ophthalmological disorders such as blepharospasm and neurological disorders such as facial spasms and cervical and limb dystonia, and it has been mainly used to relieve inappropriate or excessive tension in the skeletal muscles. Additionally, it has been reported to be effective on the smooth muscles of the gastrointestinal tract. Furthermore, its range of application was recently expanded to the treatment of pain caused by increased tension of the masticatory muscles facial asymmetry, hyperhidrosis, and osmidrosis, as well as the cosmetic reduction of masticatory and calf muscles.[13]

BOTULINUM TOXIN OVERVIEW

Botulinum toxin is a deadly poison produced by a Gram-positive bacterium called c botulinum. The clinical syndrome of botulism occurs after ingestion of contaminated food, from colonization of the infant gastrointestinal tract, or from wound infection. When foods containing the toxin are ingested, the toxin spreads to peripheral cholinergic nerve endings and blocks acetylcholine release. This results in a bilaterally symmetric descending neuroparalytic illness. The incubation period after ingestion is 18-36 h. In human beings, botulism is mainly caused by Types A, B, E, and rarely F, whereas in animals, it is caused by Types C and D. The toxin is heat labile and denatured by cooking.[14]

STRUCTURE AND TYPE OF TOXIN

BT is a neurotoxin having eight serologic types (A, B, C1, C2, D, E, F, and G) with molecular weight is approximately 150 k Da, consisting of 100 and 50 k Daheavy and light chains, respectively. The eight serotypes of BT have similar molecular structures and functions. The serotypes that are harmful to the human neurological system are A, B, E, F, and G, and BTA has the strongest toxicity. Although the spores of BTA and BTB are heat-tolerant, the neurotoxin is not. Furthermore, the toxin is intolerant to alkali but acid-resistant and, therefore, it is not degraded under acidic conditions. BTA and BTB are clinically used, and their active regions are specific with a desirable effect that can be obtained by controlling the concentration. The most commonly used BTA products marketed worldwide are BOTOX® (Allergan, Inc., Irvine, CA, USA) and Dysport® (Ipsen Ltd., Maidenhead, Berkshire, UK), and for BTB, MYOBLOC® (Elan Pharmaceuticals, Inc., South San Francisco, CA, USA). MYOBLOC®, unlike BTA, is sold in the form of a solution and is mainly used in neurology. BOTOX® and Dysport® are in the form of a white powder and are used after dilution. Because BOTOX® is 3–6 and 50–100 times more effective than comparable doses of Dysport® and MYOBLOC®, respectively, it is recommended to exercise caution when choosing the dose based on the product during treatment.[15]

Table 1 –Forms Of Botulinum Toxin

TYPE A	BOTOX DYSPORT XEOMIN
TYPE B	MYOBLOC NEUROBLOC

SITES AND MECHANISM OF ACTION OF BOTULINUM TOXIN

Modes of action of BTX are summarized in Table 2 (Muthane and Panikar, 2003). BTX induces muscle weakness by inhibiting transmission of alpha motorneurons at the neuromuscular junction. Release of acetylcholine (ACh) is mediated by the assembly of synaptic fusion complexes— a set of soluble N-ethylmaleimide-sensitive factor attachment protein receptor (SNARE) proteins, including synaptobrevin, synaptosomal-associated protein (SNAP),and syntaxin. Seven BT serotypes have been identified. BT types B, D, F, and G cleave synaptobrevin; types A,C, and E cleave SNAP-25; and type C cleaves syntaxin (Kant et al., 2009; Davis, 1993).

Table 2- Action Of Botulinum Toxin.

Absorption via the GI tract or through tissue

Reaches the lymphatic channels and the blood stream

⇩

Circulates in the blood until it reaches cholinergic synapses

⇩

Binds with the help of binding domain

⇩

Cholinergic neuronal cell membrane at nerve terminal

⇩

Enters neuron by endocytosis

⇩

light chain of the toxin

Crosses the membrane of the endocytic vesicle

⇩

Enters cytoplasm of the pre synaptic terminal

cleaves to sites on SNARE proteins

⇩

Prevents assembly of synaptic fusion complex

⇩

Blocks docking, fusion and acetylcholine release

⇩

PREPARATION

Botox is prepared by laboratory fermentation of C botulinum, which lyses and liberates the toxin into the culture. The toxin is then harvested, purified, crystallized with ammonium sulfate, diluted with human serum albumin, lyophilized, bottled invials, and sealed. Each vial contains 100 U of Botox. One unit is equal to the amount that will kill 50% of a group of 18 to 22 g Swiss Webster mice when injected intra-peritoneally. The human lethal dose is estimated to be approximately 3,000 U. Botox dosages used for cosmetic purposes typically are less than 100 U. Optimal pH of the solution is between 4.2 and 6.8, and vials should be stored at or below −5°C.

Preparations should be reconstituted with 1-5 ml of saline without preservatives just before use. Because Botox is easily denatured via bubbling or agitation, the diluents should be gently injected into the inside wall of the vial. The reconstituted solution should be refrigerated at 2-8°C and used within 4 h. Botulinum toxin B is marketed under the trade name Myobloc (Elan Pharmaceutics, San Francisco, Calif). Its relative potency to Botox is 50-125 U of Myobloc to 1 U of Botox. This product does not require reconstitution and is stable for up to 21 months in a refrigerator.[14]

THERAPEUTIC USES

Botulinum toxin may be used for a variety of disorders ranging from pain management to the treatment of tremors and tics, to the improvement of the appearance of dynamic facial wrinkles.

Table 3-Therapeutic Uses Of Botulinum Toxin

DISORDER	SUBTYPE
Focal dystonia • Involuntary, sustained or spasmodic patterned muscle activity	• Cervical dystonia • Blepharospasm • Laryngeal dystonia • Limb dystonia • Oromandibular dystonia • Orolingual dystonia • Truncal dystonia
Spasticity • Velocity-dependent increase in muscle tone	• Stroke • Traumatic brain injury • Cerebral palsy • Multiple sclerosis • Spinal cord injury
Non-dystonic disorders of involuntary muscle activity	• Hemifacial spasm • Tremor • Tics • Myokymia and synkinesis • Myoclonus • Hereditary muscle cramps
Strabismus and nystagmus • Disorder of conjugate eye movement and rapid involuntary rhythmic eye movement Disorders of localized muscle spasm and pain	Chronic low back pain • Myofascial pain syndrome • Temporomandibular joint disorders associated with increased muscle activity. • Tension headache • Migraine headache • Cervicogenic headache
Smooth muscle hyperactive disorders	Detrusor sphincter dyssynergia Achalasia cardia Chronic anal fissures
Cosmetic Use	• Hyperkinetic facial lines • Hypertrophic platysma muscle bands
Sweating disorders	• Axillary and palmar

TMD is an umbrella term used to describe a number of diseases affecting masticatory function, which may include true pathology of the temporo-mandibular joint as well as masticatory muscle dysfunction. TMD manifests with facial pain, joint sounds, headache, peri-auricular pain, neck pain, and/or decreased joint excursions.[16] Periodontal and occlusal diseases having an etiology in dysfunction of masticatory musculature are the key components of TMD. Muscular spasticity secondary to bruxism, external stresses, oro-mandibular dystonia, and psychomotor behaviors are common etiologic factors of TMD.[17] Excessive pathologic nocturnal clenching (excessive centric grinding of teeth) of the jaw which in severe cases may manifest as dystonic bruxism, contributes to TMJ dysfunction in additions to damage to teeth, bone, joints, and gums. In untreated cases of excessive pathologic clenching or TMD, tooth decay is more prevalent

because excessive forces can cause micro fractures and ab fraction of enamel, especially around the existing restorations and may also be followed by gingival recession.[16]

TMD caused by excessive biting forces has conventionally been treated with intraoral appliances, occlusal adjustments, dental restoration, and/or surgery. These techniques are invasive, irreversible, and expensive for the majority of patients.

Techniques currently employed for aesthetic, conservative restorations may not withstand the parafunctional forces continually applied by some patients. Thus, many of these treatment options are not ideal for all patients, and muscular relaxation with botulinum toxin A is a viable alternative. When a muscle relaxant is used with the muscles of mastication, this clenching reflex can be reduced or eliminated.[18]Because a very small percentage of available force is required to masticate food, a slight relaxation of muscle function reduces bruxing and is usually insufficient to affect chewing and swallowing.[19]

TREATMENT PROTOCOL FOR TMD

The treatment begins with a lower dose, because it is always possible to titrate up to a higher dose, if necessary.

The temporalis component of pain is treated with bilateral injections of 7.5 U into the anterior vertical fibers of each temporalis muscle. In more severe cases, 2.5 U are given into the middle and posterior third of the temporalis muscles. Pain relief for the tendon of temporalis is achieved with multiple injections of 2.5U equidistantly spaced in the temple area outside the orbital rim.

The masseter component of pain is treated with 5U injected into the belly of the masseter below an imaginary line joining the tragus of the ear and the corner of the mouth.[20]

There are several case reports, which are supporting the efficacy of BOTOX treatment for TMD:

Freund et al. conducted a large open-label trial with 46 patients suffering from TMD and found that 150 U injections of BOTOX to the temporalis and masseter muscles significantly decreased pain and tenderness and improved function and mouth opening.[19]

Lee et al. conducted a small open-label trial study to evaluate the effect of BOTOX on pain in six patients with limited mouth opening due to TMD. All patients showed clinical remission of pain symptoms without any adverse effects during the 5-12 months follow-up period.[21]

CHRONIC MIGRAINE

Chronic migraine is a disorder with resulting reduced quality of life associated with discomfort. Botulinum toxin can be used to treat this disorder.

Dosage

The recommended dosage is dilution of 200 units/4 mL or 100 units/2 mL, with a final concentration of 5 units per 0.1 mL. It is administered intramuscularly using a sterile 30-gauge, 0.5 inch needle as 0.1 mL (5 units) injections per each site to treat chronic migraine. Injections should be divided across following 7 specific head/neck muscle areas. (1) Corrugator: 5 U each side. (2) Procerus: 5 U one side. (3) Frontalis: 10 U each side. (4) Temporalis: 20 U each side. (5) Occipitalis: 15 U each side. (6) Facial paraspinal: 10 U each side. (7) Trapezius: 15 U each side. It has to repeat for every 12 weeks.[22]

PATHOLOGIC CLENCHING

Pathologic clenching is a disorder leading to chronic trauma to teeth, gingiva, and underlying tissues. Low doses of botulinum toxin Type A can potentially reduce this disorder. Because parafunctional clenching leads to periodontal trauma, limiting clenching before and after periodontal surgery can benefit healing.[19]

MANDIBULAR SPASM

This type of muscular spasm results from spasm of all muscles of mastication and associated mandibular muscles. This disorder places limitations on completing the basic oral hygiene necessary to prevent oral disease. Other impairments can include: Restrictions on dental treatment, difficulty with eating and diminished oral utility. Botulinum toxin treatment to the masticatory musculature diminishes the effects of hyperfunctional or spastic muscles.[23,24]

BRUXISM

Botulinum neurotoxin has also shown promise in alleviating the symptomatology of bruxism. One of the earliest reports on use of botulinum toxin type A for bruxism was by Van Zandijcke and

Marchau, who described the successful treatment of a brain-injured patient with severe bruxism with 100 U of a botulinum toxin type A injections to the temporalis and masseter muscles.[25]

DENTOFACIAL AESTHETICS

Botox and Dermal fillers can provide immediate volume to areas around the mouth, such as the nasolabial folds, marionette lines, and lips to create the proper lip lines, smile lines, and phonetics. Dermal fillers, such as Juvéderm® and Restylane®, are volumizers or plumpersthat fill out lips and static folds in the face caused by loss of collagen and fat.

Botox can also be used in a lip deformity where the lip rises more on one side than the other. It has to be injected at a specific site controlling where the lip goes and how much of it is raised and where and finally, the dreaded “black triangles” which is one of the most challenging aesthetic problems, for which there are very limited successful treatment options.. Dermal fillers can be injected into the interdental papilla to plump it and close the interdental space. Treatment outcome usually last for eight months or longer—at which point the treatment needs to be repeated.

MASSETERIC HYPERTROPHY

Patients who are chronic jaw clenchers frequently present with masseteric hypertrophy. The increased size of these muscles is evident in the patient's facial appearance, which is often altered, e.g., the jaw can appear swollen and miss-happen. To treat this, surgical resection was commonly resorted to which often resulted in substantial contracture.

In several small but well-documented clinical trials by Al-Ahmad, Al-Qudah, Mandel and Tharakan, and Rijsdijk and Vanes, injection of small aliquots of BOTOX into the masseter muscles resulted in a sustained reduction of masseter hyperactivity.[26-28]

GUMMY SMILE

The excessive display of gingival tissue in maxilla while smiling is termed as Gummy smile. Botox can be used as an alternative treatment in use of gummy smile, other treatment options are cosmetic surgical procedures, dermal fillers, orthodontic and orthognathic procedures and dental bleaching.[29]

FACIAL NERVE PALSY

Although most studies are case series, attempts have been made to treat facial paralysis with BTA. Inducing ptosis by temporarily paralyzing the muscle by injecting BTA in the levator palpebrae superoris can prevent drying of the cornea when the eyes cannot be closed normally

because of facial nerve palsy. A method for treating patients with facial paralysis using BTA has been suggested, which induces facial symmetry by causing facial paralysis following the injection of BTA into the normal side of the patient's face.[19,30,31]

OROMANDIBULAR DYSTONIA

Oromandibular dystonia (OMD) is a movement disorder characterized by involuntary spasms and muscle contractions. It manifests as distorted oral position and function resulting in difficulty in speaking, swallowing, and eating. Although it is a neurologic disorder, it is included as a subset of TMD because of its involvement of the masticatory apparatus. Most of the reported literature on OMD has been open-label studies, but all have reported improvement with botulinum toxin injections.[32-34]

TRIGEMINAL NEURALGIA

It is a unilateral neurological disorder affecting orofacial muscles leading to acute severe pain. BOTOX 25−75 U injected into pericranial muscles relieves headache by relaxing the over active muscles by blocking nerve impulses that trigger contractions. According to Elcio, excruciating pain associated with inflammation of the trigeminal nerve of the head and face can be substantially relieved by injections of BOTOX.

DENTAL IMPLANTS AND SURGERY

Overloading of the muscles of mastication can prevent or impede Osseo integration of implants and/or fracture callus formation.[35]The muscular relaxation achieved with botulinum toxin type A injections to the masticatory muscles can be therapeutically beneficial by allowing implants better unimpeded Osseo integration and fracture healing in a more stable environment.

