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Comparative Evaluation of Microleakage of Bulk Fill Packable Resin Composite Restorations and Bulk Fill Flowable Resin Composite Restoration in Class V Cavity Preparation - An in Vitro Study

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Abstract

Aim and Objective: Was to assess and compare the microleakage of bulk fill packable resin composite and bulk fill flowable resin composite in class V cavities along the occlusal and gingival margins using dye penetration test under stereomicroscope.

Materials and Methods: Hundred human extracted premolars were selected and randomly divided into 4 groups (n=25), as per the restorative materials for microleakage test. Group I: X-tra fil (Bulk fill packable resin composite). Group II: Power Fill (Bulk fill packable resin composite). Group III: SDR Flow Plus (Bulk fill flowable resin composite). Group IV Power Flow (Bulk fill flowable resin composite). Class V (box) cavities were prepared both on the buccal surfaces of each of the 100 teeth, a total of 100 cavities, restored, immersed in 2% methylene blue dye for 24 hours and then sectioned bucco lingually into two halves. Dye penetration score was measured along occlusal and gingival wall using a Stereomicroscope at 40X magnification. Statistical analysis was done using Chi square test for microleakage assessment. P value was set at <0.05.

Result: Intergroup comparison showed statistically no significant difference between the four groups both occlusal and gingival wall.

Conclusion: None of three resin composite materials were free from microleakage. All the four materials showed more microleakage at gingival wall compared to occlusal wall. Among all the tested groups Tetric power fill showed the least microleakage at the gingival wall.

Keyword: Microleakage, Class V, Resin composites.

INTRODUCTION

Resin composite restorative materials were introduced in dentistry in 1950 and have developed tremendously over years. The use of composite restorations have become more popular in recent decades because of their improved strength, esthetic quality, wear resistance, predictability and reduced water sorption as compared to earlier versions1.The major disadvantage of visible light cured composites is polymerization shrinkage. This shrinkage can

result in gap formation between the composite material and tooth structure, particularly if the restoration margin is placed in dentin or cementum. Bacteria, fluids, molecules, or ions can pass through this gap between the resin composite and the cavity wall, a process called microleakage. Microleakage is thought to be responsible for hypersensitivity, secondary caries, pulpal pathosis, and failure of restorations2.

Polymerization shrinkage of methacrylate based dental resin composites is unavoidable, due to the fact that monomer molecules are converted into a polymer network and therefore, exchanging van der Waals spaces in covalent bond spaces2. Contraction stress is the result of polymerization shrinkage taking place under confinement caused by bonding to cavity walls. The stress magnitude is affected by the volume of each increment and cavity configuration (C-factor), which are relatively larger in bulk-fill materials applications. Therefore, the stress control has been one of the main subjects in the material development3.

Various approaches have been employed in the formulation of bulk-fill composites to reduce the stress, adjust the stress generation kinetics and improve depth of cure. Those include changes in filler content and shape, modified monomer molecular weight and structure, addition of stress relievers and polymerization modulators, increase of polymerization inhibitors, new combinations of photoinitiators, enhanced material translucency and dual-cured polymerization mechanisms4.

Bulk-fill type of composite resins has been introduced in the market with a view to simplify the procedure of introducing the material into the cavity and its polymerization5. They may be used either as dentin replacement beneath conventional resin composite or as a single filling material. Bulk-fill composite can be light cured in a single increment up to 4 mm and it makes the work quicker by reducing the number of clinical steps6. Bulk-fill composite resins can be applied in thick layers due to low shrinkage of these materials and high filler content which causes shrinkage stresses to be very low6. Nevertheless, an ideal bulk-fill composite would be one that could be placed into a preparation having a high configuration factor (C-factor) design and still exhibited very little polymerization shrinkage stress, while maintaining a high degree of cure throughout7.

In this study we compare the microleakage of two bulk fill packable resin composite restorations and two bulk fill flowable resin composite restoration in class v cavity preparation.

MATERIALS AND METHODOLOGY

Preparation of the specimens: Class V (box) cavities were prepared on the buccal surfaces of 100 Premolar teeth, with a total of 100 cavities. The gingival cavosurface margin of the preparation was approximately 1.5 mm below the cementoenamel junction and occlusal margin was approximately 1.5 mm above the cementoenamel junction. The preparations were made with a No. 245 carbide bur (SS White) in a high speed standardized handpiece under copious water coolant. The dimension of the final cavity preparation was approximately 3.0 mm Occlusogingivally, 3.0 mm mesiodistally and 2 mm deep.

The preparations were etched with 37% phosphoric acid (Scotch bond Etchant, 3M ESPE) for 20 seconds, rinsed with water for 15 seconds and blot dried, leaving the dentin moist and shiny. An ethanol and water based adhesive system (ADPER single bond 2, 3M ESPE) was applied in two consecutive coats to the entire preparation, after 10 seconds of application gently air dried for 5 seconds and light cured for 20 seconds. Teeth were randomly divided into the four groups of 25 each corresponding to four different resin composites.

Group I: X-tra fil(Bulk fill packable resin composite), Group II: Tetric Power Fill (Bulk fill packable resin composite), Group III: SDR Plus (Bulk fill flowable resin composite) and Group IV: Tetric Power Flow(Bulk fill flowable resin composite).The specimens in each group were restored with the corresponding resin composite according to manufacturer's instructions. The restored specimens were stored in distilled water at 370C for 12 hours. The restorations were then finished and polished with aluminium oxide disks (Sof-Lex Pop On, 3M ESPE). The teeth were coated with two layers of nail varnish leaving approximately 1.0 mm width around the restoration, to allow the contact of the tracing agent with the margin of the restoration. The specimens were thermocycled for 1000 cycles at 50C and 550C with

30 seconds of dwell time. The specimens were immediately immersed in 2% Methylene blue dye for 24 hours. The specimens sectioned through bucco lingual direction with a sectioning disc. Then the restorations were analyzed with a stereomicroscope at 40xmagnification and scored for degree of dye penetration along the occlusal and gingival walls.

MICROLEAKAGE EVALUATION

Section of each tooth were evaluated at 40X with a stereomicroscope. The dye penetration for composite/tooth interface was scored for occlusal and gingival walls on a non-parametric scale from 0 to 4 based on the Ordinal ranking system, and the degree of leakage on the enamel and dentinal/cemental margins were determined.

0	No dye penetration
1	Dye penetration short of dentino-enamel junction (DEJ)/ cemento dentinal junction (CDJ).
2	Dye penetration up to dentino-enamel junction (DEJ)/ cemento-dentinal junction (CDJ)
3	Dye penetration beyond dentino-enamel junction(DEJ)/ cemento - dentinal junction (CDJ)
4	Dye penetration till/into the axial walls

Table 1: The teeth were then divided into four groups of 25 each.

Group	Composites	Composition
I	X-tra fil Voco America, Inc., Indian Land, USA. (Bulk fill packable resin composite)	**Monomers;** Bis-GMA, UDMA, TEGDMA, **Fillers;** 86% wt% (barium-boron-alumino-silicate glass)
II	Tetric Power Fill Ivoclar Vivadent AG, Schaan Liechtenstein. (Bulk fill packable resin composite	**Monomers**; Bis-GMA, Bis-EMA, UDMA, Bis-PMA, DCP, D3MA. **Fillers**; Barium glass, Ytterbium, Trifluoride, Copolymer, Mixed Oxide (SiO2/ZrO2) (79 wt%, 53–54 vol%)
III	SDR Plus Dentsply Sirona (York, USA) (Bulk fill flowable resin composite)	**Organic Matrix Composition:** Proprietary modified urethane dimetacrylate resin, TEGDMA; polymerizable dimethacrylate resin; polymerizable trimethacrylate resin; camphorquinone photoinitiator; ethyl-4(dimethylamino)benzoate photoaccelerator; butylated hydroxy toluene; fluorescent agent, and UV stabilizer. **Inorganic Filler Particulate:** (70.5 wt%, 47.4 vol%) barium-alumino-fluoro-borosilicate glass; silanated strontium alumino-fluoro-silicate glass; surface treated fume silicas; ytterbium fluoride; synthetic inorganic iron oxide pigments, and titanium dioxide
IV	Tetric Power Flow Ivoclar Vivadent AG, Schaan, Liechtenstein (Bulk fill flowable resin composite)	**Monomers**; Bis-GMA, Bis-EMA, UDMA, CMP-1E, DCP, D3MA. **Fillers**; Barium glass, Ytterbium, Trifluoride, Copolymer, Mixed Oxide (SiO2/ZrO2) (71 wt%, 46–47 vol%)

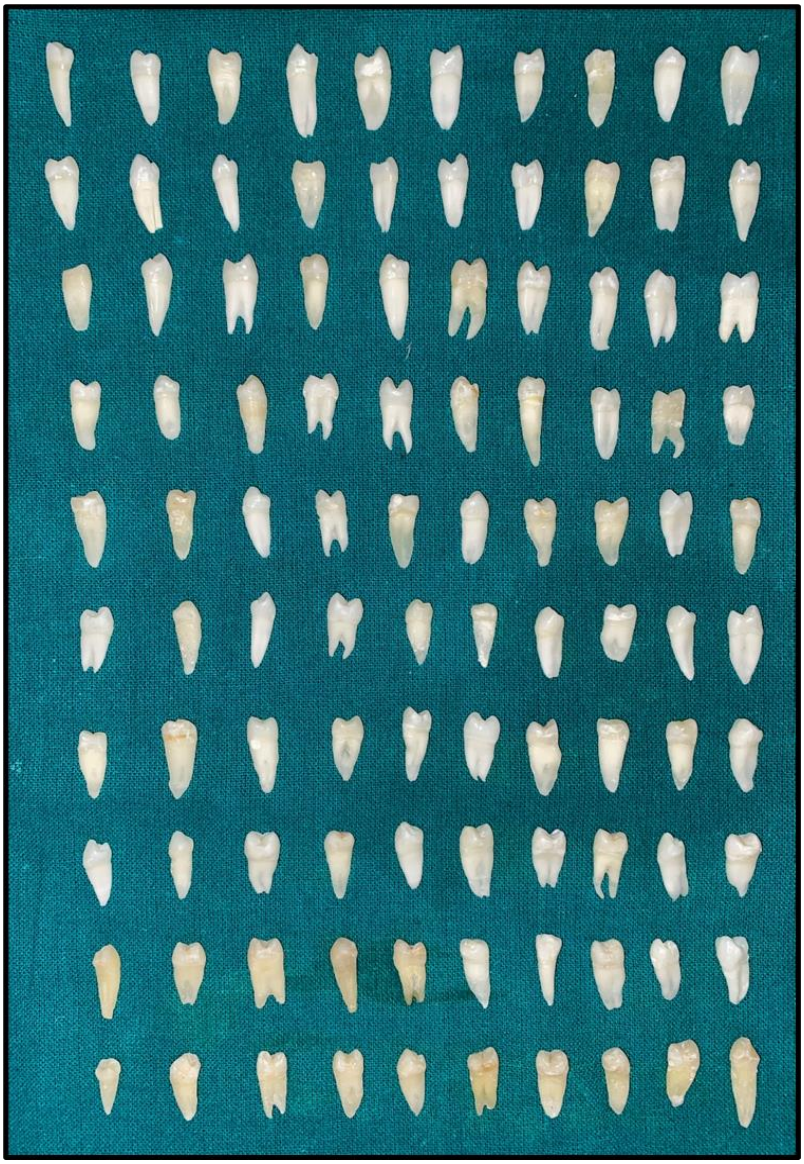
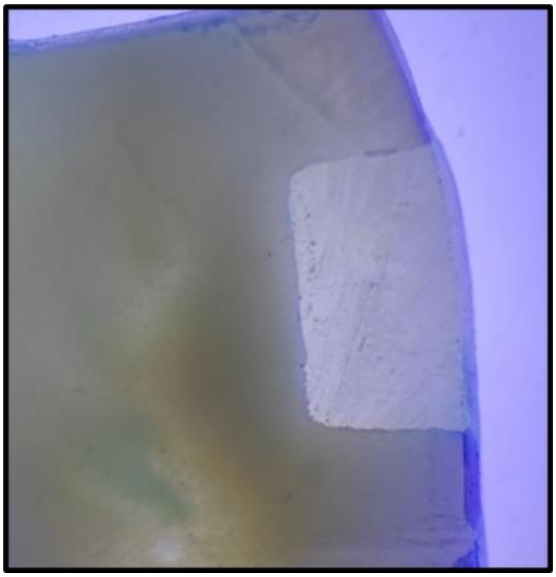
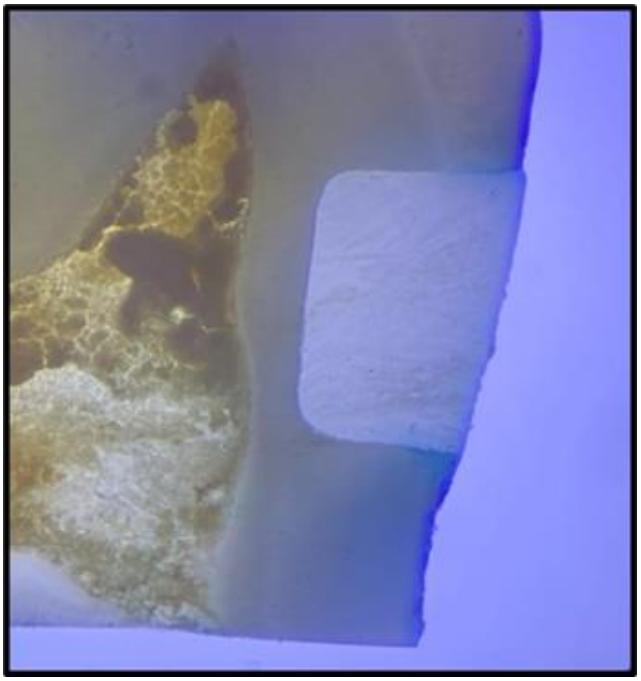


Figure 3: Extracted Premolar Teeth used for The Study

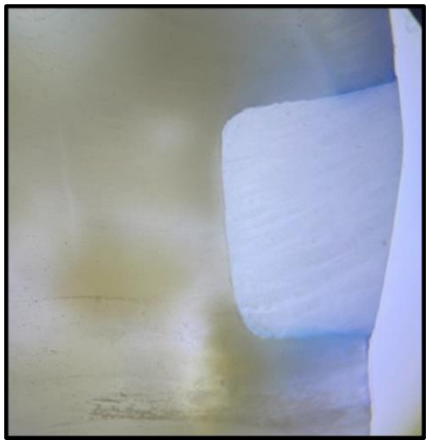


The Arrow 1 & 2 Shows no dye Penetration at Tooth Composite Interface

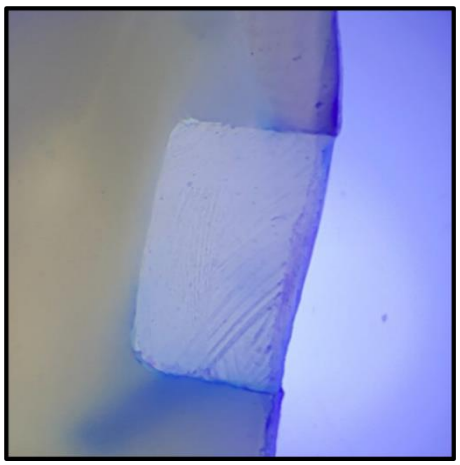
(Occlusal wall & Gingival wall Score 0)



The Arrow at interface 1 shows Dye penetration short of DEJ (Score 1) where as at interface 2 shows dye penetration beyond CDJ (Score 3)



The Arrow at interface 1 shows dye penetration up to DEJ (Score 2) where as at interface 2 shows dye penetration beyond CDJ (Score 3)



The Arrow at interface 1 Shows Dye penetration beyond DEJ (Score 3) where as at interface 2 shows dye penetration till axial wall (Score 4)

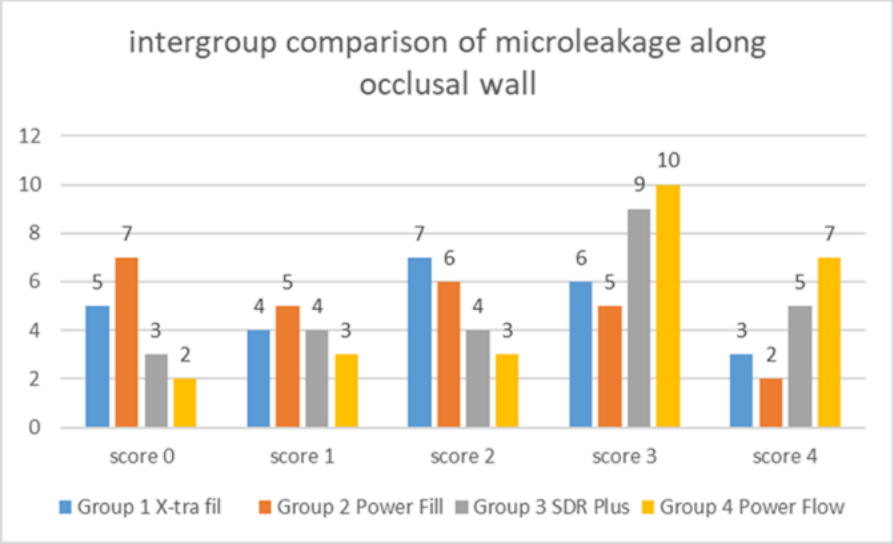
The Arrow Shows Dye penetration till/into the axial walls
(Occlusal wall & Gingival wall Score 4)

OBSERVATION AND RESULTS

The intergroup comparison of microleakage at occlusal and gingival wall of all the four study groups was done using Chi square test that showed a non significant difference between Groups I (X-tra fil), Group II (Tetric Power fill), Groups III (SDR Plus) and group IV (Tetric Power flow) ($P > 0.05$), but least amount of microleakage was shown by group II (Tetric Power Fill), and maximum microleakage was seen in group IV (Tetric Power Flow).(Table 2 and 3). However there was a statistically significant difference seen for the frequencies between groups when microleakage along occlusal wall and gingival wall was compared ($p<0.05$).(Table 4). Comparison of microleakage along occlusal wall and gingival wall between combined Packable vs Flowable composite resin, There was a statistically non significant difference seen for the frequencies between the groups ($p>0.05$). (Table 5 and Table 6). Thus, the results obtained from the present study showed that the least amount of microleakage was seen in Tetric Power Fill followed by X-tra Fil, SDR Plus , and the maximum was seen in Tetric Power Flow.

Table 2: Shows intergroup comparison of microleakage along occlusal wall

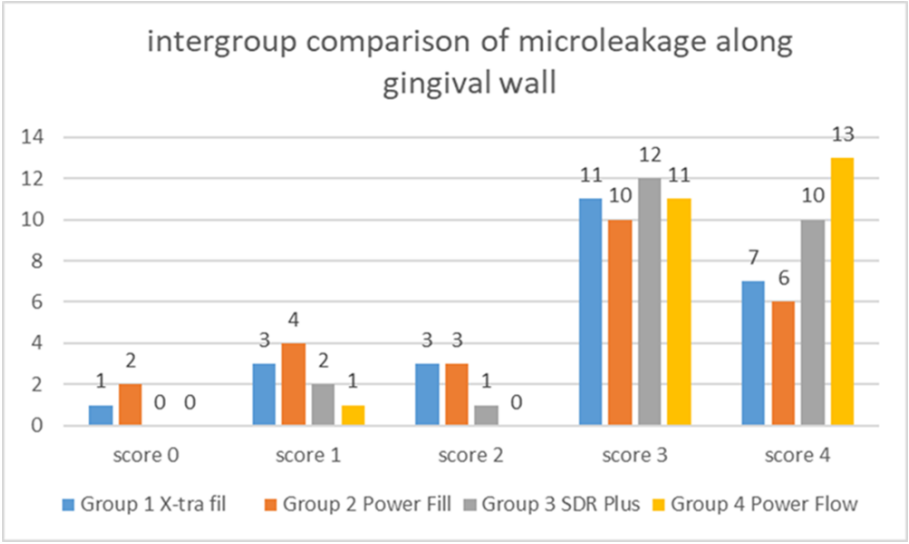
Groups	Occlusal wall dye penetration						Chi sq Value	p value of Chi sq test
	0	1	2	3	4	Total		
Group I X-tra fil	5	4	7	6	3	25(100)	9.711	0.469
Group II Tetric Power Fill	7	5	6	5	2	25(100)		
Group III SDR Plus	3	4	4	9	5	25(100)		
Group IV Tetric Power Flow	2	3	3	10	7	25(100)		



There was a statistically non significant difference seen for the frequencies between the groups (p>0.05)

Table 3 : Shows intergroup comparison of microleakage along gingival wall

Groups	Gingival wall dye penetration						Chi sq Value	p value of Chi sq test
	0	1	2	3	4	Total		
Group I X-tra fil	1	3	3	11	7	25(100)	13.039	0.366
Group II Tetric Power Fill	2	4	3	10	6	25(100)		
Group III SDR Plus	0	2	1	12	10	25(100)		
Group IV Tetric Power Flow	0	1	0	11	13	25(100)		



There was a statistically non significant difference seen for the frequencies between the groups (p>0.05)

DISCUSSION

Resin composites are widely used for restoring cervical lesions. They are esthetic, mercury free and bond to tooth structure with the use of bonding systems59. The longevity of resin based composite depends on the interfacial bonding between resin and cavity walls, which should prevent the marginal microleakage that causes staining at the margins of restorations, recurrent caries, hyper sensitivity and pulp pathology66.

Microleakage is an important property that has been used in assessing the success of any restorative material used in restoring tooth. Improvements in resin composites have increased their usefulness as restorative materials; however, polymerization shrinkage continues to remain one of the primary deficiencies of composite restorations. Polymerization shrinkage causes contraction stress within the restoration that leads to microleakage, as well as stress within the surrounding tooth structure2.

The coefficient of linear thermal expansion of resin composites is three or four times that of tooth structure. In addition to the differences in thermal expansion coefficients, the shrinkage of composites during curing induces stresses at the tooth/restorative interface and generally results in gap formation. Therefore, polymerization shrinkage and the thermal expansion coefficient of these restorative materials have been suggested as major causes of microleakage67,68,69.

Other Possible reasons for microleakage at the tooth restoration margin are cavity configuration (C-factor), dentinal tubule orientation to the cervical wall (CEJ), organic content of dentine substrate and movement of dentinal tubular fluids, incomplete alteration or removal of smear layer by acidic primers (self-etch system) for adequate demineralization and hybrid layer formation, inefficient infiltration/ penetration of primer components into the demineralized collagen fibrils, physical characteristics of the restorative material, (filler loading, volumetric expansion, and modulus of elasticity), inadequate margin adaptation of restorative material, polymerization source photo initiator incompatibilities, and finishing and polishing effects2.

It is generally believed that the conventional composite materials should be polymerized in increments not thicker than 2mm. During the polymerization of a thicker increment, the material can pass through the gel point at different times at different depths. When the superficial material layers are already in post gel phase, the deeper layers have not yet reached the gel point. The superficial part of the material becomes firm, and the deeper part is still liquid. Application of large increments of material triggers a shrinkage stress rise, and therefore the reduction of this phenomenon is a particular challenge70,71.

The recommended alternative to layered techniques, the bulk-fill techniques, has taken up this challenge. The single increment application and polymerization method (the bulk-fill technique) proposed by the manufacturers of these composites did not compromise marginal adaptation of restorations. Bulk-fill composite materials evaluated in the present study seem to meet satisfactorily the requirements of this type of materials in terms of marginal adaptation. Bulk-fill composites are more translucent than other restorations, which allow the light to get to much deeper layers. The content of photo initiators of polymerization and stress inhibitors determines the optimal marginal seal of these composites72.

The current study examined the microleakage of different composite resins placed in class V cavities using a dye penetration test. In the present study, non carious Class V restorations were chosen for evaluation, because that the preparation of Class V cavities is minimal and their restoration is relatively easy, thereby reducing technique-sensitivity and operator-related variability. Secondly, Class V cavities have margins located both partly in enamel and partly in dentin. Moreover, class V cavities have high configuration factor (C-Factor). C-Factor is the ratio of bonded to the unbounded surface area. Class V restorations has high C-Factor (5) which is the reason for the internal bond disruption as well as microfissures around the restoration and cavity walls1,73.

To evaluate microleakage, methylene blue dye was used in this study. The diameter of dye molecules is 0.80nm that is less than the diameter of dentinal tubules (1-4μm) (Bayne and Thompson, 1998)51.

Thermocycling was done in this study because it is a widely used method in dental research, particularly when testing the performance of adhesive material. It aims at thermally stressing the adhesive joint at the tooth / restoration interface by subjecting the restored teeth to extreme temperatures encountered intraorally. This process may highlight the mismatch in thermal expansion between the restoration and tooth structure, resulting in different volumetric changes during temperature changes and causing fatigue of the adhesive joint with subsequent microleakage74. In this study Adper single bond II was used as a bonding agent for all the groups which may have influenced the marginal gap formation.