Kayikvioglu and colleagues conducted a small open-label study to prospectively examine the use of botulinum toxin type A as an adjunct to zygomatic fracture fixation surgery, in an attempt to

reduce the number of fixation sites and to prevent dislocation of the zygomatic bone.[36]

MYOFACIAL PAIN DYSFUNCTION SYNDROME (MPDS)

A complex pain syndrome with an unclear etiology, MPDS is associated with pain and tenderness of the muscles, especially those involved in mastication, and with trigger points/bands. Injection of 50 U of BTX type A is a simple and effective means to reduce the muscle hyperactivity of MPDS, by blocking ACh release from the neuromuscular junction (Nixfordet al., 2002).[37] Although this mechanism of BTX has been studied extensively, the results have been inconclusive owing to the unclear etiology. For example, EMG studies of MPDS patients have not consistently shown muscle hyperactivity. BTX has only been used as a temporary therapy to alleviate pain and dysfunction in the disorder (Fallah and Currimbhoy, 2012).[38]

ARTHRITIS

This inflammatory joint disease manifests as joint pain and dysfunction, with joint contractures and muscle atrophy in advanced stages. The pain in chronic arthritis is amplified by neuropeptide release in the periphery. BTX type B inhibits neuropeptide release, there by altering the nociceptor function and reducing pain and neurogenic inflammation. BTX also causes chemodenervation of the articular pain fibers.[39]

SIALORRHEA

Botox also blocks the release of acetylcholine at the cholinergic synapses of the autonomic nervous system; thus, this toxin can block cholinergic parasympathetic secretomotor fibers of the salivary gland. Hence, botulinum toxin has been tested in some autonomic disease, such as achalasia, hyperhidrosis and gustatory sweating (Frey syndrome).[40] Lim and Choi have reported that injection of botulinum toxin type A is a highly effective and relatively safe primary method of treatment for an acute post-parotidectomy salivary fistula that, if treated with conventional pressure dressings, takes long to subside.[41]

RETRAINING MUSCLES DURING ORTHODONTIC TREATMENT

Botox can be used to prevent relapse of orthodontic treatment in case of patients with stronger muscle activity such as that of mentalis muscle. Botox can be used to reduce the intensity of the muscle post treatment and over time, the muscle may be retrained to a more physiological movement.

STRABISMUS

In 1989, the U.S. Food and Drug Administration (FDA) approved the use of BoNT/A (oculinum) to treat strabismus. The product's name was later changed to BOTOX. Further research also indicated its effectiveness in most strabismus patients. However, due to the requirement of repeated injections, BoNT/A may not be considered as an alternative to surgery. It is therefore more suitable for temporary use or in cases where surgical procedure is undesirable. Long-term treatment with BoNT/A has also proven to be safe and efficient.[42]

BLEPHAROSPASM

In 1989, the U.S. FDA approved the use of BoNT/A for blepharospasm treatment. Further studies have suggested that over 90% of patients who received BoNT/A treatment alone showed sustained improvement in their disease onset and the safety profile of BoNT/A treatment on blepharospasm patients is excellent. It was also suggested that there is no need to conduct placebo-controlled trials even though so far information on the efficiency of randomized and controlled studies is lacking.[43]

HEMIFACIAL SPASM

In 1989, the U.S. FDA approved the use of BoNT/A to treat hemifacial spasm. A large open,

case-controlled study showed that over 76% of the patients benefited from BoNT/A treatment.

A mega analysis that reviewed most of the reported studies suggested that no new large

placebo-controlled trials were needed, even though only one placebo-controlled trial had been reported to date.[43,44]

THE NEW THERAPEUTIC HORIZON OF BTX: PAIN

It has been proved that BT can cause selective weakness of painful muscles and disrupt the spasm-pain cycle, providing sustained

pain relief, allowing patients to perform physical exercises that are fundamental for long-term recovery.[45]

VOCAL TICS (GILLE DE LA TOURETTE SYNDROME)

Repetitive dys-kinetic movements of the laryngeal musculature lead to the production of embarrassing speech known as vocal tics. This is commonly seen in Gille de la Tourette syndrome. There is one RCT showing that Botox injections into the thyro-arytenoid muscles is efficacious in reducing the frequency and urge of vocal and motor tics (n = 18) [2b], but the patients did not report an overall benefit from the treatment.[46]

STUTTERING OR STAMMERING

This refers to a disorder of speech-motor control in which the flow of speech is disrupted by in voluntary repetitions and prolongations of sounds, syllables, words or phrases, with occasional in voluntary silent pauses, collectively caused by poor co-ordination between lingual, labial, laryngeal and respiratory muscles. There is only one case series that has shown that intra-laryngeal Botox injection improves fluency in speech therapy failures so its value in treating this disorder is questionable and requires further research.[47]

FIRST BITE SYNDROME

This is the development of facial pain after the first bite of each meal and is seen after surgery
in the parapharyngeal space, especially deep lobe parotidectomy. It is probably due to autonomic dysfunction of salivary myoepithelial cells. Intraparotid Botox injection was found to
significantly decrease symptom severity and improve the patients condition in a case series of five patients.[48]

COSMETIC USE OF BTA

FACIAL WRINKLES

The most common cosmetic indication of BTA is in wrinkle therapy for glabella lines and platysmal bands, and in perioral cosmetic therapies such as gummy and asymmetry smile treatment. BTA has been used to temporarily treat not only glabellar lines but also lateral cantonal lines called horizontal forehead lines, platysmal bands, perioral lines, and crow's feet. The efficacy of BTA in reducing facial wrinkles has been proven in randomized controlled trials.

Administering BTA for wrinkle therapy is generally simple. An adequate dose is perpendicularly injected considering the anatomy of the region to be treated. BTA is known to diffuse to approximately 10 mm and, therefore, is injected at that distance from major structures
such as the bony orbit.[49]

CORRECTION OF PROMINENT MANDIBLE ANGLE AND FACIAL ASYMMETRY[49]

Although prominent mandible angle mainly develops skeletally, it can also develop by bilateral masseter muscle hypertrophy, and facial asymmetry develops with unilateral masseter muscle hypertrophy. In this case, a satisfactory therapeutic effect can be obtained using intramuscular BTA injections.

OTHER USES OF BOTOX[50]

1. Botox can be used in patients with a new denture especially if the patient has long history of edentulousness and has decreased vertical dimension.
2. Higher doses of botulinum toxin type A may potentially be used as a pharmaceutical splint, Limiting muscle contraction before resetting and during rehabilitation after fracture of a facial bone (e.g., fractured mandibular condyle).
3. Botulinum toxin type A can be used to verify whether the pain is muscular or pulpal (e.g., Complex toothache) in origin in patients with chronic intermittent toothache. For example, muscle pain from the anterior temporalis is often referred to the teeth. This should be treated before any major irreversible dental treatments are undertaken. In this context, the use of botulinum toxin type A is both prophylactic as well as diagnostic.

SIDE EFFECTS OF BOTULINUM TOXIN USE[49]

Systemic side effects include anxiety, dizziness, drowsiness,

headache, dry mouth and eyes, pharyngitis, dysphagia, facial pain, flu-like symptoms, inability to focus eyes, drooping eyelid or eyebrow, double/blurred vision, sensitivity to light indigestion, nausea, sweating, fever, chills, allergic reaction like rash, itching, dyspnoea, tightness of chest, edema of face, hoarseness of voice, respiratory infection, anaphylaxis, urticaria, erythema multiforme, pruritus, loss of bladder control, loss of strength, paralysis, seizures etc.

Locally, at the injection site side effects include pain, redness,tingling, bruising, swelling or tenderness, stiff or weak muscles at or near the site, bleeding etc.When Botox is used for a long time, it may cause atrophy of the muscles injected. This atrophy is reversible if the therapy is discontinued.

CONTRAINDICATIONS/PRECAUTIONS FOR USE OF BOTULINUM TOXIN[49]

1. Pregnant women and nursing mothers (not yet completely proved)
2. Use in children – could affect the nerve growth (not yet completely proved)
3. Neuromuscular disorders e.g. Myasthenia Gravis
4. Patients with impaired hemostasis
5. Cardiovascular disorders
6. Pre-existing infection at the injection site
7. Skin infections e.g. Eczeme, psoriasis
8. Individuals on aminoglycoside antibiotics, quinine, chloroquine, calcium channel blockers, aspirin
9. Emotionally disturbed individuals especially after the age of 65 years

DRUG INTERACTION

The following drugs are seen to modify the effect of Botulinum toxin.Muscle relaxants, Aminoquinolenes, Linosamide, Magnesium Sulphate, Quinidine, D-Penicillamine, Cyclosporin, and Aminoglycosides.[50]

DISADVANTAGES[50]

1. Short-term effect
2. Assymeterical/unnatural appearance of smile sometimes due to improper injection technique.
3. Cost factor

CONCLUSION

BOTOX has important clinical uses as an adjunct therapy in temporo mandibular joint (TMJ) and bruxism cases, and for patients with chronic TMJ and facial pain. BOTOX is also used to complement aesthetic dentistry cases, as a minimally invasive alternative to surgically treating high lip-line cases, for denture patients who have trouble adjusting to new dentures, periodontal cases, gummy smiles, lip augmentation, and also for orthodontic cases where retraining of the facial muscles is necessary. However, much more is still to be discovered before its routine use in dentistry for various conditions. There are still many dental conditions which require FDA approval to be treated by botulinum toxin. BT has no doubt broadened the horizon of dentistry and is persuading dentists all over the world to bring it into their clinical practices.

Physicians should consider the suitability of BTX-A for elderly patients, taking into account the etiology of their wrinkles, skin fragility, facial anatomy, concomitant medications and medical conditions, risk of adverse effects and the likelihood of treatment benefit. Although BTX-A has a low perceived risk of side effects, older patients may be more susceptible to these effects. The benefit from BTX-A treatment is also questionable since wrinkles in older people are more likely to be caused by factors other than repeated muscle contraction. Precautions such as a obtaining a full medication and medical history, beginning with low doses, and proper injection technique are especially important for optimal outcomes in elderly patients who are deemed to be good candidates for BTX-A cosmetic injections.

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Review Article

ANIMAL MODELS IN PERIODONTAL RESEARCH - A REVIEW

Sharma Puneet , Salaria Sanjeev Kumar, Bansal Deepak, Gowda Ravi kiran N, Gupta Shakshi

BACKGROUND: Animal models and cell cultures have contributed new knowledge in biological sciences, including periodontology. Although cultured cells can be used to study physiological processes that occur during the pathogenesis of periodontitis, the complex host response fundamentally responsible for this disease cannot be reproduced in vitro. So, animal studies are complementary to in-vitro experiments prior to testing new treatments. However, there is lack of information in the literature regarding the frequency of using animal models in periodontal research.

METHODOLOGY: A review of literature was carried out using electronic databases from January 2002 to December 2012.

RESULTS: Of 420 studies were addressed; only 366 met the inclusion criteria. Rodents as animal models were used in maximum of (42.61%), dogs came at the second level (25%) and then rabbits (7.143%), mini pigs (3.57%), non-human primates (3.09%), baboons (1.67%), goats (1.428%), cows (0.952%), sheep (0.71%), hamsters, ferrets, cats and ewes(all 0.238%).

CONCLUSION: Rodents are the most important animal used in periodontal research, especially in the periodontal tissue regeneration studies and as periodontal disease models. A gold standard animal model in periodontology does not exist since every application requires a model that fulfils specific needs.

Keywords: animal model, periodontal research, rodent.

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INTRODUCTION

Spontaneous Model - is to achieve an understanding of the life process, animals are experimented since long. There are around 4500 mammalian species and 9000 species of birds. For over hundred years, periodontal diseases have been studied in many species and a wealth of dependable data about periodontitis in species other than human exists. In the field of periodontics, the first report appears to be that of Talbott (1899), who described periodontitis in mongrel dogs.

Human longitudinal studies of periodontal diseases pose many problems such as determining the individuals at risk, the level of disease activity and susceptibility to disease progression.[1]

From the view point of comparative biology, non-human primates are similar to humans, having comparable periodontal tissue structures and healthy and diseased periodontal states, as observed in humans.[2]However, most non-human primates used for research purposes are large, expensive, and difficult to handle. Furthermore, the genetic background of many of these animals has not been established, because animals used in research are often wild-captured animals, with heterogeneity in age, body weight, and oral and general health conditions.[2] Among the species of non- human primates, squirrel monkeys and marmosets are small in size and relatively easy to handle, but unfortunately do not exhibit an inflammatory profile characteristic of human periodontal disease. Periodontal tissue specimens from these animals, unlike humans, exhibit very limited numbers of lymphocytes and plasma cells.[3,4,5]

Rodents, belonging to the cohort Glires, such as mice, rats, and hamsters, have been used widely for periodontal research because of specific advantages such as small size, low cost, known age and genetic background, controllable microflora, and ease of handling and housing.[6] However, anatomical structures of periodontal tissues and histopathological features of periodontal disease of rodents are different from those of humans.[6] For example, oral sulcular epithelium is keratinized in rodents, but not in humans.[7] Neutrophils appear to be the only infiltrating cells in periodontal lesions of rodents. In contrast, periodontally involved human tissues show a complex infiltrate of lymphocytes, plasma cells, macrophages and Neutrophils.[6]Suggested reasons for these histological variances include the possibility of some fundamental differences in host responses, or at least in part, some divergence in the reaction of tissues to specific challenges between rodents versus humans.[6, 8] Thus, it is clear that efforts to find new animal models which better represent the periodontal disease state in humans would be advantageous for researchers focusing in this area.

The aim of this mini-review was to find out the most preferred animal models demonstrated in the literature in the field of

periodontal research during the last decade.

CLASSIFICATION

Animal models are classified as follows[9]:

Experimental Model- one in which the experimentally reproduced condition mimics a human disease.

Negative Model- (Non model) – are animal species in which a particular disease cannot be produced.

an animal species that has a disease which occurs naturally and mimics a human disease at least in some way.

Orphan Model- is an animal species that does not mimic a human disease. Even though the animal disease pathogenesis is well understood, the similar disease is not, therefore, the animal disease model may not be recognized as a true model.

RATIONALE FOR USING ANIMAL MODEL IN PERIODONTICS

- Animal models for testing periodontal regenerative procedures are necessary because controlled quantitative histological analysis is required to evaluate the quality and extent of newly formed supporting tissues [10].These studies are not possible in man because of the need to retrieve teeth and surrounding periodontium in large blocks appropriate for histological analysis.

- Proper evaluation of a new therapy necessarily involves the use of treated and untreated controls which are difficult to obtain in the human

-The testing of potentially harmful new devices and drugs may be unethical in man prior to thorough evaluation in higher animals.[11]

CRITERIA FOR SELECTION OF PROPER ANIMAL MODELS[9]-

- Appropriateness as an analog
- Transferability of information
- Genetic uniformity of organisms, where applicable
- Background knowledge of biological properties
- Cost and availability
- Generalizability of the results
- Ease of and adaptability to experimental manipulation,
- Ecological consequences and
- Ethical implications.

ADVANTAGES OF ANIMAL EXPERIMENTS

By comparison with human subjects, animal models have several advantages:

- Constant environmental conditions can be maintained over long periods of time, greatly increasing the power to detect genetic effects.[12]

- Different environmental conditions can be imposed sequentially on individuals to characterize genotype-environment interactions.

- Complex pedigrees that are much more powerful for genetic analysis than typically available human pedigrees can be generated.

- Genetic hypotheses can be tested prospectively by selective matings.

- Essential invasive and terminal experiments can be conducted.

An obvious advantage of experimentation in animal systems is the possibility of creating

paired defects of equal size, which simplifies statistical handling of data.[13]

LIMITATIONS OF ANIMAL EXPERIMENTS-

- Not all human diseases can be reproduced in animals

-All the conclusions derived from animal experiments may not be strictly applicable to human beings. Difficulties are encountered in extrapolating findings from animal experiments in man.

APPLICATION OF ANIMAL MODELS IN PERIODONTOLOGY[14]

- Periodontal tissue regeneration studies: Animal models can be used in the studies considering growth factors, bone grafts/materials, guided tissue/bone regeneration, Enamel Matrix Derivative (EMD) application, collagen/synthetic membranes, Bone Morphogenetic

Proteins (BMPs) application, periodontal tissues, regenerative factors and osteogenesis by means of biological cells.

- Bone Healing Investigations: Various animal models can be used in the studies considering bone healing of artificial defects.