In this present study, There was a statistically non significant difference seen for the frequencies between the groups ($p>0.05$). But Tetric Power Fill (group II) showed least amount of microleakage scores followed by X-tra fil (Group I) , SDR Plus (group III) and the maximum was seen in Tetric Power flow (groupIV). The possible reason that Tetric Power Fill showed lower microleakage was that Tetric Power Fill was optimized by including a (β-allyl sulfone) addition fragmentation chain transfer (AFCT) reagent. AFCT reagent pushes an uncontrolled radical chain growth polymerization reaction toward a step growth-like polymerization reaction4.

During standard polymerization, excited photo initiators create radicals which attack the double bonds of monomers resulting in methacrylate addition. It can lead to materials with an uncontrolled and inhomogeneous network architecture4.

In Tetric Power Fill, the radicals can potentially attack either a methacrylate double bond of a monomer resulting in methacrylate addition or the double bond of a β-allyl sulfone resulting in chain transfer. In the case of chain transfer, the growing radical chain is terminated by forming an intermediate radical that undergoes fragmentation and forms a sulfonyl radical and a new double bond. Essentially successive shorter chain formation is favoured over standard radical long-chain growth, leading to a delayed gel point and a more homogenous network4,10.

Gorsche et al. showed that the addition of an AFCT reagent to monomer formulations improved the double-bond conversion and resulted in a more homogenous polymer network76. AFCT reagents therefore allow for a certain amount of control over the radical polymerization process. It is suggested that resultant materials should have reduced shrinkage stress, increased conversion and greater toughness77. Hee Young Park et al. showed allyl sulfide addition-fragmentation chain transfer reduces the final stress in ternary thiol-ene-methacrylate polymerizations by as much as 75% at high allyl sulfide concentrations75.

Other possible reason that Tetric Power Fill showed lower shrinkage than the conventional resin composite. This could be explained due to its pre-polymerized filler particles (shrinkage stress reliever) functionalized with silane, that seems to have relatively low elastic modulus (~10 GPa), causing it to act like a microscopic spring, attenuating the forces of shrinkage stress11,78.

Due to its low elastic modulus (10 GPa), the shrinkage stress reliever within Tetric PowerFill acts like a spring (expanding slightly as the forces between the fillers grow during polymerization) amongst the standard glass fillers which have a higher elastic modulus of 71 GPa. As a result, these Isofillers are capable of accommodating the tensile stresses that occur during polymerization11,78.

When comparing group II (Tetric Power Fill) and group IV (Tetric Power Flow) the result was statistically non significant ($p>0.05$). But Tetric Power Fill showed less microleakage then Tetric Power Flow. Due to the higher monomer and lower filler content, the amount of shrinkage in the flowable composites exceeds that of the sculptable composite10.

When comparing group III (SDR Plus) and group IV (Tetric power Flow), SDR Plus (group III) showed less microleakage than group IV. The possible reason could be: larger size of the SDR resin compared to conventional resin systems (molecular weight of 849 g/mol for SDR resin compared to 513 g/mol for Bis-GMA). The SDR technology comprises the unique combination of such a large molecular structure with a chemical moiety called a "Polymerization Modulator" chemically embedded in the center of the polymerizable resin backbone of the SDR resin monomer. The high molecular weight and the

conformational flexibility around the centered modulator impart optimized flexibility and network structure to SDR resin and it produce lower stress build up during polymerization9,79.

The microleakage scores of bulk fill SDR were in accordance with other similar studies conducted by Sahadev C K et al.80 and MirosBaw OrBowski et al72.

When comparing group I and group II (packable resin composite) with group III and group IV (flowable resin composite), the result showed statistically non significant difference ($p>0.05$). But packable resin composite (group I and group II) showed less microleakage than flowable resin composite (group III and group IV).

The possible reason could be: When the contents of the fillers increase, the contents of monomers decrease, resulting in a reduction of the total level of polymerization shrinkage and shrinkage stress and an increase in the flexural modulus of the material81.

Similar to our results, Jin-Young Kim et al. reported that high-viscosity conventional composites showed lower Volemetric Contraction than low-viscosity conventional composites8.

Similar to our results, Alagarsamy Venkatesh et al. reported that Filler volume fraction is inversely proportional to volumetric shrinkage. As the volume of filler content increases, the volume of resin matrix decreases and hence volumetric shrinkage reduces proportionately. The Monomer molecules which are held together by VanderWaals forces with the intermolecular distance of 0.3 nm - 0.4 nm are replaced by covalent bonds after their polymerization where the intermolecular distance is reduced to 0.15 nm. This reduction in the distance between the molecules leads to volumetric polymerization shrinkage82.

The present study also showed that microleakage at gingival margin in each of the groups was significantly more compared to the occlusal restoration. The possible reason could be: a) marginal seal at gingival margin restoration is less than occlusal which is due to better and stronger enamel band in occlusal because the enamel has an inorganic and hemogenous structure, b) the absence of dentinal fluid in its structure has betterment infiltration of monomer in micro tags after etching and resulted in better micromechanical bond. But dentin is a dynamic substrate that contains a significant proportion of the water and organic matter that damages bonding system by the current adhesive process40. This was in accordance with previous studies done by Anil kumar S et al74 and Kumar Gupta et al21.

De Munck et al83 and Manhart et al84 showed that the Microleakage in Class V restorations in the occlusal margin was significantly different with gingival margin and the microleakage at gingival margin was higher than the occlusal in all studies.

STUDY LIMITATIONS AND SCOPE FOR FURTHER STUDY

The present study was done under in vitro conditions and used natural extracted teeth for restoration, and thermocycling was used as part of test protocol.

In vitro studies are very important for an early assessment of the dental material. However, only a clinical study takes into account, all the potential variables that vary from patient to patient. Some of the variables include masticatory forces, types of food, oral temperature, and humidity variations and presence of salivary enzymes and bacterial by-products.

Many new restorative materials are evolving rapidly, each with better properties and promising results for better performance. Therefore, further studies are required to establish the factual clinical worth of these materials to validate their in vitro established results.

CONCLUSION

Within the limitations of the study,

1. None of four resin composite materials tested were free from microleakage.
2. All the four materials showed more microleakage at gingival wall compared to occlusal wall.
3. Tetric Power Fill showed the least microleakage at both occlusal and gingival walls.

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To Evaluate the Efficacy of Pedicled Buccalfat Pad as Interpositional Material in the Management of TMJ Ankylosis

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Abstract

Background - The purpose of the study is to determine the efficacy of pedicledbuccal fat pad as interpositional material in the management of TMJ ankylosis.

Results -. Based on the results of this study, we conclude that after release of TMJ ankylosis, inter positioning of pedicled buccal fat pad followed by vigorous physiotherapy is a successful strategy for the management of TMJ ankylosis. Advantages of BFP in terms of better functional movements, maintenance of intraarticular space and prevention of recurrence because of its vascularity and effective reduction in potential dead space. MRI studies on immediate, 3 months and 6 months followup have shown mild regression in volume of fat. Hence signifying the efficacyof BFP as inter positional material in management of TMJ ankylosis.

INTRODUCTION

Temporomandibular joint (TMJ) is a ginglymoarthroidal joint, it is the only mobile joint in the entire maxillofacial region and is a part of craniomandibular articulation. It is unique because of the fact that both the joints need to move simultaneously for proper functioning and the force per unit area is much larger than most weight bearing joints of the body.

TMJ Ankylosis is common problem in developed countries yetunfortunately it is quite common in underdeveloped world. Ankylosis is greek word meaning “stiff joint”.fossa. Surgery is the only effective mean for correction of in order to restore and maintain normal function. Treatment of true ankylosis is controversial but can be divided into

three groups: gap arthroplasty, inter positional arthroplasty, and total joint reconstruction using either autogenous or alloplastic materials.

A number of interpositional materials have been used including alloplastic materials (acrylic, proplast-teflon, silastic), and autogenous tissues (temporalis muscle flaps, dermis, costochondral grafts, metatarsal, fibula, tibia, iliac crest, cranial bone and sternoclaviculargraft and cartilage.)[77]

Pedicled buccal fat pads are used in the reconstruction of various oral and maxillofacial defects, and their use as interposition material after gap arthroplasty in cases of ankylosis of the temporomandibular joint (TMJ) has been well-documented. Their proximity to the surgical defect, their blood supply, and their easy availability makes them a versatile option for interposition after gap arthroplasty and after replacement of the TMJ.[76] Anatomically a buccal fat pad has a body and four processes (buccal, pterygoid, superficial, and deep temporal), and one of the main advantages is the pedicled blood supply. Interposition of a pedicled buccal fat pad reduces the dead space, prevents formation of a hematoma, reduces the formation of heterotopic bone, and consequently improves the range of movement of the jaw.[74]

MATERIAL & METHODS

Study Site

The study was conducted in the Department of Oral & MaxillofacialSurgery, RUHS College of Dental Sciences& Hospital, Jaipur, Rajasthan.

Study Subjects

All TMJ ankylosis patients for study were selected from the Department of Oral &Maxillofacial Surgery, GDC Jaipur between march 2019 – February 2020 subjected to the following criteria and conditions; for surgical management of TMJ ankylosis.

Inclusion Criteria

1. Patient of any gender, religion or socioeconomic status.
2. Patient suffering from unilateral or bilateral ankylosis
3. Patient falling in any type of Sawhney's classification
4. Both non operated and recurrent cases

Exclusion Criteria

1. Medical contraindication for surgery
2. Refused consent

Basic oral and maxillofacial surgical instruments

Examination of each patient was done in the following order-

Inspection - extra oral examination was carried out to look for

- Mouth opening
- Facial deformity
- Chin deviation
- Scar mark

Intraoral inspection was done for:

- Midline deviation
- Mid incisor shifting
- Maximum Lateral excursion
- Maximum protrusion
- Occlusion

Palpation

Both affected and non-affected side of TMJ were examined for restricted/ diminished movements. Both joints were palpated at rest as well as during function:

- Chin deviation was measured on mouth opening and without mouth opening from midline considering as a guide line with other clinical parameters.
- Antegonial notch was also palpated on affected side.

Radiological examination

1. Pre operative 3-D CT SCANS in all patients with both coronal and axial view were obtained to determine the extent of ankylosis in mediolateral direction.
2. Post operative CT SCANS
3. Immediate and follow up post operative MRI in sequence-T1,STIR AXIAL,T1 and CORONAL,T2 SAGGITAL in close and open mouth position to evaluate viability of buccal fat pad, it's presence or absence as inter positional material , intensity of fat present and it's volume in cc.

Photographs

Preoperative, intra operative and postoperative photographs were taken for comparison and to visualize gradual changes at follow upperiod.

Preanaesthetic evaluation

All patients undergoing surgery have undergone preanaesthetic evaluation using routine blood profile, chest radiograph and other relevant investigations as the particular case required.

Anesthesia

All the patients were operated under general anesthesia with fiberoptic assisted naso-endotracheal intubation. Intravenous glycopyrrolate and midazolam were given as premedication. All patients were induced with inhalational isoflurane and intravenous fentanyl, succinylcholine and propofol. And maintained with inhalational isoflurane, 1:1 nitrous oxide: oxygen mixture and atracurium. Reversal was done with intravenous neostigmine and glycopyrrolate.

Surgical Technique

1. Exposure

The TMJ was approached through Alkayat Bramley incision ***(fig.1)***. Incision was carried through the skin and superficial fascia to the level of the temporal fascia. Starting at the root of the malar arch, an incision running at 45 ° upwards and forwards is made through the superficial layer of the temporal fascia ***(fig.2)***. The periosteum over the arch was incised horizontally, and the incision was continued inferiorly over the bony mass and extended to the identifiable unaffected portion of the ramus. The masseter muscle was dissected off the zygomatic arch, exposing the posterior and anterior border of ramus. After exposure and identification of the site of ankylotic mass ***(fig.3)***, aggressive excision of bony mass was performed.

2. Osteoarthrotomy

Bony block removal was executed using a combination of motorised surgical burs and osteotome and mallet. A plane was created with osteotome to complete the separation of the ankylotic mass and the roof of the glenoid fossa. Also special attention was directed to the medial aspect of joint to ensure the total resection. After resection, bur was used to reshape the glenoid fossa. When the excision was complete, usually created gap was 0.5 to 1 cm ***(fig4)***. The maximal opening was at least 30-35 mm ***(fig.7)***

3. Ipsilateral and contralateral (if necessary) coronoidectomy/ Coronoidotomy

In cases with long standing ankylosis, the ipsilateral, and sometimes the contralateral coronoid processes become hyperplastic, thus they create additional obstruction to jaw movement even after removal of ankylotic mass. Thereby, through the same incision, ipsilateral coronoid was resected. If the maximal incisal opening (MIO) remained less than 35 mm, the contralateral coronoid was also resected through intraoral incision.

4. Herniation and interpositioning of buccal fat pad

The BFP was approached through the same preauricular incision asused for TMJ exposure. The main body of BFP and its temporal extension lie in close proximity to coronoid process and temporalis muscle tendon (Diagram. 1)

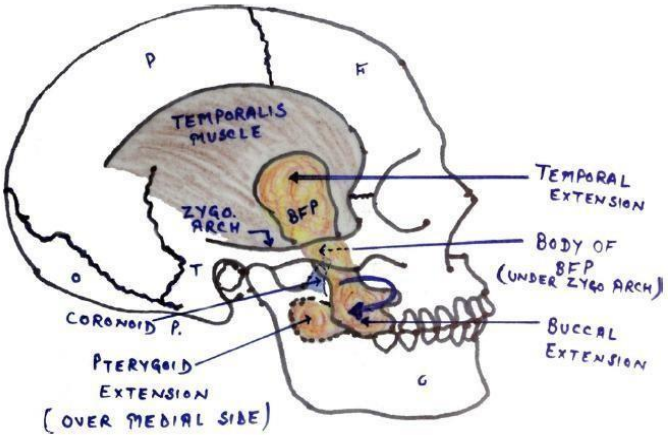


Diagram -1

The periosteal elevator was inserted anterior to the coronoid process. Blunt dissection was done with curved haemostat anterior and medial to the coronoid process to breach the periosteum. External pressure was applied over the cheek area by an assistant. The BFP easily popped into the operative area ***(fig.5)***. A continuous traction was applied to BFP with one curved artery forceps while another was used to open thesurgical field. The BFP could be easily manipulated and brought to the TMJ region. Depending upon the amount of the fat required, temporal or buccal or both processes of fat pad were manipulated and used as pedicled fat flap. The BFP was sutured to the adjoining tissue with one or two absorbable sutures ***(fig.6)***. Incision was closed layerwise ***(fig.8)*** and dressing was done.

5. Early mobilization of jaw & aggressive physiotherapy

In all patients physiotherapy was started on second postoperative day with heister (jaw opener). Patients were instructed to strictly follow the aggressive physiotherapy for at least one year.

Fig.1 Marking of Alkayat- Bramley incision

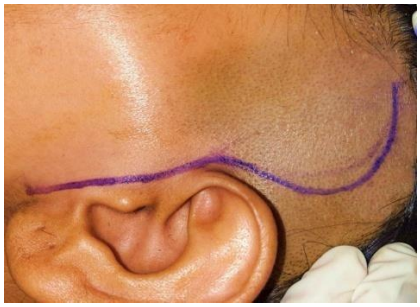


Fig.2 Oblique incision through the superficial layer of the temporalis

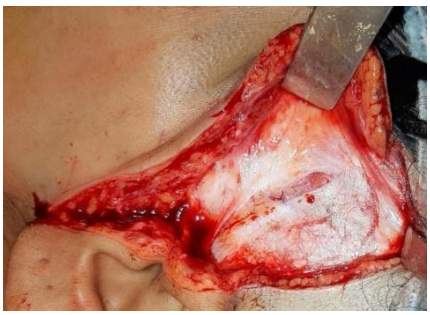


Fig.3 Exposure of ankylotic mass

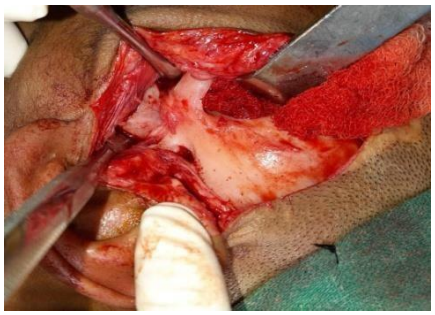


Fig.4 Osteoarthrotomy done and gap of 1 cm created

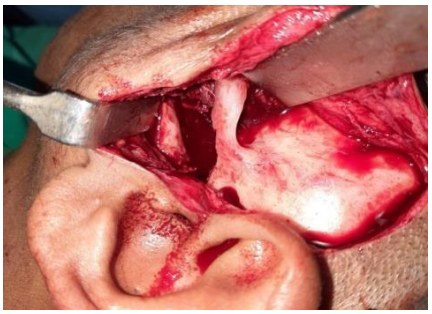


Fig.5 Herniation of buccal fat pad through fascial envelope

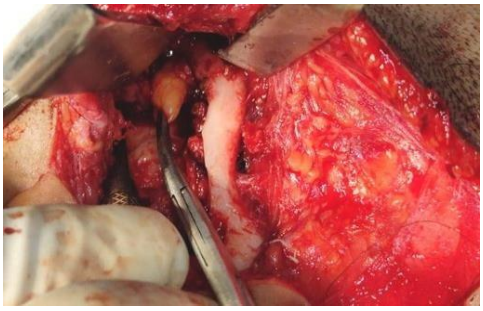
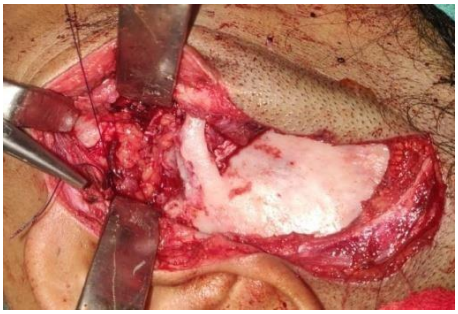
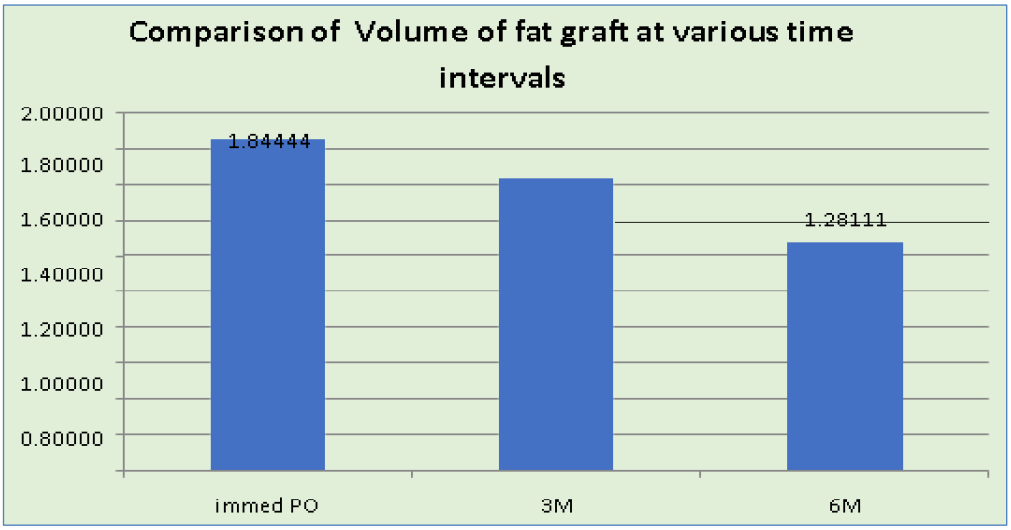


Fig.6 Packing of buccal pad fat into dead space created



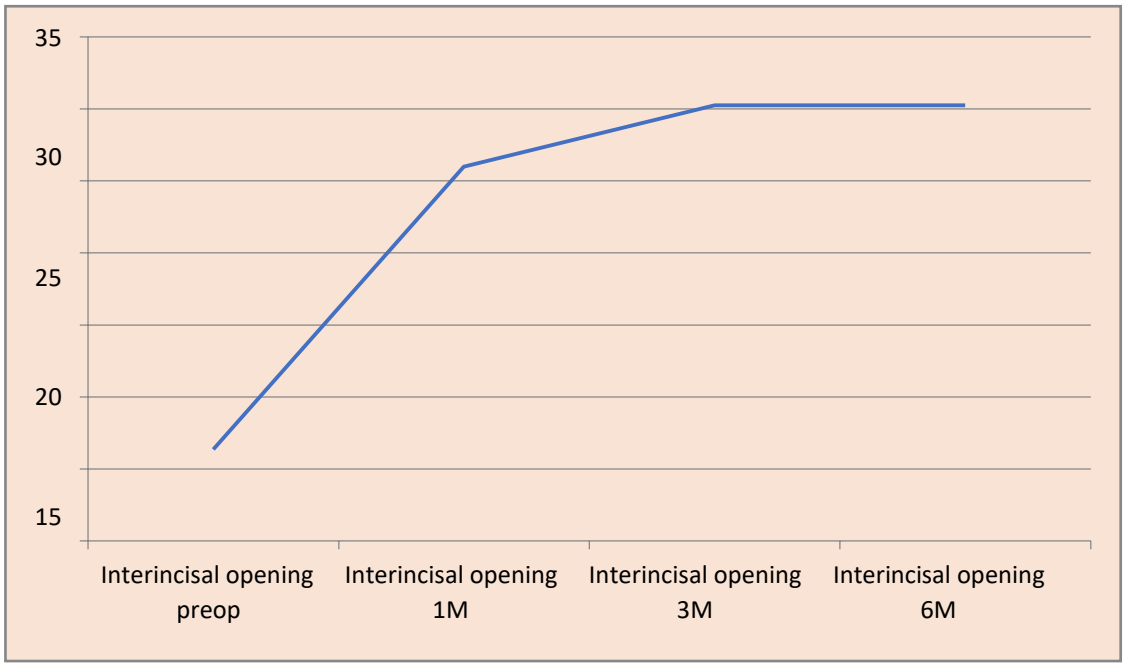
OBSERVATIONS AND RESULTS



In all the patients immediate post operative MRI revealed hyper intense fat within and along lateral aspect of joint which was of grade 1 intensity except for one patient where it was of grade 2 intensity.

On follow up postoperative MRI intensity of fat graft reduced and was of grade 2 /grade 3 intensity as graft was subjected to constant motion of normal TMJ movement.

Since the p value is <0.01, suggestive of statistically highly significant difference in volume of fat among different time intervals which means volume of fat shrinked with time.



The mean interincisal opening in mm and improvement at the end of 1st month, 3 months and 6 months is depicted in the table.

Preoperative mean interincisal mouth opening was 6.38 mm with standard deviation of 5.290.

At the end of first postoperative month, mean interincisal mouth opening was 26.00 mm with standard deviation of 3.703.

At the end of 3rd postoperative month, mean interincisal mouth opening was 30.25 mm with standard deviation of 4.833.

At the end of 6th postoperative month, mean interincisal mouth opening was 30.25 mm with standard deviation of 4.833.

Since the p value is<0.01, suggestive of statistically highly significant difference (all means were not alike).

Comparison of Pre & Post opearative Midline Deviation

	N	Mean	Std. Deviation	Minimum	Maximum	Median	Meanrank	Chi square value	p value of Friedman Test
Preop	8	2.25	1.581	0	4	2.50	3.06	9.000	.029
Post op1month	8	1.75	1.669	0	4	2.00	2.31		
Post op 3 month	8	1.75	1.669	0	4	2.00	2.31		
Post op 6 month	8	1.75	1.669	0	4	2.00	2.31		

Midline deviation: two reference marks were made over maxillary dentition corresponding to the mandibular midline at resting position and at open mouth position. The horizontal distance in mm between reference marks at resting position and mesioincisal angle of maxillary central incisor was read as midline deviation at close mouth position whereas distance between two reference marks was read as midline deviation on mouth opening.

The mean of preoperative midline deviation is 2.25 with standard deviation of1.581.

Mean of 1 month postoperative midline deviation is 1.75 with standard deviation of 1.669.

Mean of 3 months postoperative midline deviation is 1.75 with standarddeviation of 1.669.

Mean of 6 months postoperative midline deviation is 1.75 with standarddeviation of 1.669.

Since the P value is 0.029 which is <0.05, suggesting statistically significantdifference.