- Periodontitis Model Descriptions: Ferrets can be used as models to evaluate the assessments in periodontal defects, experimental/induced periodontitis or gingivitis, inflammatory

mediators in gingivitis or periodontitis, comparisons between human and animal in terms of periodontal pathogenesis and oral pathology investigations. Since the course of the periodontal lesion in ferrets follow a similar path as in humans.[15]

- Calculus formation studies: Beagle dogs, rats and ferrets could be suitable for calculus formation and research studies.[1]
- Implant studies: Various animal models can be used in the studies considering evaluation of different types of dental implants.
- Bone regeneration investigation: Nonhuman primates can be used in the studies considering bone inducing materials.
- Peri-implant tissue studies: Rhesus monkey, cynomolgus monkey and baboons have been used to study osseointegrated oral implants due to the possibility of obtaining block biopsies.
- LASER application: Animal models can be used in the studies considering all applications related to laser.

REVIEW METHODS

Studies concerning the use of animal models in periodontal research were identified by reviewing the appropriate medical subjects heading (MESH) keywords in the period between january 2002 and december 2012. Standardized methodological filters were used to identify analytical studies included the following keywords: (Animal Models) and (Periodontology). We also searched reference lists of identified articles and abstracts.

INCLUSION CRITERIA

To be eligible for inclusion in the review, studies had to:

- be pilot studies, cohort studies, in-vitro study, description papers or in vivo investigations
- be in English language
- Consider one or more animal model to investigate one or more subject in the field of periodontology.

EXCLUSION CRITERIA

- Non-English articles, reviews, case reports, reports of workshops and studies performed on human patients were all excluded from this review. Studies which were addressed without identified texts were also excluded.

RESULTS

- The electronic searching system addressed 420 studies, of which, only 366 studies met the inclusion criteria (2), (3), (4),(5), (11), (12), (13), (14, 15), (16), (17), (18), (19), (20), (21), (22), (23), (24), (25), (26), (27), (29), (30), (31), (32), (33), (34), (35), (36),(37), (38),(39),(40), (41), 42), (43),(44), (45), (46), (47), (48), (49), (50), (51), (52), (53), (54), (55), (56), (57), (58), (59), (61),(62), (63), (66), (67), (68),(69),(70), (71), (72), (73), (74), (75), (76), (77), (78), (79), (80), (81),(82),(83),(84),(85),(87),(88),(89),(90),(91),(92),(93),(94),(95),(96),(97),(98),(99),(100),(101),(102),(103),(104),(105),(106),(107),(109),(110),(111),(112),(113),(116),(117),(118),(119),(121),(122),(123),(124),(126),(127),(129),(130),(131),(132),(133),(134),(135),(136),(137),(138),(139),(140),(141),(142),(144),(145),(146),(148),(149),(150),(151),(152),(153),(156),(157),(158),(159),(160),(162),(163),(164),(165),(166),(167),(168),(169),(170),(171),(172),(173),(174),(175),(176),(177),(178),(179),(180),(181),(182),(183),(184),(186),(187),(189),(191),(192),(193),(195),(196),(197),(198),(200),(201),(202),(203),(205),(206),(208),(209),(210),(212),(213),(215),(216),(217),(218),(219),(220),(221),(222),(223),(225),(226),(227),(228),(229),(231),(232),(233),(234),(237),(238),(239),(240),(241),(242),(243),(244),(245),(246),(247),(248),(249),(250),(251),(252),(253),(254),(255),(256),(258),(259),(260),(262),(263),(264),(265),(266),(267),(268),(269),(270),(271),(272),(273),(275),(277),(278),(279),(280),(281),(282),(283),(284),(285),(286),(287),(288),(289),(290),(291),(292),(293),(294),(295),(296),(297),(298),(299),(300),(301),(301),(302),(303),(304),(305),(306),(307),(308),(309),(31 1),(312),(313),(314),(315),(316),(317),(318),(319),(320),(322),(323),(325),(326),(327),(328),(329),(330),(331),(332),(334),(335),(336),(337),(338),(339),(340),(341),(342),(343),(345),(346),(347),(348),(349),(350),(351),(353),(354),(355),(356),(357),(358),(359),(360),(361),(362),(363),(364),(366),(367),(368),(369),(370),(371),(375),(376),(377),(378),(379),(380),(381),(382),(383),(384),(385),(386),(387),(389),(390),(391),(392),(393),

(394),(395),(396),(397),(399),(400),(401),(402),(403),(404),(405),(406),(407),(408),(409),(410),(41 1),(413),(414),(415),(416),(417),(418),(419),(420)and54 studies were excluded (1),(6),(7),(8),(9),(10), (28),(60),(64), (65), (86), (108),(114),(115),(120),(125),(126),(128),(143),(147),(154),(155),(161),(185),(188),(190),(194),(199),(204),(207),(21 1),(214),(224),(230),(235),(236),(257),(261),(274),(276),(310),(321),(324),(333),(344),(352),(358),(365),(372),(373),(374),(388),(398),(412).

- Within the420 studies mentioned, Rodents were used as animal models in 179studies (3), (4), (12), (14), (16),(17),(18),(19),(20),(21),(22),(23),(24),(25),(26),(27),(29),(30),(31),(34),(36),(37),(38),(39),(40),(41),(42),(43),(45),(46),(47),(49),(50),(51),(52),(53),(54),(55),(56),(57),(58),(59),(61),(62),(63),(66),(67),(68),(69),(70),(73),(74),(76),(78),(79),(80),(85),(87),(88),(89),(91),(96),(98),(99),(101),(102),(105),(106),(107),(109),(1 11),(112),(119),(122),(123),(124),(127),(129),(130),(131),(132),(133),(137),(139),(145),(146),(150),(152),(157),(165),(166),(172),(179),(180),(182),(183),(187),(189),(192),(200),(203),(205),(212),(213),(221),(222),(223),(226),(227),(229),(233),(234),(237),(242),(243),(244),(246),(248),(249),(250),(255),(256),(266),(271),(275),(278),(279),(280),(281),(283),(292),(293),(301),(302),(303),(304),(305),(306),(309),(312),(318),(323),(326),(327),(331),(334),(337),(340),(341),(342),(345),(346),(347),(348),(350),(355),(356),(360),(361),(364),(367),(368),(370),(371),(375),(380),(382),(383),(384),(390),(397),(399),(400),(401),(405),(406),(41 1),(415),(417),(418),(419),(420).
- At the second level dogs were used as animal models in 105 studies (2), (5), (13), (15), (32), (33), (48), (71),(72), (77), (82), (83), (84), (97), (100), (103),(104),(117), (134),(140),(141),(144), (148),(151),(153),(156),(158),(159),(162),(164),(167),(168),(169),(175),(178),(186),(191),(193),(197),(198),(206),(208),(209),(210),(215),(217),(218),(220),(225),(228),(232),(241),(245),(258),(259),(262),(263),(264),(265),(268),(272),(282),(284),(286),(287),(288),(291),(294),(296),(297),(298),(299),(300),(308),(31 1),(314),(317),(320),(325),(328),(329),(335),(336),(349),(353),(354),(357),(359),(362),(366),(369),(381),(386),(387),(389),(391),(392),(394),(395),(396),(403),(409),(410), (416).
- At the third level, rabbits were used as animal models in 29 studies (11), (95), (113), (136), (138), (149), (160),(170), (174), (196), (201), (202), (216), (219), (231),(240), (251), (260), (267),(273),(316),(322),(338),(339), (343), (363),(376),(378),(407).
- Mini Pigs were mentioned in 15 studies - (90),(121),(163),(270),(277),(285),(307),(315),(330),(332),(379),(385),(402),(404),(414).
- Non-human primates were used as animal models in 13 studies - (44), (94), (116), (118), (135), (142), (173),(177), (195),(289),(290), (313), (377).
- Baboons were used to describe animal model in seven studies-(35), (75), (93), (116), (252), (269), (319).
- Goats were used to describe a new animal model in periodontology in six studies-(247), (251), (253), (254),(393), (413).
- Cows were mentioned in four studies-(110), (176),(238), (295).
- Sheep's were considered in three studies-(92), (184),(408).
- Finally, only one study considered hamsters (181), ferrets (81), cats (39) and ewes (171).

Table representing number of studies in various years studied and animal model studied-

Year	Rodents	Dogs	Rabbits	Mini-Pigs	Non-human Primates	Baboons	Goats	Cows	Sheeps	others	Exclusion studies
2002	4	7	1	-	2	1	1	-	-	-	1
2003	16	11	5	2	2	-	-	1	-	1	7
2004	16	14	4	4	-	-	-	-	-	-	3
2005	28	15	5	1	1	2	-	-	1	1	6
2006	18	15	4	2	1	-	3	2		-	5
2007	16	21	6	4	1	-	2	-	1	-	13
2008	9	2	2	-	5	1	-	1	-	-	3
2009	16	4	1	1	-	1	-	-	1	1	4
2010	16	5	-	-	-	-	-	-	-	-	2
2011	24	2	1	1	1	1	-	-	-	1	7
2012	16	9	1	-	-	1	-	-	-	-	3
Total	179	105	30	15	13	7	6	4	3	4	54

DISCUSSION

In designing any medical or dental animal study, it is often advantageous to select an animal that is phynogenetically similar to humans. The wide range of animal species allows appropriate selection of bio-models for different investigations. Each species has unique similarities and dissimilarities to humans.

Choosing a gold animal model which suits all fields of application is a current goal in research though seems to be very difficult or impossible.

It was the aim of the current mini-review to address the most frequent animal model used in periodontal research in last decade.

According to the electronic search, it was shown that rodents were most used in periodontal research (42.61%).Rodents have similar molar structure to humans and are inexpensive models. But they are naturally resistant to periodontitis and have different microbiota from humans. They have small size and therefore amount of tissue for analysis. So, large numbers of animals are needed.

At the second level, dogs (25%) were used as animal models. In view of their docile temperament and natural susceptibility to periodontal disease, dogs, particularly beagles, are used in dental research for the study of periodontal disease progression, guided tissue regeneration, tissue wound healing, and dental implants. They develop natural or experimental periodontitis similar to humans. They are relatively expensive, need special daily care, husbandry issues and dentition is different from humans. Rabbits came at the third level as an animal model in periodontal research (7.143%).Then came the miniature pigs (3.57%) in studies as an animal model. They have dental structure similarity to humans and natural or experimentally periodontitis can be induced. But they are relatively expensive, husbandry issues; relatively few studies are there. Non-human Primates came at the fifth level and have similar dental structure, micro flora, and disease to humans. Natural or experimentally periodontitis can also be induced. They are very expensive, with ethical and husbandry issues. Baboons were considered in 1.67% cases followed by goats in 1.428% studies. Other animal models used were cows, sheep, cats, ferrets and hamsters. Ferrets have naturally or experimentally induced disease with similarity to humans but have some husbandry issues.

CONCLUSION

According to the mini-review of literature achieved in the current study, it could be stated that rodents showed the most animal model used in periodontal research, especially in the periodontal tissue regeneration studies and as periodontal disease models. Dogs came at a second level and then came rabbits, pigs, monkeys, baboons, goats, cows, sheep, cat, hamsters, ferrets and ewes, each of which was used in a specific field in periodontal research.A gold animal model in periodontology does not exist since every application requires a model that fills specific needs.

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Review Articles

ACCELERATED TOOTH MOVEMENT: A REVIEW OF VARIOUS MODALITIES

Sharma Surbhi, Ahuja Sachin, Gupta Seema, Bhambri Eenal, Thapa Raghu Pratap

ABSTRACT

The increased demand for rapid orthodontic treatment, especially by adult patients, has led to the development of numerous methods to accelerate the rate of orthodontic tooth movement. Conventionally, orthodontic tooth movement is a slow and gradual process and overall treatment times can range anywhere between 12-48 months. By enhancing the body's response to the orthodontic forces, tooth movement can be accelerated. Many methods are available to accelerate tooth movement. There is a high amount of researches done on the biological method for tooth movement; unfortunately, the majority of them were done on animals. Low-level laser therapy has shown positive outcome, but further investigation should be done for the optimal energy and duration to achieve the best possible results. Surgical approach has the most predictable outcomes but with limited application due to its invasive nature and associated patient discomfort. The aim of this article is to discuss the mechanisms behind each of the modalities being used to accelerate tooth movement during orthodontic treatment and to come up with the best possible modality.

Key words: Cholecalciferol, LLLT, prostaglandin, orthodontic treatment

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INTRODUCTION

Orthodontics has Orthodontics has grown leaps and bounds in the technological realm in achieving the desired results both clinically and technically. Reduced treatment duration is important both, for care givers as well as receivers i.e. patients. It is also desirable that aesthetic concerns and time dependent adverse events (discomfort, pain, external apical root resorption, sub optimal oral hygiene, white spot lesions and dental caries) are held to the minimum. Currently, fixed orthodontic treatment entails a long duration of about 2–3 years, which is a great concern and poses high risks of caries, external root resorption and decreased patient compliance. Thus, accelerating orthodontic tooth movement and the resulting shortening of the treatment duration would be quite beneficial.

The Prolonged treatment duration is one of the main deterrents in orthodontics. Lengthy orthodontic treatment prompts many patients, especially adults, to either avoid treatment or to seek compromised shorter alternative solutions. Therefore, the treatment modalities that decrease treatment time without compromising the treatment outcome is an active area of research in orthodontics today. Until now, numerous novel modalities have been reported to accelerate orthodontic tooth movement. A number of attempts have been made to create different approaches both pre-clinically and clinically in order to achieve quicker results, but still a lot needs to be done because of the prevailing uncertainties towards these techniques. Most attempts can broadly be categorized into biological, physical, biomechanical, and surgical approaches. Before going into details of these attempts, it is important to understand the basics of orthodontic tooth movements and the factors that initiate inhibition and delayed tooth movement.

Orthodontic tooth movement occurs in the presence of a mechanical stimuli sequenced by remodeling of the alveolar bone and periodontal ligament (PDL). Bone remodelling is a process of both bone resorption on the pressure site and bone formation on the tension site.[1]

Orthodontic tooth movement can be controlled by the magnitude of the applied force and the biological responses from the PDL.[2] The force applied on the teeth will cause changes in the micro environment around the PDL due to alterations of blood flow, leading to the secretion of different inflammatory mediators such as cytokines, growth factors, neurotransmitters, colony-stimulating factors, and arachidonic acid metabolites. This results in re-modelling of the alveolar bone.

Orthodontic force induces a cellular response in the periodontal ligament, which brings about bone resorption on the pressure side and bone deposition on the tension side. This happens via

induction of osteoclasts via the RANK-RANKL pathway and presence of various inflammatory mediators such as IL-1, IL-8, TNF-alpha etc.[3]

There are three phases of tooth movement:

1. **Initial phase-** characterized by rapid movement after the application of force
2. **Lag period-** where little or no movement,
3. **Post lag -** where gradual or sudden increase of movement occurs.[4]

The early phase of tooth movement involves acute inflammatory responses characterized by leucocytes migrating out of blood capillaries and producing cytokines, which stimulates the excretion of prostaglandins and growth factors. The acute phase is followed by the chronic phase that involves the proliferation of fibroblast, endothelial cells, osteoblasts, and alveolar bone marrow cells remodelling process.

There are various mechanisms by which one can attempt to accelerate the orthodontic tooth movement. This can be done by various mechanisms which may be broadly classified as

1. Stimulating the artificial pathway to increase the rate of tooth movement
2. Stimulating the natural pathway to enhance the rate of tooth movement.

Stimulating the artificial pathway to increase the rate of tooth movement

Stimulation of artificial pathway can be done either by using chemical agents or by physical stimulation.