DISCUSSION

TMJ ankylosis is one of the most disabling condition which can affect a person. This condition during childhood will jeopardize proper development of face and result in considerable facial deformity, lack of function, social unacceptance and psychological stress. Along with this loss of masticatory ability, pain from infected teeth which cause extensive agony cannot be removed due to restricted mouth opening, improper oral hygiene, amount to a social and physical handicap.[81]

The primary goal of treatment of TMJ ankylosis is to restore the jaw function as well as prevent recurrence. Conventional methods for treatment of ankylosis were mainly dependent on gap arthroplasty and placement of interpositional autogenic or all oplastic graft to decrease or prevent fibrous formation and the chances of reankylosis. Surgical method of release and correction has been directed toward the creation of pseudoarthrosis.[4,5]

Interpositional arthroplasty is widely accepted as the primary surgical treatment for TMJ ankylosis. Rowe (1982)[38,39] laid down certain criteria for restoration of ankylosed TMJ cases. The prime objective which he emphasized was release of ankylosis by cutting 1.5 – 2 cm of ankylosed bone thus achieving a functional articulation with adequate mouth opening. He further emphasized that lost capability of growth can be restored in young children by use of autogenous graft with growth potential, improving existing facial deformity. Inspite of implanting a growth centre, the remnant facial deformity must be corrected by orthosurgical procedures. All these procedures should be done with all precaution to prevent relapse.

Based on the results of this study, we conclude that after release of TMJ ankylosis, inter positioning of pedicled buccal fat pad followed by vigorous physiotherapy is a successful strategy for the management of TMJ ankylosis. Advantages of BFP in terms of better functional movements, maintenance of intraarticular space and prevention of recurrence because of its vascularity and effective reduction in potential dead space. MRI studies on immediate, 3 months and 6 months followup have shown mild regression in volume of fat. Hence signifying the efficacy of BFP as inter positional material in management of TMJ ankylosis.

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Efficacy of Single Piece Basal Implant in Dentoalveolar Rehabilitation

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Abstract

Background: The purpose of this study is to study the effectiveness of single piece basal implant in dentoalveolar rehabilitation of partially and complete edentulous patients using IOPAR at regular intervals and observation of implant mobility ad gingival index.

Methods: The Present study was conducted in the postgraduate clinic and Implant clinic of the Department of Oral & Maxillofacial Surgery RUHS College of Dental Sciences, Jaipur to clinically evaluate the basal cortical implant. The definition of implant success was based on the following clinical and radiologic criteria:

1) Absence of clinically detectable implant mobility,
2) Absence of pain or any subjective sensation,
3) Absence of continuous radiolucency around the implant.

Hard tissue parameters using IOPA radiographs were taken using the Parallel cone technique and assessed at the time of loading 1, 3 and 6 months.

Results: The present study was done to evaluate the success of single piece basal implant in dentoalveolar rehabilitation. In the present study 50 BCS implants were placed in 15 patients (3 female and 12 male) and loaded immediately, who report to the postgraduate clinic of oral and maxillofacial surgery, which showed promising results at a follow- up of 6 months. Observation was made at time of loading(baseline), postoperatively on 1month, 3 month and 6 month, eight factors were evaluated namely mobility, periimplant radiolucency, mean probing depth, pain, implant mobility, peri-implant radiolucency, gingival inflammation, sinus discharge, marginal bone loss and paraesthesia. 42 implants show crestal bone loss, 8 implants show crestal bone gain at the time of 6 months follow up as compare to crestal bone level at the time of loading.

INTRODUCTION

The elusive dream of replacing missing teeth with artificial analogs has been part of dentistry for a thousand years. Conventional rehabilitation of partial or complete tooth loss has limitation for many people and such devices can cause eating difficulties, psychological problems and problems related to esthetics, retention and stability of prosthesis. Because of these problems, patients often suffer decreased self confidence and develop psychological problems.

Definition of Corticobasal Implants: Corticobasal implants are implants which are osseo-fixated in cortical bone areas with the intention to use them in an immediate loading protocol. The "Consensus on Basal Implants" (2018) of the International Implant Foundation applies to such corticobasal implants.

RATIONALE FOR USING BASAL IMPLANTS: According to the concept of basal implantology the jaw bone comprises of two parts the tooth bearing alveolus or crestal part and the basal bone. The crestal bone is less dense in nature and is exposed to infections from tooth borne pathologies, injuries or iatrogenic factors and is therefore subject to higher rate of resorption whereas the basal bone is heavily corticated and is rarely subject to infections and resorption. It is this, i. e. ; the basal bone that can offer excellent support to the implants because of its densely corticated nature, at the same time the load bearing capacity of the basal bone is many times higher than that offered by the spongy crestal bone. This rationale stems from Orthopedic surgery and from the experience that cortical areas are essential, since, they are resistant to resorption, as a result basal implants are also called as "Orthopedic Implants"

SURGICAL TECHNIQUE

Unlike conventional implants basal implants have a different surgical approach. The technique is simple and easy to execute and does not involve extensive drilling of bone thus avoiding thermal injury. Throughout the surgery the mode of irrigation used is external and usually for almost any case a single pilot osteotomy with a "Pathfinder Drill" is sufficient for KOS, KOS Plus and BCS implants, the kit also consists of manual drills for a controlled osteotomy preparation. Basal implantologists do not advocate raising a flap for these implants as it results in a decreased blood supply and also because of the design of these implants raising a flap is pointless, another factor to be considered is the immediate loading of these implants; a sutured site is not a favorable area to receive an immediate prosthesis

MATERIALS AND METHODS

The Present study was conducted in the postgraduate clinic and Implant clinic of the Department of Oral & Maxillofacial Surgery RUHS College of Dental Sciences, Jaipur to clinically evaluate the basal cortical implant

The definition of implant success was based on the following clinical and radiologic criteria:

1) Absence of clinically detectable implant mobility,
2) Absence of pain or any subjective sensation,
3) Absence of continuous radiolucency around the implant.

Hard tissue parameters using IOPA radiographs were taken using the Parallel cone technique and assessed at the time of loading 1, 3 and 6 months.

Change in crestal bone level was measured in millimetres by comparing the radiographs which is taken at the time of loading to the most recent radiographs available for review. Changes in bone levels over time were estimated by direct measurements on non-standardized, periapical radiographs. The length (mm) of the implant was measured on the radiographs from the implant-abutment interface to the apex of the implant which standardizes the measurements and reduces the margin of error. Next, the distance between the observed crestal bone level and the implant-abutment interface was measured at the mesial and distal implant surfaces. The actual implant length was known based on manufacturing standards. To adjust the measurements for magnification error, the following equation was used to determine the corrected crestal bone levels:

Corrected crestal bone level

$$= \textbf{Measured crestal bone level} \times \frac{\textbf{actual implant length}}{\textbf{measured implant length}}$$

MATERIALS AND EQUIPMENT / ARMAMENTARIUM

The following standardized materials and equipment/armamentarium were used for the purpose of study.

a) The implant system used in this study was Simpladent Implant System; Implants were of lengths 10, 12, 14, 17, 20, 23, 26, 29 mm. The implants were available in diameter of 3. 6mm.

b) Surgical Armamentarium for Surgery

1. Surgical Guide Drill: Pilot drill was generally used to initiate the bone drilling.
2. Surgical Twisted Drills: Surgical twist drills of various diameters ranging from 2. 0 mm to 2. 8mm were used in sequence to prepare the site.
3. Depth Gauge/Paralleling Pins: These gauges were used to obtain parallel preparation and to guide the direction of drilling preparation. They were also used to measure the depth of the surgical preparation for implant placement.
4. Physiodispenser and Reduction handpiece with internal Q irrigation: used for bone drilling
5. Hex Ratchet: Hex ratchet was used to engage the fixture insertion tools to screw the implant in its proper position.
6. Standard Diagnostic Tools; Mirror, Probe, Tweezers, Tooth tissue holding forceps, needle holder and scissor were used.

METHOD

All patients reporting to the outdoor patient department were evaluated for implant insertion. The study comprised of 15 patients for 48 implants (age range from 18 to 72 years) were selected for implant placement. Patients were accepted into the study based on the following

Inclusion Criteria

- Patient above age of 18 years and medically fit.
- Two stage implant or bone augmentation has failed.
- All kind of bone atrophy.
- Poor prognosis of teeth or missing teeth.
- Also cases where alveolar bone is lost.

Exclusion Criteria

- Medical condition; Medically unfit patient
- Pt. with large preiapical pathology
- Medicines;drugs like Biphoshphonates
- Irradiated cancer pt.
- Any other dental or medical contraindication
- If immediate loading is contraindicated. Like deep bite, bruxism etc.

The baseline clinical examination consisted of a thorough medical and dental history, general and oral health status, assessment of future implant site. The available vertical, mesiodistal and labiolingual bone dimension were determined by palpation, radiograph. Intraoral periapical radiographs and CBCT were done to evaluate the volume of remaining bone. In order to prevent infection all surgical procedures were performed under strict aseptic conditions with greatest attention paid for preservation of implant bed. The dental unit, instrument tray, patient, operating assistants were covered with sterile drapes. Sterile surgeon gowns face masks, gloves and instruments were indispensable. The surgical armamentarium including the tool kit was autoclaved.

The written and informed consent was taken from the all subjects prior to the start of the procedure.

Preparation for surgery was made according to standard protocols.

Amoxicillin (1 g) and dexamethasone (8 mg) were administered 1 hour prior to surgery. Following administration of local anesthesia (2% xylocaine with 1: 80, 000 adrenaline). Teeth were carefully luxated and removed with forceps. Care was taken not to fracture the buccal plate of bone and to retain gingival tissue attachment at the mesial and distal crestal bone.

Extraction sockets were debrided with hand instruments to remove granulation tissue if required and prepared for implantation.

In case of healed socket Basal implantologists do not advocate raising a flap for these implants as it results in a decreased blood supply and also because of the design of these implants raising a flap is pointless,

another factor to be considered is the immediate loading of these implants; a sutured site is not a favorable area to receive an immediate prosthesis.

PLACEMENT OF IMPLANTS AND IMPRESSION MAKING

The oral cavity was rinsed with 1% Povidone Iodine mouth wash prior to the implant placement procedure. Local infiltration with 2% Lignocaine and 1:80000 Adr was done for mandibular procedures. However, for maxillary procedures, a nerve block along with local infiltration, akin to a dental extraction procedure was carried out. A straight surgical handpiece with a physio dispenser with 1:1 torque and 20000 rpm were used to drill the osteotomy. The path finder (pilot) drill was used in mandibular anterior region where the bone appeared to be very hard, however for all other sites the osteotomy was done using a 2mm (30/40mm) twist drill directly. The osteotomy depth and direction were decided intraop depending on the tactile feedback indicating penetration of the second / third cortical bone.

Various principles of cortical engagement were used in order to firmly place the implants in the residual alveolar ridge. The implant heads were subsequently bent to achieve approximate parallelism using the insertion adapter and or ratchet. No torque measuring device was used in our study, the firmness of the implant was determined empirically.

Pickup impression was made after placement of the impression caps on the implants using addition silicone impression material on stock trays. In case of full mouth restorations or long span segments the impression caps were stabilized using light cure composite material. The occlusal reduction of the implants was then carried out for single tooth and segment cases in order to remove occlusal interferences, this however was not required to be done in full mouth rehabilitation cases. The patient was prescribed broad spectrum antibiotics as per the following regimen: Tab Amoxicillin + Clavulanic acid 1. 2 gms BD, Tab Tinidazole 500 mg BD, Tab Ibuprofen 400 mg + Paracetamol 325 mg, Tab B Complex OD, and Tab Ranitidine 150 mg BD. An OPG was done to verify the implant placement.

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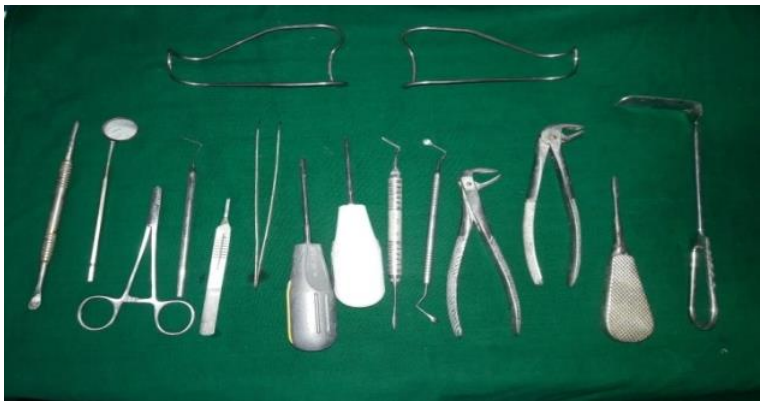
ARMAMENTARIUM



Observation and results: The present study was done to evaluate the success of single piece basal implant in dentoalveolar rehabilitation. In the present study 50 BCS implants were placed in 15 patients (3 female and 12 male) and loaded immediately, who report to the postgraduate clinic of oral and maxillofacial surgery, which showed promising results at a follow- up of 6 months. The observed factors were graded as:

Observation were made at time of loading(baseline), postoperatively on 1month, 3month and 6 month, eight factors were evaluated namely mobility, periimplant radiolucency, mean probing depth, pain, implant mobility, peri-implant radiolucency, gingival inflammation, sinus discharge, marginal bone loss and paresthesia.