Chemical agents

There are a number of chemical agents that have been studied and it has been found that they play a significant role in accelerating the rate of orthodontic tooth movement. These are various hormones like parathyroid hormone (PTH), calcitonin, Prostaglandin E etc.

Parathyroid hormone (PTH)

Parathyroid glands secrete PTH, which causes an increase in the concentration of calcium in the blood by stimulating bone resorption. Continuous elevation of PTH leads to bone resorption; intermittent short elevations of PTH are anabolic for the bone, which may be related to the biphasic effect.Increase in the rate of tooth movement by exogenous PTH occurs in a dose depend entmanner.

PTH has been shown to accelerate orthodontic tooth movement on rats, which was studied by continuous infusion of PTH (1 to 10 µg/100 g of body weight/day) implantation in the dorsocervical region, and the molars were moved 2- to 3- fold faster mesially by orthodontic coil spring.[5]

Some studies have shown that locally injected PTH induces local bone resorption, and it is more advantageous to give PTH locally rather than systemically.[6] The development of a slow-release application that keeps the local concentration of PTH for a long time was very efficient as shown later that the daily injection ofPTH dissolved in gel medium allowed a slow release which caused 1.6-fold faster acceleration of teeth compared to daily injection of PTH dissolved in saline solution which did not cause any acceleration.[7]

Other hormones(thyroxin, calcitonin, estrogens)

Thyroxin affects intestinal calcium absorption. It increases the rate of tooth movement by increasing boneresorption. It is also indirectly involved in bone turnover and induction of osteoporosis.

Prostaglandin effect on tooth movement

Prostaglandins (PGs) are inflammatory mediator and a paracrine hormone that acts on nearby cells; it stimulates bone resorption by increasing directly the number of osteoclasts. In vivo and in vitro experiments were conducted to show clearly the relation between PGs, applied forces, and the acceleration of tooth movement. Yamasaki[8] was among the first to investigate the effect of local administration of prostaglandin on rats and monkeys. In addition, experiments done by Leiker et al[9] have shown that injections of exogenous PGE2 over an extended period of time caused acceleration of tooth movements in rats. Furthermore, the acceleration rate was not affected by single or multiple injections or between different concentrations of the injected PGE2. However, root resorption was very clearly related to the different

concentrations and number of injections given. It has also been shown that the administration of PGE2 in the presence of calcium stabilizes root resorption while accelerating tooth movement.[10] Furthermore, chemically produced PGE2 has been studied in human trials with split-mouth experiments in the first premolar extraction cases. In these experiments the rate of distal retraction of canines was 1.6-fold faster than the control side.[11]

Effect of Vitamin D3 on tooth movement

Vitamin D3 has also attracted the attention of some scientist to its role in the acceleration of tooth movement; 1,25 dihydroxycholecalciferolis a hormonal form of vitamin D and plays an important role in calcium homeostasis with calcitonin and parathyroid hormone (PTH). Vitamin D3 (1, 25-dihydroxycholecalciferol) regulates calcium and phosphate serum levels by promoting their intestinal absorption and re-absorption in the kidneys. It promotes bone deposition and inhibits PTH release. It can increase the rate of tooth movement if injected locally. Another set of investigators[12] have made an experiment where they have injected vitamin D metabolite on the PDL of cats for several weeks; it was found that vitamin D had accelerated tooth movement at 60% more than the control group due to the increase in osteoclasts on the pressure site as detected histologically. A comparison between local injection of vitamin D and PGEs on two different groups of rats was also investigated. It was found that there is no significant difference in acceleration between the two groups. However, the number of osteoblasts on the pressure side which was injected by vitamin D was greater than on the PGE2side. This indicates that vitamin D may be more effective in bone turnover.[13]

Osteocalcin and corticosteroids

Local injection of osteocalcin causes rapid movement due to attraction of numerous osteoclasts into the area. In the presence of cytokines, such as IL-6, they stimulate osteoclastogenesis and cause osteoporosis. The effect of corticosteroids on tooth movement can vary based on the dosage and whether they are administered before the expression of cytokines (induction period) or after their presence. The anti-inflammatory effect of corticosteroids can decrease the rate of tooth movement.

Relaxin effect on tooth movement

Relaxin effect has also been investigated. Relaxin is a hormone that helps during childbirth by widening of the pubic ligaments in females and is suggested to be present in cranial suture and PDL. The role of relaxin is known in the re-modelling of soft tissue rather than re-modelling of bone.

It has been shown that it increases collagen in the tension site and decreases it in compression site during orthodontic movement. Also, the administration of human relaxin may accelerate the early stages of orthodontic tooth movement in rat experiments.[14] However, another study showed that human relaxin does not accelerate orthodontic tooth movement in rats, but can reduce the level of PDL organization and mechanical strength of PDL and increase tooth mobility.[15] In these experiments in vitro studies were also performed to test the PDL mechanical strength and tooth mobility using tissue from additional 20 rats that had previously received the same relaxin treatment for several days.[15] The remodelling of PDL by relaxin might reduce the rate of relapse after orthodontic treatment. Recently, randomized clinical trials on humans were done by weekly injections of 50 μg of relaxin or placebo control for 8 weeks. Tooth movement was measured weekly on polyvinyl siloxane impressions which were scanned digitally. There was no significant difference between the relaxin and the placebo control group regarding the acceleration and relapse.[16] However, the mechanism of how relaxin accelerates tooth movement is not yet fully understood.

Physical stimulation

Mechanical stimulation Recent research shows very positive results for application of high-frequency, low-magnitude forces (vibration) to increase the rate of tooth movement. This is a non-invasive and safe technique, designed for home usage during orthodontic treatment, which increases and prolongs osteoclast activity in the periodontal ligament. Heat, light, electric currents, and magnetic fields and laser Application of heat,light, minute electric currents, and an electromagnetic field during orthodontic tooth movement has demonstrated an increase in the rate of tooth

movement.

Device-assisted treatment

This technique includes direct electric currents, pulsed electromagnetic field, static magnetic field, resonance vibration, and low level laser which was mostly investigated and gave the most promising results. The concept of using physical approaches came from the idea that applying orthodontic forces causes bone bending (bone bending theory) and bioelectrical potential develops. The concave site will be negatively charged attracting osteoblasts and the convex site will be positively charged attracting osteoclasts as detected by Zengo[17] in his measurements on dog alveolar bone.

The bioelectrical potential is created when there is application of discontinuous forces, which leads to the idea of trying cyclic forces and vibrations. It has been found that applying vibrations for different duration per day accelerated tooth movements between 15% and 30% in animal experiments.[18]

Direct electric current effect on tooth movement

Another approach is to use direct electric current. This technique was tested only on animals by applying direct current to the anode at the pressure sites and cathode at the tension sites, generating local responses and acceleration of bone remodelling. Their studies were more successful than the previous attempts because electrodes were placed as close as possible to the moving tooth. The bulkiness of the devices and the source of electricity made it difficult to be tested clinically. Further development of the direct electric device and the bio-catalytic fuel cells is needed to be done so that these can be tested clinically.

Low-level laser therapy (LLLT)

LLLT uses low-level lasers or light-emittingdiodes to alter cellular function. Low-level laser therapy (LLLT) is one of the most promising approaches today. Laser has a bio-stimulatory effect on bone regeneration which is seen in the midpalatal suture during rapid palatal expansion. Laser light induces the proliferation of osteoclast, osteoblast, and fibroblasts, there by affecting bone remodelling and accelerates tooth movement. The mechanism involved in the acceleration of tooth movement is the production of ATP and activation of cytochrome C. The low-energy laser irradiation enhances the velocity of tooth movement via RANK/RANKL and the macrophage colony-stimulating factor and receptor expression. In 2004, Cruz et al was the first to perform a human study on the effect of low-intensity laser therapy on orthodontic tooth movement. They concluded that the irradiated canines were retracted at a rate 34% greater than the control canines over a period of 60 days.[19]There are a lot of contradictory results related to the LLLT.

Animal experiments have shown that low-level laser can accelerate tooth movement. Further more, clinical trial attempts were made in which different intensities of laser were used and different results were obtained.[20] Low-level laser therapy can be a very useful technique for acceleration of tooth movement since it increases bone remodelling without side effects to the periodontium. Laser wavelength of 800 nm and output power of 0.25 mW have indicated significant stimulation of bone metabolism, rapid ossification,[21]and also acceleration of tooth movement to 1.5-fold in rat experiments. Lately in a clinical trial study, the laser wavelength they have used in a continuous wave mode at 800 nm, with an output of 0.25 mW, and exposure of 10 s was found to accelerate tooth movement at 1.3-fold higher than the control.[20] In another study done by Kau[22] on 90 subjects (73 test subjects and 17 controls), there was 1.12 mm change per week in the test subjects versus 0.49 mm in the control group.

With varied laser parameters and durations of exposure used in the previous literature, more research is needed in order to differentiate the optimum energy, wavelength and theoptimum duration for usage.

Stimulating the natural pathway to increase the rate of tooth movement

The natural pathway of inflammation can also be stimulated using various techniques in order to enhance the rate of orthodontic tooth movement. These are, corticotomy, also known as, selective alveolar corticotomy, piezocision, microosteoperforations.

Corticotomy

It was first tried in orthodontics by Kole where tooth movements were achieved between 6 and 12 months and it was suggested that

bony blocks were created as a result of the corticotomy, hence causing faster tooth movement.[23]

Conventional corticotomy is one of the surgical procedures that is commonly used, in which only the cortical bone is cut and perforated but not the medullary bone. This reduces the resistance of the cortical bone and accelerates tooth movement. Due to significant bone trauma, corticotomy generates a massive inflammatory response that can compromise anchorage during orthodontic treatment. It is beneficial in cases of mild to moderate crowding where only simple levelling and aligning mechanics are required.

Corticotomy assisted acceleration of orthodontic tooth movement has been investigated in several studies.[24-26] Corticotomy was reported to accelerate the rate of canine tooth movement significantly during the first month after the application of the intervention. However, the effectiveness of this intervention is questionable over time, since a sharp decline of the tooth movement rate is apparent after the second month of observation.[25] This transient nature of the intervention might be overcome if a second surgery was to be performed. No studies have been done, until now, to assess this treatment strategy. However, this procedure would be associated with higher costs and further discomfort and morbidity for the patient. The intervention is reported to have a negative impact on the oral health quality of life, with partial recovery after 7 days.[26]

Piezocision

One of the latest techniques in accelerating tooth movement is the Piezocision technique. Dibart[27] was among the first to apply this technique. Piezoincision requires a vertical incision in the soft tissue mesial and distal to the tooth to be moved and use of a piezoelectric blade to create linear incisions in the bone along the soft tissue openings. This increases levels of inflammation and bone remodeling.

Piezocision technique did not cause any periodontal damage as reported by Hassan.[28] Another benefit of this technique is that it can be used with Invisalign, which leads to a better aesthetic appearance and less treatment time as reported by Keser.[29] Piezocision is a promising tooth acceleration technique because of its various advantages on the periodontal, aesthetic, and orthodontic aspects.

Micro-osteoperforations

To further reduce the invasive nature of surgical irritation of bone, a device called Propel, was introduced by Propel Orthodontics. They called this process as micro-osteoperforations (MOP) or Alveocentesis, which literally translates to puncturing bone.[30]This procedure consists of small and shallow osteoperforations that are placed on the surface of the buccal or lingual cortical plates. Application of a few shallowosteo perforations in the proximity of the moving tooth results in a significant increase in inflammation, osteoclast activation, bone remodelling, and tooth movement. Micro-osteoperforations can preserve anchorage if applied only around movingteeth and can be repeated as dictated by the bio-mechanical needs. Micro perforation scan be delivered by orthodontists during routine visits. Performing micro-osteoperforations (MOPs) on alveolar bone during orthodontic tooth movement can stimulate the expression of inflammatory markers which leads to increase in osteoclast activity and rate of tooth movement.[3]

Mani Alikhani et al (2013) performed a single centre single blinded study to investigate this procedure on humans. It was found that MOPs significantly increased the expression of cytokines and chemokines which are known to recruit osteoclast precursors and stimulate osteoclast differentiation. MOPs increased the rate of canine retraction 2.3-fold compared to the control group, MOPs are an effective, comfortable, and safe procedure to accelerate tooth movement during orthodontic treatment. MOPs could reduce orthodontic treatment time by 62%. However, this was the first study investigating the MOPs method and certain issues were not addressed, such as, effect on root resorption, number of perforations required, long term effects.[30]

Chan et al [31] conducted an investigation to examine the effects of micro-osteoperforations on orthodontic root resorption with microcomputed tomography. This 28-day prospective trial showed that microosteoperforations cause larger volumes of

orthodontic root resorption craters when the maxillary first premolars are subjected to a buccal tipping force.

CONCLUSION

Tooth acceleration phenomenon is still a relatively new horizon and researchers have yet to seek a single most ideal and prudent technique for the patient. Given the various options that are available, none of them provide ideal results and the clinician has to choose from these weighing the risks and the requirements. The surgical techniques have most of the human trials and also show very favourable and longterm effects adding to the stability and retention of the orthodontic therapy. However the invasiveness and cost of these might make it little less viable option for the patients. Microsteoperforation, piezocision on the other hand are the least discomforting among all the surgical procedures and this will make them more commonly used procedures in future. The evidence available regarding these modalities shows that there is no single all in one technique which provides best of both the worlds viz. hastening tooth movement with least discomfort. Hence, the practitioner has to device a combination of procedures which best suites the patient and him/herself as any of these techniques, once adopted, can prove to be immensely beneficial in hastening orthodontic treatment time.

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Case Report

SUBMANDIBULAR SIALOLITHIASIS: A CASE REPORT

Kumar Jitendra, Bansal Shallu, Verma Dinesh Kumar

ABSTRACT

Sialoliths are the second most common anomalies of the salivary glands. They are most commonly seen in submandibular glands due to various anatomic and physiologic reason. Its estimated frequency is 1.2% (12 in 1000) in the adult population every year, with a slight male predominance (2:1). Commonly, sialoliths measure from 5 to 10 mm in size, sialolith measuring more than 10 mm are extremely rare. Here we present a case with an unusually sized sialolith in Wharton's duct of right submandibular gland in an 28 years old female patient and a review of the literature about the unusually sized sialoliths and various anatomical and physiological consideration of the duct which contribute to the higher incidence of sialolith in the duct.

Keywords: Sialolithiasis, sialolithotomy, wharton's duct,

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INTRODUCTION

Sialolithiasis is the formation of calcific concretions within the ductal system of a major or minor salivary gland.[1]The structure of sialoliths is crystalline, and sialoliths are composed primarily of hydroxyapatite. The chemical composition is calcium phosphate and carbon, with trace amounts of magnesium, potassium chloride, and ammonium.[2]The colour may vary from chalky white to pale yellow or even orange, depending upon their organic matrix. The surface may be smooth or rough. If manipulated with force, they easily disintegrate like a chalk.[1]

It is considered to be the most common salivary gland disorder and it accounts for about 1.2% of unilateral major salivary gland swelling. Submandibular gland has got highest predilection for sialolithiasis with 80% occurrence rate, followed-by 19% in the parotid and 1% in the sublingual glands. Sialolithiasis usually appears between the age of 30 and 60 years, and it is uncommon in children as only 3% of all sialolithiasis cases has been reported in the paediatric population until to date. Males are affected twice as much as females. Since the underlying cause is unknown and uncorrected in most patients, the recurrence rate is approximately 20%.[3]

Commonly, sialoliths are less than 10 mm in size. They are rarely larger than 10 mm.[4]The aim of this article is to report a case of a salivary duct stone of unusual dimension and discuss its surgical management.