Pain (VAS)	0 - No pain 1- 3-mild pain 4 -7 moderate pain 8-10 severe pain
Swelling	Present = 1 Absent = 0
Implant Mobility	Present = 1 Absent = 0
crownMobility	Present = 1 Absent = 0
Peri-implantradiolucency	Present = 1 Absent = 0
MeanProbingdepth	in mm.
Gingivalinflammation	No inflammation = 0 Mild inflammation = 1 Moderate inflammation = 2 Severe inflammation = 3
Sinus discharge	Present = 1 Absent = 0

Intra group comparision was done using repeated measures ANOVA(for x>2 observations)
Comparision of frequencies of categories of variables with groups was done using chi-square Test
For all the statistical tests, p<0. 05 was considered to be statistically significant, keeping α error at 5% and β error at 20%, thus giving a power to the study as 80%.
* = statistically significant difference (p<0. 05)
** = statistically highly significant difference (p<0. 01)
# = non significant difference (p>0. 05) … for all tables

TABLE SHOWING MEAN AGE OF THE SUBJECTS

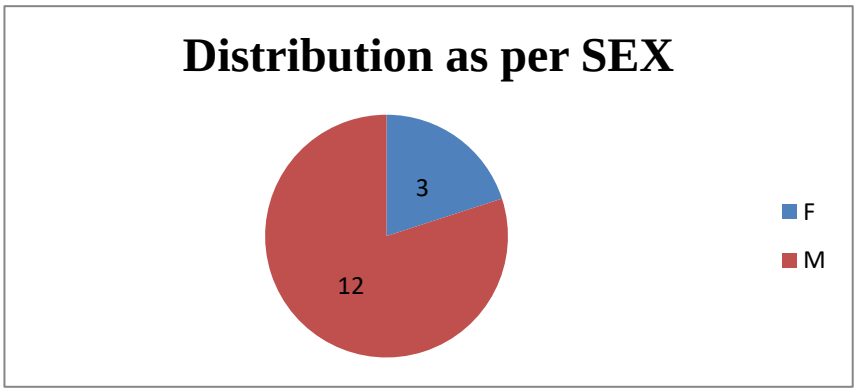
	N	Minimum	Maximum	Mean	Std. Deviation
AGE	15	17	78	41. 73	21. 319

Age of participants was in between 17-78 years. the mean age was 41+-21

FREQUENCY TABLES

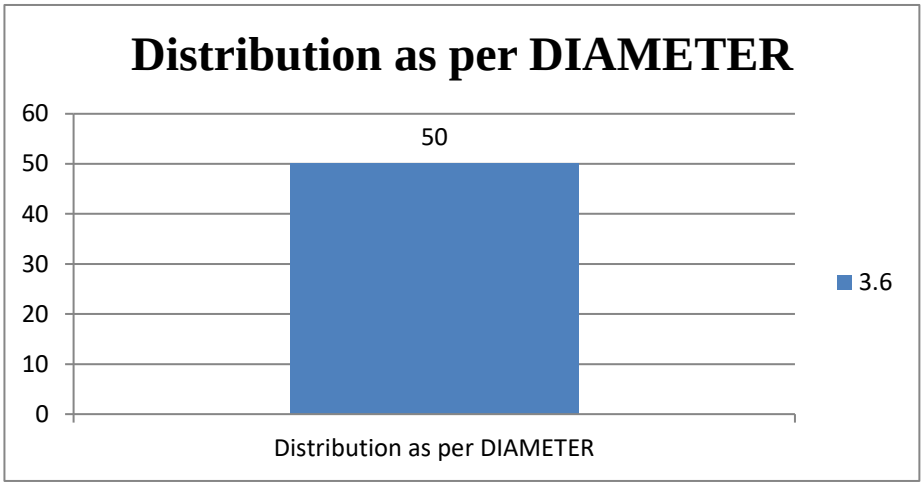
Distribution as per SEX

	Frequency	Percent
F	4	36
M	11	80
Total	15	100.0



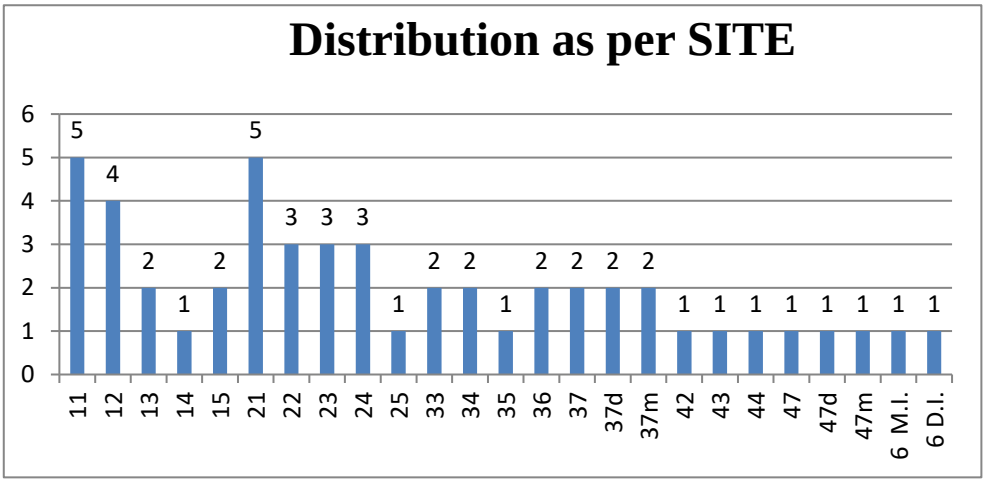
Distribution as per SITE (tooth no.)

	Frequency	Percent
11	5	10. 0
12	4	8. 0
13	2	4. 0
14	1	2. 0
15	2	4. 0
21	5	10. 0
22	3	6. 0
23	3	6. 0
24	3	6. 0
25	1	2. 0
33	2	4. 0
34	2	4. 0
35	1	2. 0
36	2	4. 0
37	2	4. 0
37d	2	4. 0
37m	2	4. 0
42	1	2. 0
43	1	2. 0
44	1	2. 0
47	1	2. 0
47d	1	2. 0
47m	1	2. 0
6 M. I.	1	2. 0
6 D. I.	1	2. 0
Total	50	100. 0



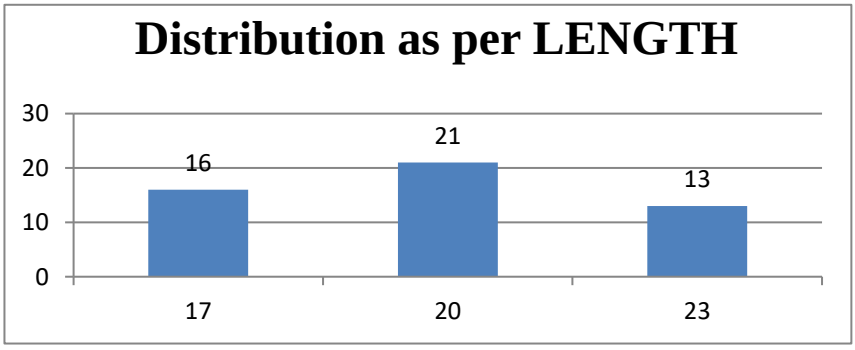
Distribution as per DIAMETER (in mm.)

	Frequency	Percent
3. 6	50	100. 0



Distribution as per LENGTH

	Frequency	Percent
17	16	32. 0
20	21	42. 0
23	13	26. 0
Total	**50**	**100.0**



Time has been denoted as

1. Baseline
2. 1M
3. 3M
4. 6M

Analysis of pain with the help of visual analogue scale

	TIME	Mean	Std. Deviation	p Value
PAIN	1	1. 90	. 735	
	2	. 00	. 000	
	3	. 14	. 351	. 000**
	4	. 00	. 000	

Pain scores are discrete values, Intra group comparison was done using repeated measures ANOVA (for >2 observations). There was a statistically highly significant difference seen for the values between the time intervals as the p value is 0. 000 (p<0. 01), and according to VAS score it was noted that only mild pain felt during surgery. Pain was gradually decreased with time which showed statistically significant results and success of the surgery, just like pain mild swelling noted immediately after implant placement that swelling was gradually decreased with time period, three months after loading few patients feel pain which might be due to high points on prosthesis, which get corrected and reduction in pain at six months which showed statistically significant

Distribution of probing depth at different time period

	MEAN	S. D.	p VALUE	INF
BASE LINE	0. 32	. 513	. 000	HS
1 MONTH	0. 52	. 614	. 000	HS
3 MONTHS	0. 64	. 693	. 000	HS
6 MONTHS	0. 98	. 685	. 000	HS

Table showed probing depth which was noted at the time of loading and consecutive follow ups. probing depth increases with time which was noted 0. 32+-0. 51mm at the time of loading and which was increases up to 0. 98-+ 0. 68 at the time of 6 month follow up. there was a statistically highly significant difference seen for the values between the time intervals as the p value is 0. 000 (p<0. 01) for periodonta pocket with higher values at 6 month.

Distribution of gingival inflammation at different time period

	MEAN	S. D.	p VALUE	INF
BASE LINE	. 06	. 240	. 164	NS
1 MONTH	. 20	. 404		NS
3 MONTHS	. 16	. 370		NS
6 MONTHS	. 10	. 303		NS

Table showed gingival inflammation at different follow up period. Gingival inflammation was gradually decreased with the time period which showed non-statistically significant results.

Distribution of marginal bone level at different time periods

	MEAN	S. D.	p VALUE	INF
BASE LINE	3. 000000	2. 1505585	. 000	HS
1 MONTH	4. 000816	1. 7479426		HS
3 MONTHS	4. 379400	1. 7831735		HS
6 MONTHS	4. 773958	1. 6918449		HS

Table shows the bone level changesat different time period which is measured at mesial/distal side for implants placed ad immediatelty loaded. Table shows the bone level changes at different time period (Baseline, 1, 3and 6months). Marginal boe loss increases with time which was noted 3. 0+-2. 1mm at the time of loading and which was increases up to 4. 77+- 1. 6 at the time of 6 month follow up. there was a statistically highly significant difference seen for the values between the time intervals as the p value is 0. 000 (p<0. 01) for marginal bone loss with higher values at 6 month.

Total 50 implants placed, 42 implants shows crestal bone loss, 8 implants shows crestal bone gain at the time of 6 months follow up as compare to crestal bone level at the time of loading

COMPARISON OF CATEGORICAL VARIABLES WITH TIME

IMPLANT MOBILITY * TIME

		TIME				Total	Chi square value	p value
		1	2	3	4			
IMPLANT MOBILITY	**0**	50	50	50	50	200	---	---
	Total	50	50	50	50	200		

Table showed mobility-wise success at the time of loading, 1, 3 and 6months after loading. There was no any mobility noted after loading of implant. Not a single implant was mobile or failed

a. No statistics are computed because data (implant mobility) is a constant

PERIIMPLANT RADIOLUCENCY TIME

		TIME				Total	Chi square value	p value
		1	2	3	4			
PERIIMPLANT RADIOLUCENCY	0	50	50	50	50	200	---	---
	Total	50	50	50	50	200		

Table showed peri-implant radiolucency wise success of implant, At the time period of 6 months no implant shows periimplant radiolucency

No statistics are computed because IMPLANT MOBILITY is a constant

SUPURATION TIME

		TIME				Total	Chi square value	p value
		1	2	3	4			
SUPURATION	0	50	50	50	50	200	---	---
	1	0	0	0	0	0	000	---
	Total	50	50	50	50	200		

Table showed suppuration wise success of implant, At the time period of 6 months no implant shows sius discharge

No statistics are computed because data is a constant

PARASTHESIA TIME

		TIME				Total	Chi square value	p value
		1	2	3	4			
PARASTHESIA	0	50	50	50	50	200	---	---
	1	0	0	0	0	0	000	---
	Total	50	50	50	50	200		

Table showed parasthesia wise success of implant, At the time period of 6 months no implant shows parasthesia

No statistics are computed because data is a constant

SUMMARY AND CONCLUSION

The present study was done to evaluate efficacy OF SINGLE PIECE BASAL IMPLANT IN DENTOALVEOLAR REHABILITATION. The osteotomy was performed and 50 implants were placed in 15 patients (11 male and 4 female) who reported to the Postgraduate Clinic of oral and maxillofacial surgery department. Observation was made post-operatively as the baseline, further observations were made at follow up visits at 1, 3 and 6 months interval from the baseline. After stage II surgery eight factors were evaluated namely pain, implant mobility, peri-implant radiolucency, mean probing depth, gingival inflammation, sinus discharge (suppuration), parasthesia and marginal bone loss. All the fifty implants were placed using a high torque hand piece to prevent the drill from stopping while drilling. Drilling was done at the rate of 1000-1500rpm with continuous irrigation using chilled saline to avoid the overheating of the surrounding bone. In order to control the speed of drilling, the control box knob was set at the level of 1000 rpm. All implants were snugly fitted using strict asepsis.

In the present study all the 50 implants were free of mobility, peri implant radiolucency, sinus discharge for the first 4-6 months. All the 50 implants were perfectly engaged In cortical bone.

The mean probing depth was evaluated by Williams periodontal probe at 1st, 3rd month and 6th month and there was no significant difference in mean probing depth taken at various interval of time for both groups.

The assessment of changes in marginal bone height and mobility is considered an important parameter in evaluating implant success. In this study, with the radiographs taken as a baseline the bone level at mesial /distal areas and there was noted some amount of loss in crestal bone level as compare to bone present at the time of loading. The overall survival rate of implants in present study was 100%) which is in accordance with most of the long term clinical studies done on implants.

Overall summary can be drawn from this study that the implants placed either in extraction/healed socket will heal predictably and there are reductions in the treatment time required. After extraction of teeth, bone present at a site will heal and remodel till 6 months to 1 year. So there is change in bone level

around implant in some amount either gain or loss is predictable and natural. To conclude we can say that though the survival rate in present study was good, study shows some amount of loss in crestal bone level and there is no significant difference found in healing and crestal bone level in both groups till 6 months of follow up, yet since the study was of a very short duration with a small sample size and no histological evaluation was done to measure the crestal bone level changes and bone implant integration and the success rate of the implants, Further longitudinal clinical studies with large sample size and also with histological evaluation are required to actually assess the changes in crestal bone level around implants.

THUS WE CAN CONCLUDE THAT….

BASAL IMPLANT IS SUCCESSFUL TREATMENT MODALITY IN CASES OF IMMEDIATE LOADING

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A Clinical Evaluation of Inter Observer Variability in Shade Selection by Using Conventional and Spectrophotometric Shade Matching Devices

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Abstract

Determining an accurate shade match is one of the most critical steps for cosmetic procedures. Shade selection for dental restorations is usually done visually by matching with a shade guide. Different persons may make different interpretations of the light stimulus, and thus shade selection could become a subjective assessment. Aim of this study was to assess the reliability of shade matching of dentists using conventional shade matching systems and to analyse if knowledge and experience of dentists affect the shade selection of natural teeth for restorative rehabilitation.

Settings and Design: A total of 30 undergraduate dental students studying in M. G. Dental College were selected as subjects for the study after fulfilling exclusion and inclusion criteria. Ten investigators comprising dental surgeons with different levels of training and experience were included in this study.

Methods and Material: The shade selection of right maxillary central incisor of each subject was done by all nine investigators (Group 1,2 & 3) using both Vita classical and Vitapan 3D Master tooth shade guides and the values were recorded. Consequently, the principal investigator (Group 4) recorded shade of each subject using Digital Spectrophotometer and the readings were noted down. Finally, all the data recorded were converted to mathematical coordinates according to CIE-L*a*b values.

Statistical analysis used: All statistical analysis were performed using IBM SPSS 19.0 Software.

Result: Results showed that there was no significant difference amongst different groups but there was significant difference when the group 1, group 2 and group 3 were compared with group 4.

Conclusions: This study showed that among the groups of investigators, dental interns showed a slight edge over postgraduate students and senior faculty.

Keywords: Shade Selection, Inter-obsever, Spectrophotometer, CIE L*a*b*.

INTRODUCTION

One of the main driving forces in dentistry today is the need to provide restorations that match the colour of the existing dentition. However, selecting the correct shade and fabricating a restoration to match this colour is subjective and therefore varies between individuals. Included within restorative and esthetic dentistry is color science, in the practice of shade matching. Today's color science principles still originate with Newton in the 1600s and are still based on Munsell's basic three-dimensional notation theory of the early 1900s.[1]

While color instrumentation and shade matching procedures have been widely addressed in dental literature, the most popularly used shade guides have not changed much through the last 50 years. The Vita Toothguide 3D-Master was developed with a systematic arrangement for a wide range of natural dentition shades.[2]

Spectrophotometers are amongst the most accurate, useful and flexible instruments for overall color matching and color matching in dentistry. A spectrophotometer contains a source of optical radiation, a means of dispersing light, an optical system for measuring, a detector and a means of converting light obtained to a signal that can be analysed. Some of the commercially available spectrophotometers are Crystaleye (Olympus, Tokyo, Japan), Vita Easyshade Compact (Vita Zahnfabrik, Bad Sa¨ckingen,Germany), Shade-X (X-Rite, Grandville, MI), SpectroShade Micro (MHT Optic Research, Niederhasli, Switzerland) etc.[3,4,5]

All colour matching instruments use L*a*b color system. The CIE (Commission Internationale d'Eclairage) was authorized to develop a mathematically defined standard color table which should fulfil the wish for precision and objectiveness. Starting from this basic concept, CIE developed the color chart (Standard Color Table, Standard Valency System). Maxwell's traditional, trichromatic values RGB were converted into the three new tristimulus values x, y and z. In the resulting color chart, the value x represents the horizontal axis and the value y the vertical axis.[6]

Recently, digital systems (spectrophotometers, colorimeters or digital cameras) have been used to measure tooth color. Within these systems, color is expressed in CIEL*a*b* space, which provides its specification in three dimensions and allows for more accurate assessments. These digital systems are precise instruments that produce highly reliable, easily evaluated results in terms of visual importance.[7,8] However, till recently, high cost and complex operation have restricted their use to laboratory or clinical research.[8,9]

Visual color determination by comparison of tooth color with a standard (eg, commercially available shade guides) is the most frequently applied method of color assessment in dentistry.[10,11] This procedure is regarded as difficult to reproduce and highly subjective; variables that affect shade selection include external light conditions, metamerism, age, sex, fatigue of the eye, experience, and probably color blindness.[7,11,12] Instrumental methods for determination of tooth color are objective and more rapid than visual shade matching. Computer-assisted spectrophotometers and colorimeters generate mathematically comparable L*a*b* (lightness, red/green, yellow/blue) or L*C*h* (Value, Chroma, Hue) values that quantify color.[7,10]

Shade selection through the use of shade guides is inadequate due to lack of standardization. Both intra and inter-operator errors are common in shade selection.[11] Several methods for shade selection have been investigated to find a justifiable one.[1,13]

A phenomenon called metamerism occurs when two colors appear to match under a given lighting condition but have a different spectral reflectance. As a result, in different lighting condition, the colors do not match. Currently, there are several electronic shade-matching instruments available for clinical use. A spectrophotometer functions by measuring the

spectral reflectance or transmittance curve of a specimen. A prism disperses white light from a tungsten-filament bulb in the spectrophotometer into a spectrum of wavelength bands between 5 and 20 nm. The amount of light reflected from a specimen is measured for each wavelength in the visible spectrum. Spectrophotometers have a longer working life than colorimeters and are unaffected by object metamerism.[14]

In addition to the factors previously mentioned, the level of knowledge and training of the operators may also affect the accuracy of shade matching process using conventional shade guides. Studies have shown that there are varied results in shade matching ability among individuals. Recent studies have shown the high level of accuracy of shade matching by currently available spectrophotometers. However, there are very few studies regarding the effect of the knowledge and level of training of operator on the shade matching results as compared to spectrophotometers.

Hence, this study was planned to compare inter-observer variability in shade matching ability of dentists of different training level and experience by using conventional shade guides and a digital spectrophotometer. The null hypothesis was that there will be no significant difference in shade matching among different observers using conventional shade guides and also when compared with digital spectrophotometer.

Aim of this study was to assess the reliability of shade matching of dentists using conventional shade matching systems and to analyse if knowledge and experience of dentists affect the shade selection of natural teeth for restorative/prosthodontic rehabilitation.

Objectives of this study was to compare the results of shade matching of each group of investigator using conventional methods to results obtained using the commercially available digital spectrophotometer and to compare the inter-observer variability in shade selection.

SUBJECTS AND METHODS

A total of 30 undergraduate dental students were selected as subjects for the study. Prior to this, 108 undergraduate students were screened using the inclusion and exclusion criteria of which 82 students were eligible to be included in the study. Out of these 82 students, 30 were selected randomly using table of random numbers (Simple Random Sampling).

The inclusion and exclusion criteria were applied.After obtaining their consent to be a part of the research study, a detailed clinical exam was performed and a thorough oral prophylaxis was done.

Investigators comprising dental surgeons with different levels of training and experience were included in this study, viz. senior faculty members (12-27 years of experience), post graduate students (6-7 years of experience) and dental interns (2-3 years of experience). Each investigator was ruled out for colour blindness using Ishihara plates (Tokyo, Kanehara and Co.) before inclusion in the study.

METHOD OF COLLECTION OF DATA METHODOLOGY

Thirty undergraduate dental students were randomly selected for the study after fulfilling exclusion and inclusion criteria. Students selected underwent oral prophylaxis before participating in the study.

The investigators were grouped as Group 1 (Senior Faculty members), Group 2 (Postgraduate Students), Group 3 (Dental Interns) & Group 4(Postgraduate Student).

All investigators were given a questionnaire to fill out their name, age, gender and years of experience. Years of experience was counted as number of years from the third professional year of BDS course to the current time.

Before commencement of the study, all the investigators were given brief training about the shade selection technique with both conventional shade guides and introduction to tooth colour differentiation based on value, Chroma and Hue. Following this, the shade selection of right maxillary central incisor of each undergraduate dental student was done by all nine investigators (Group 1, Group 2, Group 3) using both Vita classical and Vitapan 3D Master tooth shade guides and the values were recorded using a structured Proforma. Consequently, the principal investigator (Group 4) recorded shade of each subject using Digital Spectrophotometer and the readings were noted down.

VISUAL SHADE MATCHING PROCEDURE

Each investigator selected the shade of the maxillary right central incisor of all the subjects visually separately using both conventional shade guides. This was done between 1100 hrs and 1400 hrs in daylight on a clear day. Examinations were held in a separate room, not to be influenced by the other investigators. The conditions of tooth shade match were: natural light, a sunny day at noon time, in front of the window.

Before shade taking, the teeth were cleaned with a mixture of water and pumice and a brush on a low speed handpiece to remove any accumulated plaque and stain. Lipstick if any, was removed and the subjects were covered with a gray bib before the shade selection.

During the visual shade selection using the shade guides, the participants were upright, and the shade guides were positioned at the eye level of the examiner and at the level of the maxillary central incisor of the participant. The selected shade was individually recorded for each participant.

The investigators were informed not to focus at the teeth for a longer period of time to avoid fatigue to the eyes. They were given sixty seconds for shade selection and after every ten seconds of gazing they were asked to rest the eye by looking into a neutral blue card.

DIGITAL SHADE MATCHING

The principal investigator determined the shade of maxillary right central incisor of each subject by using the digital spectrophotometer as per the manufacturer's instructions. In this case the light or environment conditions did not influence the results. The readings corresponding to both Vita Classic and Vita 3D Master Guides were recorded.

The colour of the Vitapan classical and Vita Classical shade guide tabs was measured and CIE L*a*b* values were noted down by digital Vita Easyshade device. This procedure was performed by switching the device mode to 'Shade Tab' mode and the measurement were perform similar to the tooth measurement procedure describe earlier.

STATISTICAL PROCEDURE

Mean and Standard Deviation of each variables was calculated for all the groups and one-way ANOVA test was used for comparision of group mean. For sake of multiple comparison post hoc test was applied. All statistical analysis were performed using IBM SPSS 19.0 Software.