CASE REPORT

A 28-year-old female patient came with complaint of pain in the right side under the tongue for 10 years. Pain was dull, continuous and radiating to temporal region which aggravate during meals and subsided in few hours after meals and pain also get relieved by taking medication. History of bleeding from floor of the mouth since 2-3 month but after 4-5 episodes of bleeding patient reported to the department. Clinical examination revealed a hard swelling in the floor of the mouth on the right side 2 cm from midline. The swelling was tender on palpation. Intraorally, palpation revealed induration along the right Wharton's duct with purulent discharge from the duct orifice. On occlusal radiograph an oval elongated radiopaque mass of 12mm located within the right side of Wharton's duct (**Figure 1**). Right submandibular lymph node was palpable single in no, mobile and tender. On the basis of physical and radiographic findings, a diagnosis of sialolithiasis of the right Wharton's duct was made.

After administrating lingual nerve block of 2% lignocaine local anaesthesia, sialolithotomy was performed via intraoral approach. Posterior to the sialolith a stay suture was given around warthon's duct with 2-0 silk suture to prevent posterior slippage of sialolith in gland. The ends of the suture were left long to aid in traction of the duct (**Figure 2**). Upward and medial pressure was applied to the submandibular gland to make the sialolith prominent on the floor of mouth and stabilized it. An incision of 2 cm length was placed directly over the sialolith to expose it (**Figure 3**). The sialolith was carefully dissected and a hard, spherical shape,rough surface and yellow colour mass was extirpated. It measured 12x10 mm (**Figure 4**), along with another small 2x2 mm of sialolith was also retrieved from same site (**Figure 5**). The stay suture was removed and confirmatory radiograph was done. Then mucosa was sutured with 3-0 silk suture (**Figure 6**). Patient was instructed to maintain hydration and apply 3-4 drops of lemon drop on her tongue for 3-4 times per day. Medication prescribed was tablet amoxicillin 500 mg + clavulanic acid 125 mg tds × 5 days, tablet metronidazole 400 mg tds × 5 days, tablet aceclofen + paracetamoltds × 5 days, capsule pantoprazole + domperidone od × 5 days. Advised to come for regular follow up and recalled after 1 week for suture removal. After 1 month of follow up, healing was found to be satisfactory and salivary flow to be normal and patient was relieved of the symptoms. Patient is under regular follow up.

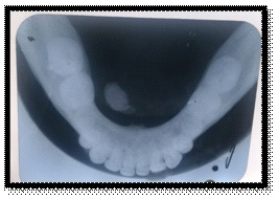

Figure-1: Occlusalradiographshowing radiopacity in right side of floor of mouth.

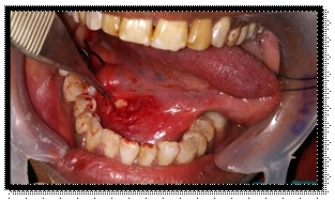

Figure 2 : 2-0 silk suture posterior to warthon's duct for traction of duct.

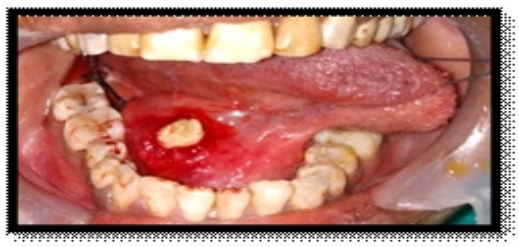

Figure 3 : Prominent sialolith on floor of mouth.

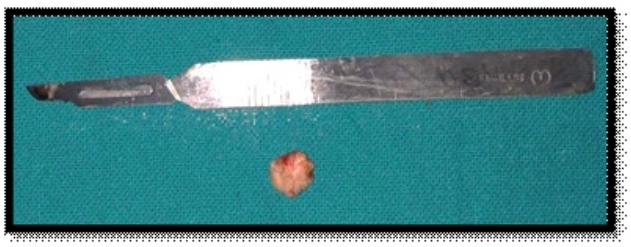

Figure 4 : The retrieved large sialolith of 12 x 10 mm size

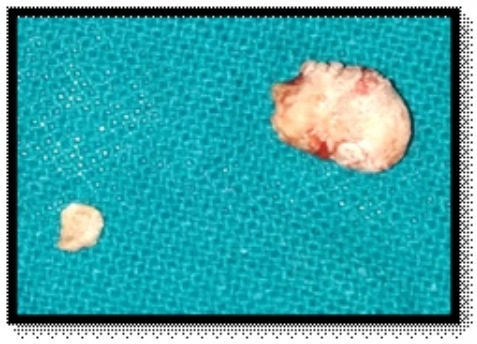

Figure 5: Small sialolith seen at
left side of picture size = 2 x 2 mm

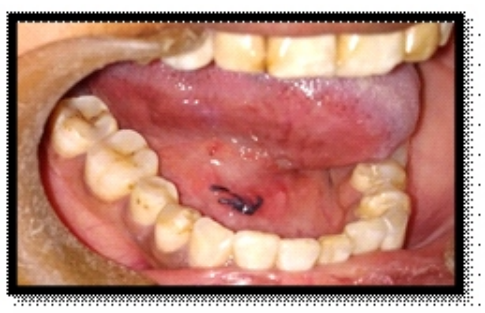

Figure 6 : Mucosa was sutured with 3-0 silk suture.

DISCUSSION

The true prevalence of sialolithiasis is difficult to determine since many cases are asymptomatic. The etiology of sialolith formation is still unknown, yet several factors that cause pooling of saliva within the duct are known to contribute to stone formation.[2]

Various reasons for common involvement of submandibular gland have been proposed. a) pH of saliva: The salivary pH in submandibular gland is alkaline favouring precipitation of calcium salts. b) Calcium content: Submandibular gland contains relatively higher concentration of calcium and phosphate salts in form of apatite's. c) Viscosity: The submandibular gland expresses more viscous saliva due to higher mucous content. d) Anatomic factors: The submandibular duct drains saliva against the gravity as the gland is situated lower than the ductal orifice, contributing to stagnation. Additionally, the ductal course is long and tortuous. The lingual nerve is also held responsible for possible kinking of the duct as it crosses the duct. There is also a possible kinking/bend at the region where the duct passes over the posterior border of mylohyoid.[1]

Giant sialoliths are a rare entity with sizes varying from 1 to 7 cm, mostly in male patients[5] but in the present report it was observed in female patient.

Salivary stones are single in 70 to 80% of cases, two calculi in 20% of cases and rarely more than two in 5% of cases.[6]However; we found that the right submandibular gland was affected with one small and one giant sialolith in its duct.

Since 80% submandibular stones are radiopaque, standard mandibular occlusal radiograph and panoramic radiograph reveal calcification within the duct and submandibular gland respectively.[7] Even in our case, occlusal radiographs has been taken. Less mineralized calculi can be visualized by sialography or sialoendoscopy. Other imaging techniques include lateral oblique, submento-vertex view, apart from this, ultrasonography, CT and MRI may also be used to detect calculi and to diagnose atrophy of the gland, and these are less invasive unlike sialography which requires an injection of contrast medium.[6]

Treatment depends upon the location and size of the sialolith. If it is small, conservative measures, such as effective hydration, use of heat, gland massage and sialagogue's and a course of oral antibiotics will be helpful. In our case, the giant intraductal sialolith was retrieved by trans-oral sialolithotomy procedure, which is the commonly used surgical procedure for palpable intraductal sialolith. Advanced treatment modalities includes CO2 laser, combined approach of sialoendoscopy plus open sialolithotomy and sialolithotripsy in which calculus will be broken and washed down. However, if the gland has been damaged by recurrent infection and fibrosis then excision of the gland becomes necessary.[6]

CONCLUSION

This case report represents the sialolith within the wharton's duct of right submandibular gland which underwent transoralsialolith to my procedure under local anesthesia.

According to literature different treatment modalities has been discussed depending upon the size and location of sialolith which ranged from simple conservative management to advanced surgical procedures. So prompt attempt should be undertaken to prevent the inflammation of ductal system otherwise in recurrent

cases gland removal should be done.

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Case Report

EARLY TREATMENT OF GROWING SKELETAL CLASS III MALOCCLUSSION WITH FACEMASK

Goyal Ankit, Ahuja Sachin, Gupta Seema, Bhambri Eenal

ABSTRACT

The treatment of true Class III malocclusion is one of the difficult problems for the orthodontist. Orthopedic correction of skeletal Class III malocclusion in a growing patient is important as it can eliminate the need of future surgical procedures. Further, as surgery is done only at a later stage, early treatment helps to avoid the visual effects produced by the facial mutilation on the patient's social life. Although treatment in the late mixed or early permanent dentition can be successful, results are generally better in the deciduous or early mixed dentition. This case report describes the treatment of a growing skeletal class III child aged 10 years. The treatment plan involved the use of a reverse pull headgear (facemask) and hyrax therapy with alt-REMAC protocol resulting in successful correction of the malocclusion. The treatment results were highly satisfactory resulting in improved facial esthetics, a skeletal Class I, an ideal overjet and overbite. In properly selected cases functional therapy decrease the need for surgical intervention.

Keywords: Class III malocclusion, facemask, maxillary deficiency

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INTRODUCTION

The treatment of true class III malocclusion is one of the difficult problems for the orthodontist.[1]Ellis and McNamara[2] concluded that the most common combination of variables in an adult class III malocclusion are a retrusive maxilla, protrusive maxillary incisors, retrusive mandibular incisors, a protrusive mandible, and a long lower facial height. retrognathic maxilla ideally requires forward maxillary movement and for prognathic mandible, mandibular growth inhibition or redirection is desirable.

On an average, 60% of Class III malocclusions are characterized by maxillary deficiency.[2]Studies has showed that the maxillary growth seizes before that of the mandible. Thus, Class III discrepancy worsens with age. Since Class III malocclusions are the most common type of malocclusion which require surgical intervention, early treatment of this discrepancy is of outmost importance to avoid surgeries at a later stage.[3]

The early Class III treatment has many advantages, it facilitates the eruption of canines and premolars in a normal relation, eliminates the traumatic occlusion of incisors, which might lead to gingival recession, provides an adequate maxillary growth, and improves the self-esteem of the child.

In the early management cases of maxillary deficiencies, a combination of rapid maxillary expansion (RME) along with a face-mask to protract the maxilla has become a standard protocol.[4,5]

CASE REPORT

A 10-year-old male patient reported to department of orthodontics with the chief complaint of spacing in upper and lower front teeth. No relevant pre- and post-natal history or family history was reported, he underwent restorations of 55 and 65. On extra oral examination, the patient showed a concave profile, anterior divergence with deficient maxilla (Figure 1), a negative lip step and an acute naso-labial angle. Intraoral examination showed the patient to be in a mixed dentition stage with anterior cross bite of 1 mm in 11, 21 and 22, spacing in upper and lower anteriors. The first molars were in a Class III relation on both sides. Cephalometric analysis indicated a Class III sagittal relationship (ANB = −5) with a retrognathic maxilla (SNA = 80°, Nperp to A = −2 mm), mild prognathism of the mandible (SNB = 85°) and hypo divergent

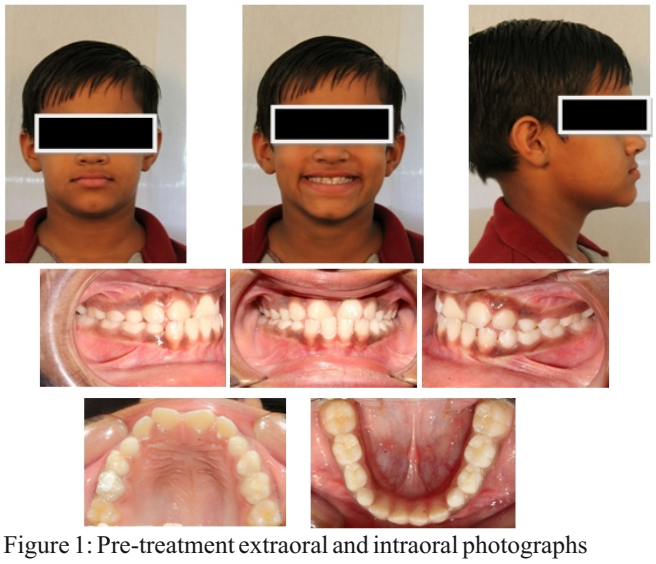
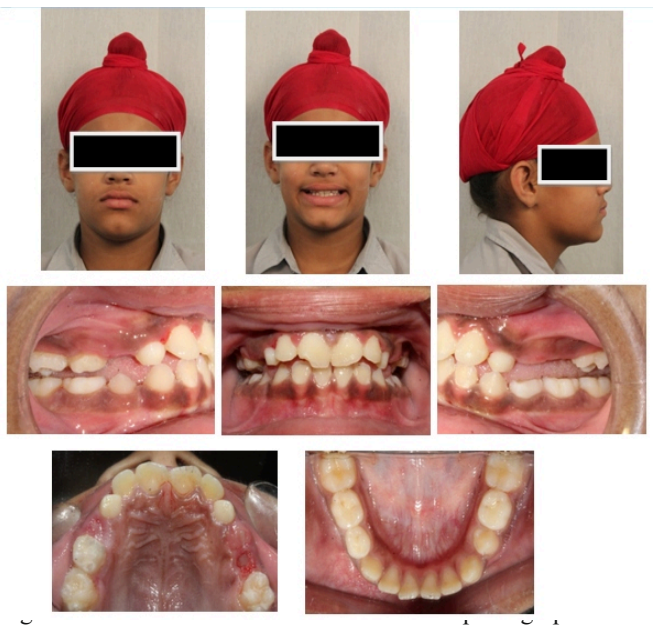


Figure 1: Pre-treatment extraoral and intraoral photographs

skeletal pattern (FMA = 20°, SN-GoGn = 26°). The upper incisors were moderately proclined (U1-NA = 6 mm and 32°) and lower incisors showed mild retroclination (L1-NB = 3 mm and 16°). The upper lip was retro positioned, and the lower lip was positioned forward with respect to Rickett's E line (UL-E line = -2 mm, LL-E line = 0 mm). No mandibular deviation on closure or clicking of the TMJ was observed. The patient was diagnosed as growing skeletal class III with dental class III molar relation with spacing.

So, to correct the maxillary deficiency, it was planned to protract the maxilla using a facemask while simultaneously expanding it using RME device as it disrupts the maxillary suture system and promotes maxillary protraction.



Treatment was started with bonded RME device which consisted of a HYRAX screw (Leone, Italy). It had hooks incorporated on the buccal aspect at the position of the deciduous canines to engage the elastics for a facemask. This appliance was cemented in place in the patient's mouth. The schedule of RME was according to alt-RAMEC[6] (alternating RME and contraction). After 15 days of alt-RAMEC protocol, face-mask was delivered to patient. The patient was advised to wear the device daily for as many hours as possible.

The approximate duration of wear as reported by the patient's parents 2 weeks later was 14–15 hours. Starting with a force level of 8 oz on each side, it was increased to 14 oz on each side from the 2nd week. Positive overjet and Class I molar relation was achieved after 7 months, but the device was maintained for 10 months to achieve over correction(Figure 2).

DISCUSSION

The treatment effects of the face-mask are a combination of skeletal changes in the maxilla and mandible. In this patient, the maxilla moved downward and forward as a result of the protractive force. As a consequence of this effect, the mandible rotated downward and backward, thus improving profile in sagittal direction. However, this led to increase in the lower facial height. Since the patient has a relatively low mandibular plane, the effect was esthetic. This rotation of the mandible was a major contributing factor in establishing an improvement in anterior overjet. Williams et al.[7] in their prospective long-term study regarding the effects of maxillary expansion during face-mask therapy, concluded that average anterior movement of point A post-treatment was 1.54 mm, and that of maxillary teeth were 2.73 mm. They stated that few statistically significant changes occurred in the mandible, but those changes further contributed to Class III correction.[8] The skeletal and soft tissue profile was straightened and the posture of the lips improved. An in vitro study by Tanne et al.[9] concluded that a downward pull from 45° to 30° in the face-mask gave the most translatory effect. Similar to the study by Ngan et al.[10] we favored a 30° angulation to produce an acceptable clinical response. The downward movement of the maxilla increased the upper incisor exposure, thus producing a more pleasing smile.

The need for eight surgical interventions for the placement and removal of bone plates and the possibility of root damage decreased its favorability for this young patient. Although there are concerns regarding the stability of Class III orthopedic treatment; Turley[11]showed that treated patients who had a maxillary deficiency but normal mandibular dimensions generally showed good stability. In addition, the degree of relapse has been shown to be negatively correlated with the length of stabilization. This case report shows that skeletal Class III

malocclusion with maxillary deficiency in a growing individual can be successfully managed using the RME face-mask procedure followed by fixed orthodontic treatment. Thus careful case selection, patient cooperation, and long-term stabilization ensure a treatment result that is successful, stable, and esthetic

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Case Report

MANAGEMENT OF RANULA BY MODIFIED MICRO-MARSUPIALIZATION TECHNIQUE IN YOUNG PATIENT : A CASE REPORT

Kumar Vinit, Chandni

.**ABSTRACT:**

A ranula is a type of mucocele found on the floor of the mouth. It is present as a swelling of connective tissue consisting of collected mucin from a ruptured salivary gland duct, which is usually caused by local trauma. Ranulas pose a challenging situation, both clinically and surgically, because of their location on the floor of the mouth, an area that exhibits tightly-netted vital structures. Several treatments have been proposed, including excision with or without removal of the sublingual gland, marsupialization with or without cauterization of the roof of the lesion, drainage of the lesion, and micro-marsupialization. It has been suggested that a modified micro-marsupialization technique can establish drainage of saliva and formation of new permanent epithelized tracts along the path of sutures, thereby reducing the recurrence. This paper presents a report of a ranula in a 25 year-old female patient that was successfully managed using a modified micro-marsupialization procedure.

Keywords: Micro-marsupialization, mucocele, ranula

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Source of support: Nil **Conflict of interest**- Nil

INTRODUCTION

Ranulas are cystic lesions that develop from mucus released by the sublingual or submandibular glands and mainly occur in the floor of the mouth[1]. Ranula can be plunging or intraoral. Plunging ranulas induce neck swelling by extruding through the mylohyoid muscle.[1]

Treating ranula is always a challenging condition. Although most ranulas are currently treated with surgical excision of the salivary gland, surgical treatment requires hospital admission as well as the administration of general anesthesia and can cause complications, such as salivary duct injury, damage to the lingual or hypoglossal nerves, pain, and infections. Thus, the standard treatment of care for ranulas is still controversial, although surgical treatment is currently preferred.[1]

Since the introduction of micro marsupialization in 1995, applications of this technique has resulted in fewer complications and higher cure rates, even though it has been performed on only a small number of patients with ranulas.[3]

CASE REPORT

A 25 year old female patient reported with a cystic swelling on the ventral surface of the tongue present since 20 days. The gradually increasing cystic lesion caused the patient pain and difficulty in swallowing. No significant medical or history of allergy was recorded. On clinical examination, a 3.5 x 3 cm cystic lesion (Figure-1) was seen on ventral surface of the tongue, which was painful to palpation. The lesion was sessile, soft and non-infected. After obtaining consent from the patient and the parent, micro-marsupialization technique was planned for the patient on the same day.

MATERIAL AND METHOD

Micro-marsupialization was performed according to the following technique: After disinfecting the area with Betadine solution, Topex Spray was applied (Benzoczine 20%) over the entire lesion. Local anesthesia with 2% lignocaine with 100,000 Adrenalin was given submucosal in the tissue surrounding the lesion. 3.0 silk sutures were passed through the widest diameter of the lesion from the base and a surgical knot was made. Two sutures were passed (Figure-2), in different directions as the lesion was large and single suture may not have been sufficient enough to drain the mucous efficiently. The Mucocele was then compressed to help extravasation of mucus. 0.5% chlorhexidine gel was applied postoperatively to prevent secondary infection. Sutures were removed after 30 days. Follow up after 1 year did not show any remission. (Figure-3)

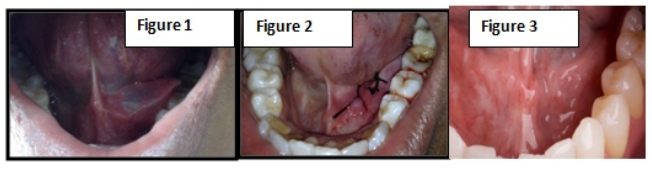

Figure- 1: The lesion in the left floor of the mouth.
Figure-2: The lesion was sutured with a 4-0 silk suture.
Figure-3: Completely resolved lesion and the stitches were removed.

DISCUSSION

Intraoral ranulas develop due to leakage of saliva from injured salivary duct. Treatments of ranulas typically include ranula excision, resection of the submandibular and sublingual glands, incision and drainage, sclerotherapy, botulinum toxin injection, marsupialization and micromarsupialization.[1,4]

However, we believe that surgery is still the standard therapy for ranulas. There is general agreement that incision only as a treatment should not be performed because of the resulting rapid closure of the wound and recurrence of ranulas.[5] The widely practiced surgical techniques for the treatment are marsupialization and sublingual gland excision. Excision of the sublingual gland or a ranula has shown good outcomes[6-7]because this gland is the main source of the ranula. However, recurrence was reported after 20 of 942 excisions of the sublingual gland.[2]However, excision of sublingual glands and ranulas may carry the potential risks of severe hemorrhage from the lingual and sublingual vasculature, lingual nerve damage, and duct damage. Anatomically, the submandi bularduct, as it travels in the anterior and superior direction from the gland to its orifice, is in immediate contactwith the medial surface of the sublingual gland.[8] Assuch, the duct may be damaged during ranula surgery or, more likely, during removal of the sublingual gland.

Due to the side effect of surgical procedure the new trend in the management is non-surgical. A variety of non-surgical procedures have been proposed for the treatment of ranula, all of them aim at avoiding surgery in the floor of the mouth, which may be complicated by the proximity to important structures, like the submandibular duct and the lingual nerve and artery. Among non-surgical procedures micro-marsupialization is one of the best treatment option. Micro-marsupialization that sutures the dome of a cystwas introduced by Morton and Bartley[3] in 1995. Delbemet al[9] successfully managed cysts by suturing along theirgreatest diameters with 4-0 silk. Micro-marsupialization of oral ranulas by seton, in whichsutures are inserted into the roof of the ranula, was successful in almost all cases.[3,4]

In our case the patient was young, and the lesion is large in size and that too on the ventral surface of the tongue, excising it under local anesthesia would have been very challenging considering the longer duration of cooperation expected out of the patient and holding the tongue in position during surgical procedure. Treating the patient under general anesthesia would have been the treatment of choice. Opting for micro-marsupialization, not only reduced the surgical time, but also saved the patient from day care surgical procedure causing patient minimum discomfort. The micro-marsupialization technique is of simple execution, less traumatic, and well tolerated by the patient. The most important advantage of this technique is virtually no bleeding and zero side effect. Even if the lesion does not resolve with this technique at any point surgical excision can be easily carried out. Simple incision and drainage will result in recurrence of mucus retention phenomena. The introduction of a suture presumably maintains a tract while permitting an epithelial tract to form between the surface and the underlying salivary glandulartissues[4,10,11] Micro-marsupialization consists in draining the accumulated saliva and creating new epithelialized tracts alongt he path of the sutures. It is a minimally invasive technique, and most cases can be carried out under topical anesthesia alone. The required procedure time is brief (approximately 3 min), there is practically no tissue damage or inflammation, and it appears to be a particularly suitable technique for patient who cannot tolerate long or invasive procedures. Micro marsupialization does not enable a biopsy to be conducted, and the diagnosis remains exclusively clinical.[12] Furthermore, it should be carefully used in palatal or buccal lesions, as minor salivary gland tumors are often located in those areas.

CONCLUSION

This study suggests that micro-marsupialization could be a treatment option for patients with ranula. It is simpler to perform, minimally invasive, requires no local infiltration of anesthesia, has a lower postoperative complications rate, and is well tolerated by patients.

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Case Report

TREATMENT OF ANKYLOGLOSSIA WITH ELECTROCAUTERY: A CASE REPORT

Singla Lalita, Verma Kanika Gupta, Juneja Suruchi, Goyal Virinder

ABSTRACT

The tongue is responsible for speech, swallowing, positioning of the teeth, and taste. Lingual frenum attaches the tongue to the floor of mouth. Abnormal thick and shortened lingual frenum results in ankyloglossia (Tongue-tie) causing limited tongue movement, difficulty in speech and breast feeding. This abnormal lingual frenum can be treated by partial or complete removal of the frenum (frenectomy).

Keywords : Ankyloglossia, electrocautery frenectomy

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INTRODUCTION

The lingual frenum is a mucosal fold that connects the ventral surface of the tongue to the floor of the mouth and to the body of the mandible. Abnormal thick and short lingual frenum results in ankyloglossia or tongue tie. Term ankyloglossia is derived from the Greek words "ankylos" which means tied and "glossa" means tongue.[1]

In 1963, Wallace defined ankyloglossia as acondition in which the tip of the tongue cannot beprotracted beyond the lower incisor teeth because of a short frenulum linguae. This canvary from a thin elastic membrane to a thickened white non-elastic tissue.[2]Its prevalence is around 4.4% to 4.8% in newborns, with a male to female ratio of 3:1.[3] It reduces tongue mobility and may cause difficulty in breast feeding, swallowing and speech, malocclusion, problems related to oral clearance and psychological stressin affected individuals.[4,5]

The ankyloglossia can be classified into 4 classes based on Kotlow's assessment[6]

Class I (Mild)	12 to 16 mm
Class II (Moderate)	8 to 11 mm
Class III (Severe)	3 to 7 mm
Class IV (Complete)	< 3 mm

Clinically acceptable, normal range of free tongue is greater than16 mm.[7]

Ankyloglossia can be treated with various surgical techniques such as frenotomy, frenectomy and frenoplasty which are carried out by conventional technique using scalpel, electrocautery and diode lasers. Electrocautery and diode laser have added advantages over conventional techniques.[8]

CASE REPORT

A 8 year old girl reported to the Department of Pediatric and Preventive Dentistry, Surendera Dental College and Research Institute, Sriganganagar with the chief complaint of missing teeth in lower front tooth region. No relevant past medical and dental history was found. On soft tissue examination, gingiva was reddish pink in color with rolled out margins and bleeding on probing was not present. On hard tissue examination, type of dentition seen was mixed dentition, dental caries w.r.t 62, 64, 72, 75 and 85 and missing teeth w.r.t 12, 32, 41,42 (Figure 1 and 2). On clinical examination, patient had short and thick lingual frenumwhich restricted the tongue movement (Figure-3a). On protrution of tongue, V-shaped notching was observed (Figure-3b). Orthopantomograph revealed that 12, 32, 41,42 teeth were congenitally missing (Figure 4).The treatment planned was GIC restorations w.r.t 64, 75 and 85, composite restorations w.r.t 62 and 72. Surgical correction of lingual frenum was planned followed by removable partial denture for missing teeth.

Treatment plan

The treatment procedure was explained to parents and informed consent was obtained.The lingual frenectomy was performed under local anaesthesia using electrocautery method.Tip of the tongue was held with the help of suture (Figure 5) and then the lingual frenum was clamped using he mostats. Then frenum was excised with the help of loop electrode tip and sutures were placed (Figure 6 and 7). Instructions were given to the patient following the procedure and patient was recalled after one week. After 1 week, the sutures were removed and healing was uneventful. On evaluation, significant changes were observed in terms of tongue movement extendibility(Figure 8). The patient was advice speech therapy for linguo-palatal sounds.

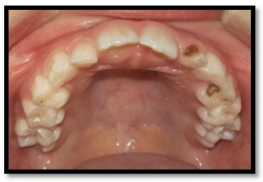


Figure1: Maxillary arch view showing dental caries w.r.t 62 and 64

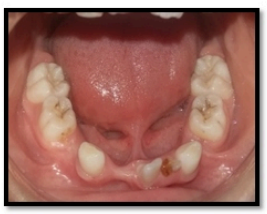
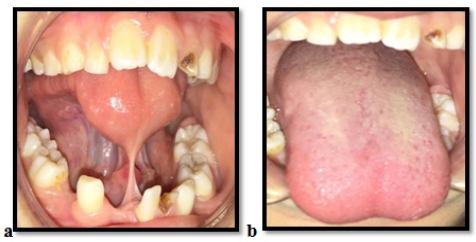


Figure 2: Mandibular arch view showing dental caries w.r.t 72,75 and 85 and missing teeth w.r.t32,41,42



a b

Figure 3: Preoperative photographs a) showing ankyloglossia; b) V- shaped notch at tip of the tongue

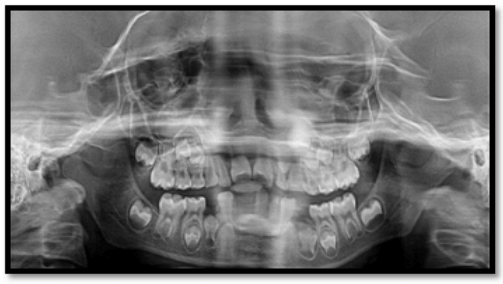


Figure 4: Orthopantomograph showing missing teeth w.r.t12,32,41,42

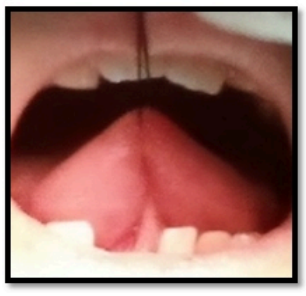


Figure 5: Holding of the tongue with the help of suture

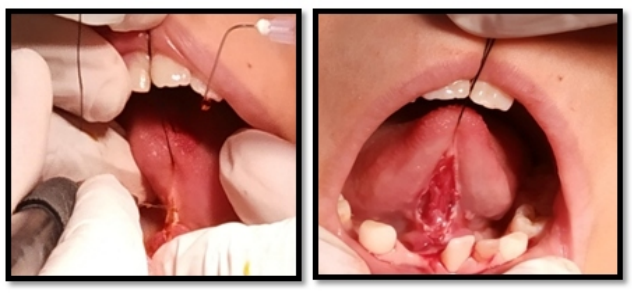


Figure 6: Excision offrenum with the help of loop electrode

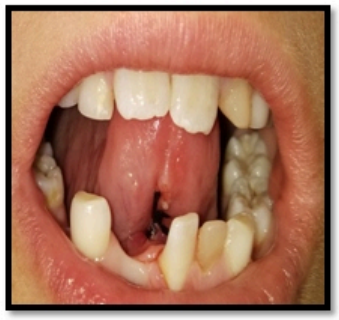


Figure 7: Placement of suture

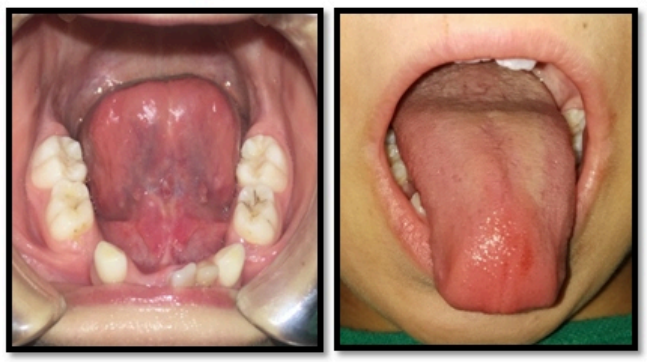


Figure 8: Postoperative photographs

DISCUSSION

Ankyloglossia (tongue tie) limits the mobility of the tongue, impairing its ability to fulfill its functions like speech, the position of teeth, swallowing, and certain social activities.[9] Optimal management of ankyloglossia includes timely and appropriate surgical intervention followed by speech therapy. Various surgical techniques are used for correction of ankyloglossia which includes frenotomy, frenectomy and frenoplasty. Frenectomy can be performed by various methods like conventional, electrocautery and soft tissue lasers. Electrocautery has various advantages over conventional method (using scalpel, BP blade).[8] It is a fast and smooth technique that maintain a bloodless field. Less bleeding during the procedure is helpful in better visibility to the surgical site. It is an effective and safe method which is acceptable to paediatric patients.[10]

CONCLUSION

Ankyloglossia is congenital abnormality of tongue which restricts the tongue mobility, causingspeech difficulty and malocclusion. Early diagnosis and treatment of ankyloglossia is important for correction of speech and malocclusion. Electrocautery can be

opted for frenectomy in paediatric patients being the safe and cost effective method.

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Case Report

MANAGEMENT OF MANDIBULAR PARASYMPHYSIS FRACTURE IN PEDIATRIC PATIENT: A CASE REPORT

Aggarwal Atul, Bansal Shallu, Verma Dinesh Kumar

ABSTRACT

Fractures of the mandible are less common in pediatric populations than adults due to child protected anatomic features. Treatment protocols of mandibular fractures in pediatric populations differ from adults due to mandibular growth and developing dentition. A case of 6 year old boy with fractured mandibular parasymphysis is treated by using acrylic cap splint and circummandibular wiring is presented.

Keywords: Mandibular fracture. Acrylic cap splint, Circummandibular wiring

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INTRODUCTION

The primary differences in craniomaxillofacial trauma in the pediatric or growing patient compared with the adult patient are based on developmental anatomy. Facial fractures are less common in the growing patient than in adults.[1] Fractures of the facial bones and mandible are uncommon in the pediatric age group with the overall frequency being about 1–15%.[2] Only 0.8–1.0% of facial fractures occur in children younger than 5 years; and 10–14.7% occurs in patients older than 16 years.[2,3] In pediatric patients symphysis and parasymphysis fractures account for 15%–20% and body fracture rare.[4]

The pediatric maxillofacial complex is malleable, because there is a greater cancellous-to-cortical ratio. As such, greenstick fractures of the facial skeleton occur more frequently in children compared with adults. The consistency of the growing patient's bone (more cancellous than cortical) is less conducive to the use of screw or wire fixation to fixate fractures internally.[1] Open reduction and osteosynthesis of the pediatric fracture with titanium plates and screws or absorbable plates and screws carries risks of a negative effect on the skeletal growth and damaging unerupted teeth. For these reasons, closed reduction is a viable option for most facial fractures in the growing patient.[5]

Several studies have recommended the use of pre-fabricated acrylic splints as a treatment for pediatric mandibular fractures. These splints are more reliable than open reduction or MMF techniques with regard to cost effectiveness, ease of application and removal, reduced operating time, maximum stability during healing period, minimal trauma for adjacent anatomical structures and comfort for young patients.[6]

The purpose of this paper is to present a method of managing a displaced mandibular fracture in a 6-year-old boy using a pre-fabricated acrylic cap splint.

CASE REPORT

A 6 year old male child reported to the outpatient department of Oral and Maxillofacial Surgery, Surendera Dental College and Research Institute, Sri Ganganagar, Rajasthan, with a history of fall. Extraoral examination revealed the presence of a swelling in the anterior region of mandible associated with limited mouth opening. Pre-auricular palpation of TMJ movements were normal (Figure 1). On intraoral examination, #16,21,26,36,31,41,46 were present. A displaced fracture of mandible in the area between #31 and 72. There was a derangement of occlusion. Step deformity between #31 and 72 with tenderness and mobility were elicited along the lower border of mandible on the left side of anterior mandible region. The examination also revealed a subluxation of 72. There were no fractures of teeth (Figure 2). OPG showed a radiolucent line between 31 and 72 extending till lower border of mandible. A diagnosis of left parasymphysis fracture of mandible was made (Figure3). All routine blood investigation were advised. Impressions of both jaws were taken with alginate impression material and model prepared with dental stone. (Figure4) Then cast was split at the fracture site (Figure 5). The fracture was manually reduced against maxilla on the cast to simulate the reduction that would be done clinically. Then split cast was stabilized with sticky wax and base was formed (Figure 6). An acrylic cap splint was then constructed on the reconstructed model and the splint was trimmed to cover the occlusal third of the teeth (Figure 7). Two grooves on either side of the fracture were made on the splint.

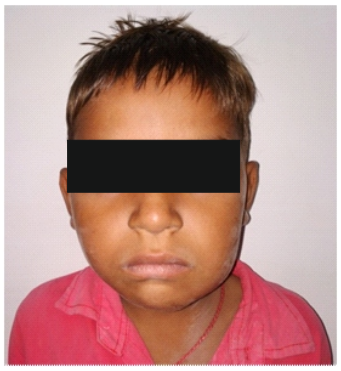

Figure 1: Pre-operative photograph

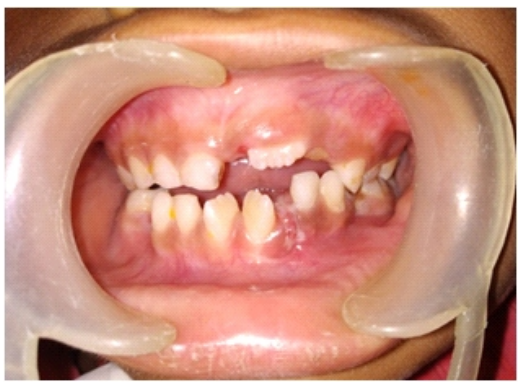

Figure2:Pre-operative photograph showing derangement of occlusion and step deformity between #31 and 72

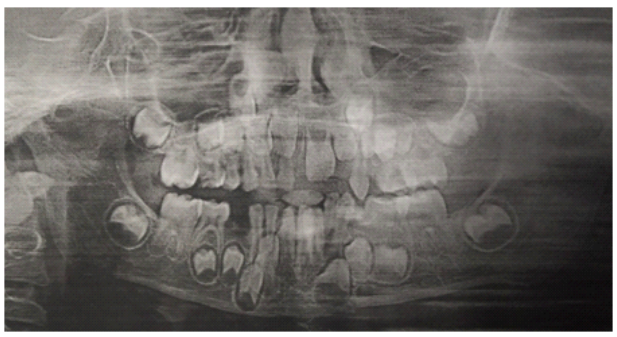

Figure 3: Pre-operative OPG showing left side mandibular parasymphysis fracture

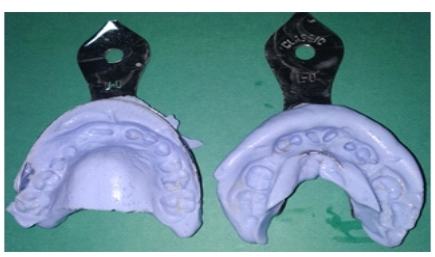

Figure 4 – Alginate impressions

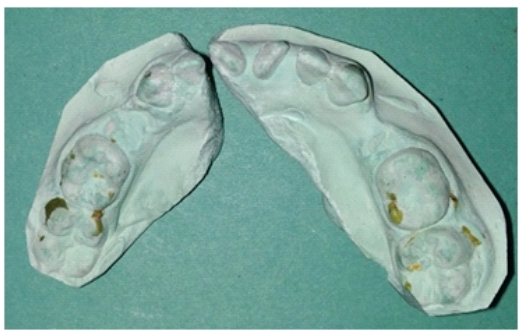

Figure 5- Mandibular cast split at the Fracture Site

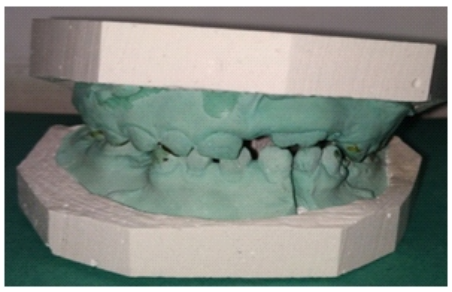

Figure 6: Split mandibular cast reduced against maxillary occlusion and base formed

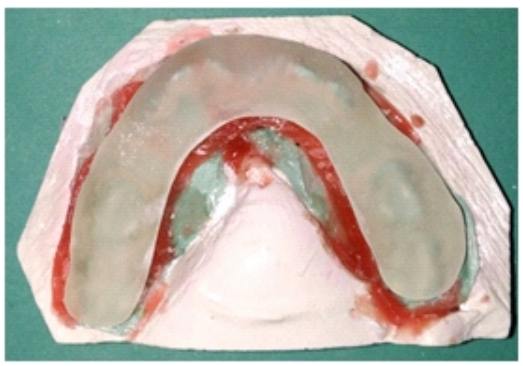

Figure 7: Acrylic cap splint fabricated on model

Under general anesthesia, under aseptic conditions standard painting and draping was done. A small stab incision was placed at the inferior border of the mandible on the right side. A William kelsey Fry awl was introduced through the stab incision (Figure 8). The bone awl was guided along the lingual surface of body of the mandible and taken out in the lingual vestibule. Next the 24G wire was threaded in the eye of the awl. It was gently retracted till the lower border of the mandible and the awl was taken out into the buccal sulcus. The wire was unthreaded from the eye of the awl followed by retraction of the awl completely. Using the same technique another 24G wire is passed in the molar region on both lingual and buccal vestibule side.The same technique was used on

left side also by placing 2 wire on lingual and buccal vestibule. The acrylic cap splint was then stabilized by tightening the wires over it (Figure 9). Extra orally stab incision was sutured (Figure 10).

OPG was taken postoperatively to confirm positions of the wires (Figure 11). Postoperative antibiotic treatment was started for 3 days. Soft diet, avoidance of physical activities, and anti-bacterial mouth rinse were prescribed. Postoperative monitoring was performed on a weekly basis and was favorable in both healing and function. No complications were observed during the healing period. The interdental wiring and acrylic splint were removed after 3 weeks.

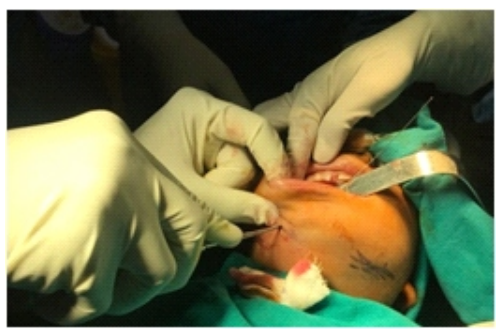

Figure 8: intraoral insertion of awl

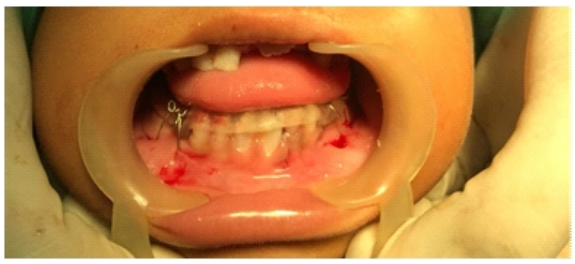

Figure 9: Intraoperative photograph showingsplint inposition, secured with circummandibular wires

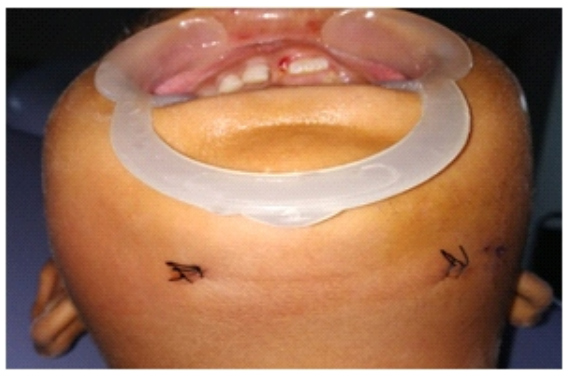

Figure 10: Extraoral suturing of stab wounds

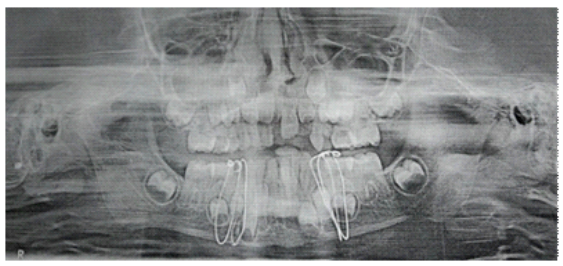

Figure 11: postoperative OPG showed circummandibular wiring

DISCUSSION

Fractures of mandible are uncommon in children because bone is resilient at this age and considerable force is required to affect a fracture.[7] 5% of all facial injuries occurred in children younger than 12 years and less than 1% of these fractures occurred in children younger than 6 years. Of pediatric facial fractures observed in MVAs, 51.4% were nasal fractures, 15.5% were mandibular fractures, 11.6% were orbital fractures, and 8.7% were fractures in the zygoma and maxillary bones.[1]

The differences in cranio-maxillofacial trauma in the pediatric patients compared with the adult patient are based on developmental anatomy. At birth, the cranium-to- face ratio is 8 : 1. This decreases to 4: 1 by age 5 and 2.5 : 1 as an adult.[1] The osteogenic and bone remodeling potential of a child exceed that of an adult. In the pediatric patients, greenstick fractures are common**.** The high elasticity young bones, a thick layer of adipose tissue, high cancellous to cortical bone ratio and flexible suture lines are contributing to minmum displacement of fractures segment.[8,9]

The anatomy of deciduous crown, which does not lend itself well to circumdental wiring when arch bars are necessary to stabilize fractures during childhood. It is unsafe to apply transosseous wires or to insert bone pins or plates. Specific to the pediatric patient is the presence of underlying tooth buds, which may complicate reduction and fixation of mandibular fractures.[1]

Open reduction of the angle, symphysis, or body of the mandible in the pediatric patient is rarely indicated. In patients with associated condylar fractures, however, internal fixation of the symphysis fracture limits the need for MMF and permits early function of the condyles. Typically, open reduction is limited to patients in whom there is a severely displaced fracture, closed reduction is not

feasible, or there is an associated condylar fracture. ORIF includes micro/miniplates or biodegradable devices.

Complications are very rare in pediatric trauma due to greater osteogenic potential, faster healing rate and number of fractures are minimal or non-displaced. Malocclusion is rare. Infection, wound dehiscence, nonunion occur less frequently with closed reduction versus open. Late complication such as damage to permanent tooth buds may occur in 50% of mandibular fractures.[10] Isolated fractures of the mandibular angle, body, and symphysis region in the growing patient are typically treated conservatively via closed reduction, because these fractures are usually easily reduced. The closed reduction and immobilization can be achieved by prefabricated acrylic cap splints (occlusal/lingual), orthodontic brackets, orthodontics rubber elastics, nickel titanium staples, circumferential wiring, arch bar or gunning splints.

CONCLUSION

Mandibular fractures in children heal rapidly and some undisplaced fracture is stable within a week and firmly united within 3 weeks. Normal growth of mandible will be disturbed if unerupted permanent tooth germs are lost because the alveolus will not develop normally in the areas affected. A prolonged follow-up should be done, so that there are no long term effects on both mandibular growth and normal development of the permanent dentition. The commonly used treatment option, acrylic cap splints is best choice. It avail support from adjacent teeth and bone. It is easy to fabricate and economical. The result of the fracture treatment presented in this case report verified the effectiveness of acrylic cap splint.

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Case Report

RESTORING AESTHETICS USING SILICON PALATAL TEMPLATE: A REPORT OF TWO CASES

Kasat Shubhada, Sidhu Punnet, Saini Mahima, Singla Lalita

ABSTRACT

Traumatic injuries involving anterior crown fractures are common form of injury that mainly affects children and adolescents. Complicated and uncomplicated crown fracture to the permanent teeth has an intense effect not only on the patient's appearance, but also on function and speech. Today, in restorative dental treatments, the focus is on aesthetics. Hence, dental mock ups in such cases not only help to build teeth morphology but at the same time may acts as an aid in communication with the patient, which may help in resolving doubts of the patient. This paper presents the report of two cases, in which form and function of tooth was restored with Nano-hybrid composite taking assistance from Silicon palatal template.

Keywords: Aesthetics, composite, palatal template, mock up

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INTRODUCTION

Traumatic injuries are common form of injuries that affect most children and adolescents in early mixed dentition period, resulting in fracture of teeth which can be complicated or uncomplicated depending on the involvement of pulpal tissue.[1]The prevalence of traumatic injuries in primary dentition is 11 to 30% and in early mixed dentition is 5 to 29%, among this the prevalence of traumatic injuries involving upper central incisors is 37%.[2]The traumatic injuries to anterior teeth, present a challenge to the pedodontist because of psychological impact on the children and their parents. This increases the concern towards restoring esthetics along with form and function of the tooth with the best possible minimally invasive procedures. To restore the proper anatomy of the tooth, various materials are available in market with shades, tints and opaquers,[3] matching the chroma of the tooth, like composites, compomers, ormocers, zirconomers, etc. The most commonly used material meeting with aesthetic requirements is composite. The success of treatment is based on characteristic of material as well as operator skills. The patient satisfaction is the goal of successful treatment planning; that can be achieved by showing the patient outcome of the treatment. The technique of mock-up over the dental cast is an effective way of justifying the treatment goals of dentist. This technique has several advantages:

- ✓ Does not require sophisticated software or digital imaging.
- ✓ Requires minimum chair time for setting of material and trimming
- ✓ Patient can anticipate the results beforehand.

Hereby, presenting two case reports showing the restoration of aesthetics with mock-up and Silicon putty template.

CASE REPORT 1:

A 10 year old boy reported to the Department of Pediatric and Preventive Dentistry, Surendera Dental College and Research Institute, Sriganganagar with the chief complaint of fractured teeth in upper front region of jaw. No relevant past medical and dental history was found. On clinical examination, Ellis class II fracture w.r.t#11 and Ellis class III fracture along with swelling and sinus tract w.r.t # 21 (Figure 1). Electric pulp testing w.r.t # 11 revealed normal response but # 21 was non-responsive. IOPAR w.r.t # 11 and 21 revealed blunderbuss canal w.r.t # 21 and fracture involving the enamel and dentin w.r.t # 11. The treatment planned was apexification with MTA,[4] followed by root canal treatment. To restore the form and function of teeth, composite build up w.r.t # 11 and PFM crown w.r.t # 21 was advised to patient. For strength post and core was required w.r.t # 21. For esthetic reasons, glass fiber post was used, followed by a composite build up (till the PFM crown was placed) w.r.t 21. As with direct composite build up w.r.t # 11 and 21, it was very difficult to restore form of teeth palatally. So, after post cementation, an alginate impression of the maxillary arch was made, and the diagnostic cast was obtained. Dental mock up w.r.t # 11 and 21 was done using blue inlay wax (Figure 2), to build proper morphology of the tooth according to the esthetic demand of the patient. After this, silicone putty impression (Figure 3,4) of the required segment was obtained, labial surface of the silicone putty template was removed to aid in fabrication of palatal silicone putty template. A clinical try-in of

the template was done to ensure adequate fit. After appropriate shade selection of the composite material using shade guide (Figure 5,6), composite build up was done incrementally, with building up of palatal wall as the first step (Figure7,8) using a palatal template. Composite used was Nano hybrid composite, because of its high polish ability and better handling and adaptation. After composite build-up of 11 and 21, finishing and polishing was done using finishing and polishing discs.

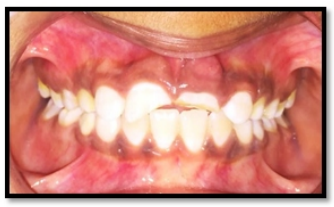

Figure 1: Pre-operative photograph with maxillaryand mandibular teeth in occlusion.

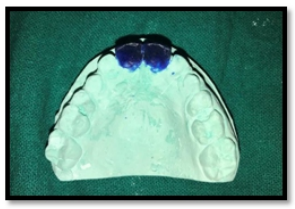

Figure 2: Dental mock-up w.r.t # 11, 21 on diagnostic cast using blue with inlay wax

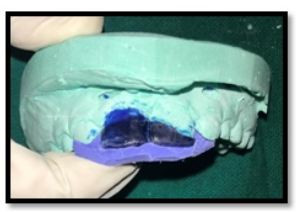

Figure 3: Fabrication of palatal template

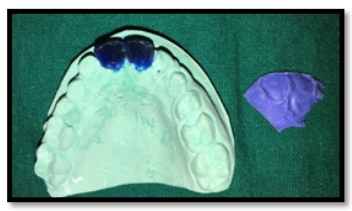

Figure 4: Palatal template covering #12, 11, with Silicon impression material.21and 22.

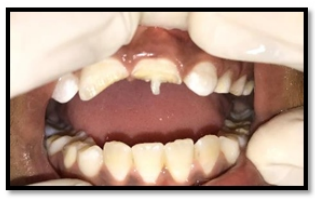

Figure 5: Glass fibre post cemented (Shade A2).

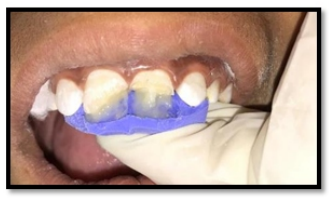

Figure 6: Palatal wall build-up with the support w.r.t # 21. of palatal template using nano-hybrid composite

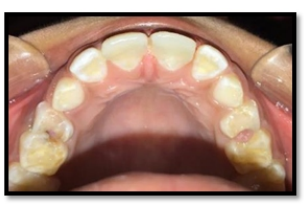

Figure 7: Post-operative picture after finishing and polishing (Occlusal view)

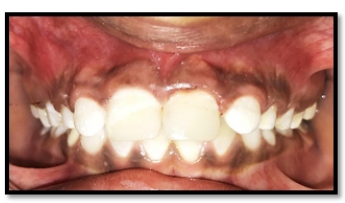

Figure 8: Post-operative picture after finishing and polishing (Facial view)

CASE REPORT 2:

A 14 year old boy reported to the Department of Pediatric and Preventive Dentistry, Surendera Dental College and Research Institute, Sriganganagar with the chief complaint of malformed teeth in upper front region of jaw (Figure 9). No relevant past medical and dental history was found. On clinical examination, maxillary lateral incisors were observed to be peg shaped. The treatment planned was restoring the form and shape of lateral incisors with direct composite build-up for better esthetics using palatal putty template.The treatment procedure was explained to parents and informed consent was obtained. The diagnostic impression of the maxillary arch with alginate impression material was made, and the diagnostic cast was prepared. The dental mock up w.r.t # 12 and 22 was done using composite restorative material to achieve the satisfaction of patient and parents. Mock-up revealed restored esthetics by redefining the shape of lateral incisors and closure of interdental spaces between incisors and canines bilaterally (Figure 10). After this, silicone putty impression of the required segment was obtained; labial surface of the silicone putty template was removed to aid in fabrication of palatal silicone putty template (Figure 11, 12). A clinical try-in of the template was done to ensure adequate fit. After appropriate shade selection, the Nano-hybrid composite material was used incrementally after establishing the palatal wall of the fractured teeth using palatal template (Figure 13, 14). After this, finishing and polishing of composite was done using finishing and polishing discs.

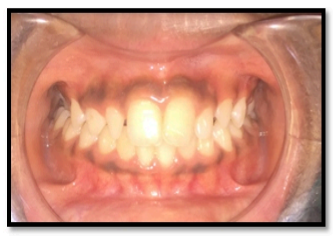

Figure 9: Preoperative photograph showing peg laterals.

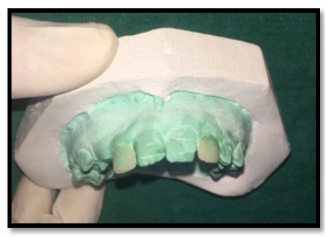

Figure 10: Dental mock up done with composi restorative material.

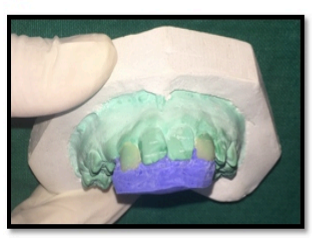

Figure 11: Fabrication of palatal A2 shade)

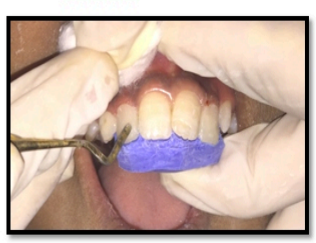

Figure 12: Compositebuild up (Nanohybrid template)

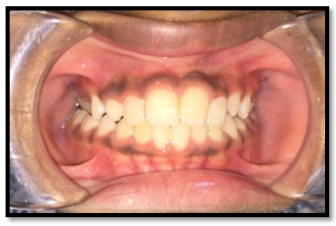

Figure 13: Post-operative picture (Facial view)

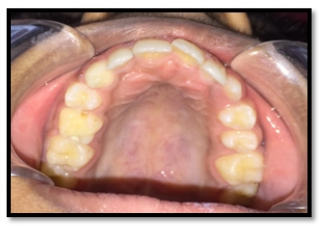

Figure 14: Post-operative picture (Occlusal view)

Correction of dental esthetic inconsistencies needs careful evaluation, planning and multidisciplinary approach. Anatomic mock-up is one of the most important tools when planning to alter the patient's esthetic demands. The various benefits of an anatomic mock-up are as follows:

- Diagnostic mock-up allows the clinician to visualize the alterations needed to achieve a pleasing smile and assist him/her in treatment planning.
- This will allow the clinician to communicate with the patient regarding the final esthetic result.
- Once the size, shape and proportion of the teeth have been finalized by the patient and the dentist, an impression is taken with the pre-evaluation temporaries in position. This can act as a guide for the dentist in the build-up of the teeth.[5,6]

Therefore, careful planning with the aid of anatomic mock-up is required to maintain the intra-dental proportion (width to length ratio) and inter-dental proportion (ratio of width of individual teeth in the esthetic zone).[7] Composite restorations offer a cost effective treatment alternative where esthetics is a major concern. The survival rates of these anterior composites are extremely satisfactory, when proper isolation is maintained as the material is technique sensitive. With improvements in the bonding chemistry and introduction of nano-composite, it is speculated that the success rate of composites will improve even further.The nanohybrid composite (GC Solare Sculpt) is material with excellent properties of flow, easy handling and gives desired morphology according to requirement. Also, it requires minimal finishing and polishing.[8,9]Putty matrix technique allows for a Mock-up to be fabricated with great ease and short clinical time. A mock-up review of anticipated final restoration is an important tool of communication between the doctor and the patient.[10]

CONCLUSION

With the Mock-Up technique, we are sure of the steps we take during the aesthetic treatment. By avoiding the repeat of each step, especially the repeat of the final result (if it could happen in the conventional way), we can have a controlled cost in terms of time and money. It is very important that through this way, we gain the trust of the patient. This is because since at the first steps of the work, he feels being involved like a collaborator and knows that he would not have bad surprises at the end.

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2. The full names and professional/academic affiliations of all authors. All authors must have made substantive intellectual contribution to the study. For authorship of multicenter trials, the individuals directly responsible for the manuscript should be identified.
3. Contact details including phone, fax and e-mail address should be provided for the corresponding author.
4. If the paper was presented at an organized meeting, the name of the organization, location and date of the meeting should be included.
5. Disclaimers, if any.
6. Source(s) of support in the form of grants, equipment, drugs or all these.
7. Running head of no more than 40 characters (including spaces).
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9. The number of figures and tables.

Preparation of Manuscripts

The manuscript should be typed, double-spaced on standard-sized paper (8.5" × 11") with 1" margins on all sides. Times New Roman font 12 pt should be used. The fonts used in the text as well as graphics should be restricted to Times New Roman, Symbol.

Abstract and Keywords: Should be structured and limited to 250 words. A brief summary of the research should be given under the subheadings, introductions, methods, results and conclusion. Not more than six keywords are needed. It should not contain abbreviations, footnotes or references.

Introduction: Description of the research area, pertinent background information and the hypothesis tested in the study should be included under this section. The introduction should provide sufficient background information such that a scientifically literate reader can understand and appreciate the work to be described. A detailed review of the literature is not at all required under this section. The specific aims of the project should be identified along with rationale for the specific experiments and other work performed. The introduction must include in-text citations including a few references pertinent to the background and justification for the study.

Materials and Methods: Materials and/or subjects utilized in the study as well as the procedures undertaken to complete the work. The methods should be described in sufficient detail such that they could be repeated by a competent researcher. The sources of all major instruments and reagents used (kits, drugs, etc.) must be used with parenthesis. Illustrations and/or tables may be helpful in describing complex equipment elaborate procedures. The statistical tool used to analyze the data should be mentioned. All procedures involving experimental animals or human subjects must accompany a statement on ethical approval from appropriate ethics committee.

Results: Data acquired from the research with appropriate statistical analysis described in the methods section should be included in this section. The results section should highlight the important result obtained. Data should be organized into figures and tables. Qualitative as well as quantitative results should be included, if applicable.

Discussion/Conclusion: This section should relate the results section to current understanding of the scientific problems being investigated in the field. Description of relevant references to other work/s in the field should be included here. This section also allows the authors to discuss the significance of the results. This section should end with answers/questions that arise as a result of the author's work.

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Legends for illustrations should use Arabic numerals corresponding to the illustrations. When symbols, arrows, numbers or letters are used to identify parts of the illustrations, identify and explain each one clearly in the legend. Explain the internal scale and identify the method of staining in photomicrographs.

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References: Readers should be provided with direct references to key original research sources, whenever possible. All references must be cited in the text, using the Vancouver style (numbered references). References should be marked in order of appearance with superscript numbers, and listed numerically in the reference list at the end of article.

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1. West JD, Oates TW. Identification of stability changed for immediately placed dental implants. Int J Oral Maxillofac Implants 2007;22:623-30.

Book Reference Style:

1. Lee JS, Kim JK, Park YC, Vanarsdall RL. Applications of orthodontic mini implants. Chicago: Quintessence 2007.
2. Baumgartner JC. Pulpal infections including caries. In: Hargreaves KM, Goodis HE (Eds). Seltzer and Bender's Dental Pulp. Chicago: Quintessence 2002:281-307.

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Review articles: It is expected that these articles would be written by individuals who have done substantial work on the subject or are considered experts in the field. A short summary of the work done by the contributor(s) in the field of review should accompany the manuscripts.

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