RESULTS

Dependent Variable	(I) Group Name	n	Mean	SD	(J) Group Name	Mean Difference (I-J)	Std. Error	'p'
3D Master_L*	Group 1	30	75.51	2.44	Group 2	0.58	0.73	0.4309
					Group 3	-0.17	0.73	0.8168
					Group 4	-7.29	0.73	0.0000
	Group 2	30	74.93	2.69	Group 1	-0.58	0.73	0.4309
					Group 3	-0.75	0.73	0.3086
					Group 4	-7.87	0.73	0.0000
	Group 3	30	75.68	2.46	Group 1	0.17	0.73	0.8168
					Group 2	0.75	0.73	0.3086
					Group 4	-7.12	0.73	0.0000
	Group 4	30	82.80	3.61	Group 1	7.29	0.73	0.0000
					Group 2	7.87	0.73	0.0000
					Group 3	7.12	0.73	0.0000

*** p < 0.05 : significant difference**

Inference - The data in Table No 2 indicate that Intergroup variability is not significant amongst group 1, 2 and 3. For L*(value), least difference can be seen among group 1 and group 3. Highly significant difference can be seen when group 1, 2 and 3 are compared individually with group 4. However, the least mean difference can be found in group 3 when group 1, 2 and 3 are compared with group 4.

Dependent Variable	(I) Group Name	n	Mean	SD	(J) Group Name	Mean Difference (I-J)	Std. Error	'p'
3D Master_a*	Group 1	30	0.36	0.57	Group 2	-0.26	0.21	0.2176
					Group 3	-0.10	0.21	0.6505
					Group 4	1.28	0.21	0.0000
	Group 2	30	0.62	0.76	Group 1	0.26	0.21	0.2176
					Group 3	0.17	0.21	0.4338
					Group 4	1.54	0.21	0.0000
	Group 3	30	0.45	0.65	Group 1	0.10	0.21	0.6505
					Group 2	-0.17	0.21	0.4338
					Group 4	1.38	0.21	0.0000
	Group 4	3+0	-0.93	1.17	Group 1	-1.28	0.21	0.0000
					Group 2	-1.54	0.21	0.0000
					Group 3	-1.38	0.21	0.0000

*** p < 0.05 : significant difference**

Inference - The data in Table No. 1 indicate that Intergroup variability is not significant amongst group 1, 2 and group 3. For a*(Red/Green axis), least difference can be seen among group 1 and 3. Highly significant difference can be seen when group 1, 2 and 3 are compared individually with group 4. However, the least mean difference can be found in group 1 when group 1, 2 and 3 are compared with group 4.

Dependent Variable	(I) Group Name	n	Mean	SD	(J) Group Name	Mean Difference (I-J)	Std. Error	'p'
3D Master_b*	Group 1	30	15.39	3.14	Group 2	0.89	0.84	0.2916
					Group 3	0.45	0.84	0.5980
					Group 4	-1.70	0.84	0.0463
	Group 2	30	14.50	2.79	Group 1	-0.89	0.84	0.2916
					Group 3	-0.45	0.84	0.5967
					Group 4	-2.59	0.84	0.0026
	Group 3	30	14.95	2.67	Group 1	-0.45	0.84	0.5980
					Group 2	0.45	0.84	0.5967
					Group 4	-2.14	0.84	0.0123
	Group 4	30	17.05	4.22	Group 1	1.70	0.84	0.0463
					Group 2	2.59	0.84	0.0026
					Group 3	2.14	0.84	0.0123

*** p < 0.05 : significant difference**

Inference - The data in Table No. 4 indicate that Inter group variability is not significant amongst group 1, 2 and 3. For b*(Yellow/Blue axis), least difference can be seen among group 1 and 3. Significant difference can be seen when group 1, 2 and 3 are compared individually with group 4. However, the least mean difference can be found in group 1 when group 1, group 2 and group 3 are compared with group 4.

Dependent Variable	(I) Group Name	n	Mean	SD	(J) Group Name	Mean Difference (I-J)	Std. Error	'p'
Classical L*	**Group 1**	30	75.02	1.89	Group 2	-0.15	0.66	0.8252
					Group 3	-0.21	0.66	0.7472
					Group 4	-7.78	0.66	0.0000
	Group 2	30	75.16	2.36	Group 1	0.15	0.66	0.8252
					Group 3	-0.07	0.66	0.9191
					Group 4	-7.64	0.66	0.0000
	Group 3	30	75.23	1.94	Group 1	0.21	0.66	0.7472
					Group 2	0.07	0.66	0.9191
					Group 4	-7.57	0.66	0.0000
	Group 4	30	82.80	3.61	Group 1	7.78	0.66	0.0000
					Group 2	7.64	0.66	0.0000
					Group 3	7.57	0.66	0.0000

*** p < 0.05 : significant difference**

Inference - The data in Table No. 5 indicate that Intergroup variability is not significant amongst group 1, 2 and 3. For L*(value), least difference can be seen among group 2 and group 3. Highly significant difference can be seen when group 1, 2 and 3 are compared individually with group 4. However, the least mean difference can be found in group 3 when group 1, 2 and 3 are compared with group 4.

Dependent Variable	(I) Group Name	n	Mean	SD	(J) Group Name	Mean Difference (I-J)	Std. Error	'p'
Classical_a*	**Group 1**	30	-0.89	0.56	Group 2	-0.09	0.20	0.6647
					Group 3	0.17	0.20	0.4069
					Group 4	0.04	0.20	0.8555
	Group 2	30	-0.80	0.72	Group 1	0.09	0.20	0.6647
					Group 3	0.26	0.20	0.2077
					Group 4	0.13	0.20	0.5384
	Group 3	30	-1.06	0.53	Group 1	-0.17	0.20	0.4069
					Group 2	-0.26	0.20	0.2077
					Group 4	-0.13	0.20	0.5171
	Group 4	30	-0.93	1.17	Group 1	-0.04	0.20	0.8555
					Group 2	-0.13	0.20	0.5384
					Group 3	0.13	0.20	0.5171

*** p < 0.05 : significant difference**

Inference - The data in Table No. 6 indicate that Intergroup variability is not significant amongst group 1, 2 and 3. For a*(Red/Green axis), least difference can be seen among group 1 and group 2 .No significant difference can be seen when group 1, 2 and 3 are compared individually with group 4. However, the least mean difference can be found in group 1 when group 1, 2 and 3 are compared with group 4.

Dependent Variable	(I) Group Name	n	Mean	SD	(J) Group Name	Mean Difference (I-J)	Std. Error	'p'
Classical_b*	**Group 1**	30	15.16	2.31	Group 2	0.70	0.72	0.3308
					Group 3	1.19	0.72	0.1019
					Group 4	-1.9286667*	0.72	0.0086
	Group 2	30	14.45	2.22	Group 1	-0.70	0.72	0.3308
					Group 3	0.48	0.72	0.5027
					Group 4	-2.6328889*	0.72	0.0004
	Group 3	30	13.97	1.77	Group 1	-1.19	0.72	0.1019
					Group 2	-0.48	0.72	0.5027
					Group 4	-3.1176667*	0.72	0.0000
	Group 4	30	17.09	4.22	Group 1	1.9286667*	0.72	0.0086
					Group 2	2.6328889*	0.72	0.0004
					Group 3	3.1176667*	0.72	0.0000

*** p < 0.05 : significant difference**

Inference - The data in Table No. 7 indicate that Intergroup variability is not significant amongst group 1, 2 and 3. For b*(Yellow/Blue axis), least difference can be seen among group 2 and 3. Highly significant difference can be seen when group 1, 2 and 3 are compared individually with group 4. However, the least mean difference can be found in group 1 when group 1, 2 and 3 are compared with group 4.

DISCUSSION

This in-vivo comparative study was conducted to evaluate whether knowledge and experience of dentists affects the shade selection of natural teeth for restorative/prosthodontic rehabilitation. The results of this study supported a part of the null hypothesis that there will be no significant difference in shade selection between different groups of investigators. But, the other part of the null hypothesis that there will not be difference between the groups and results of the digital spectrophotometer was rejected.

In this study, visual shade matching was done by investigators individually following a standard protocol under controlled viewing conditions. Efforts were made to standardize the conditions for optimal shade matching to minimize the variables that could affect the results. Digital shade matching was performed by the principal investigator of same subjects following manufacturer's instructions.

Vita Easy Shade Advance 4.0 is a latest version of digital spectrophotometer commercially by VITA. Several studies in the past have investigated the previous versions of this instrument and have found that it is reliable shade matching device in terms of both repeatability and accuracy. Alma Dozic et al, Da Silva et al and Kim-Pusateri et al have investigated various commercially available digital shade matching devices and concluded that the Vita Easy Shade device was one of the most reliable among them.[14,15,16] So, in this study we have chosen this instrument as the control to which the results of visual shade matching was compared.

The subjects chosen for the study were dental undergraduate students in the age group of 18-25 years. It was expected that subjects in this age group were likely to satisfy the exclusion and inclusion criteria. Middle third of the labial surface of maxillary right central incisor was used for shade matching. It has been stated by some authors that errors may occur in absolute colour measurements due to the curved surfaces of both the subject's maxillary central incisor and Vita shade tabs.[17,18]

Investigators were chosen among the dental interns, post-graduate students in Prosthodontics and senior faculty in Department of Prosthodontics. This was done to achieve on of the main objectives of the study to evaluate the role of training and experience of dentists on the shade matching. Culpepper has shown that there was a varied result in shade matching ability among individuals.[19] O'Brien & Nilsson also have stated that dental personnel were more discriminating in colour matching than non-dental personnel. Barrett, Anusavice & Moorehead also found that experience does play a role in the shade matching ability of dentists.[17]

Results of this study showed that there is no significant difference amongst different groups except when they were compared with group 4, i.e. the three groups with different levels of training and experience did not show significant difference in visual shade matching amongst each other.

Senior faculty' did not seem to have any additional advantage in colour matching despite additional training that the senior faculty had undergone in addition to presumably more experience in shade selection. This concurred with the study by Davison & Myslinki, that showed no significant improvement in shade selection between the Prosthodontist group and that of the dental students and general practitioners.[13] A similar finding was reported by a study by Amit V Naik et al.[20]

A noteworthy finding from the present study is that, even though there were no significant difference between groups, dental interns exhibited a slight edge over postgraduate students and senior faculty in shade matching ability when compared to a digital spectrophotometer. Similar results have been reported by Abdullah Al Farraj Al-Dosari and by Fernandes A et al.[18,21]

This finding could be attributed to their patience in utilizing all the time allowed for colour selection, concentration at work, enthusiasm and sincerity in young professionals as in any field. Besides, this variation could also be attributed to their age and hence the ability for accurate colour perception as substantiated previously by many researchers. Aging is also associated with yellowing of cornea that effects the blue and purple colour discrimination and chronic diseases, certain medications and environmental exposure to cigarette smoke, sun and lasers affect the colour perception.[18] These could also be the factors for the dental interns, being the youngest group in this study for demonstrating the highest ability for accurate shade matching.

Another important finding from the result of the present study is that though there was no statistically significant difference between groups of investigators, a highly significant difference was found between individual groups and the results obtained by the digital spectrophotometer.

Previous studies have shown varied results when visual methods of shade matching are compared with digital spectrophotometers. Ahmad Judeh et al examined the reliability of a spectrophotometer in shade selection compared to visual method. They showed significant difference between digital and visual methods in shade selection. Digital method was five times more likely to match the original shade colour compared to visual method.[22] Jivanescu A and coworkers (2010) also conducted a study to determine the inter-observer variability in shade selection for the upper central incisor when using two shade guides (Vita Classical and Vitapan 3D Master) and to compare the results with those of Vita Easy Shade spectrophotometer. They also showed significant difference between digital and visual methods in shade selection.[23]

Another noteworthy observation from this study was that, among the three components of the L*a*b values, all the three groups varied significantly in the L* component, i.e. the Value component in comparison to the control. This is in concurrence to the results of a study done by Sim et al who showed that significant difference that was observed in ΔE for dark shades between the dental personnel was mainly contributed to a disparity in L* values. A

significant difference in ΔL* was observed between dental technicians and Prosthodontists.[17]

The results of the current study should however be considered in the light of the following limitations. Experience of investigators in this study was calculated as number of years from their Third professional year of B.D.S to the current time, i.e. their total clinical experience in dentistry. Further, experience of using the two shade guides used for the study in particular was not kept as a reference in choosing the investigators.

CONCLUSION

Future studies may be directed towards evaluating shade guides of other manufacturers, both manual and digital. A detailed survey on actual practical training in shade matching techniques in academic courses needs to be done as there are no such reports in the literature in recent years. A survey on the usage of digital shade matching devices in clinical practice also needs to be done.

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Efficacy of Eminectomy in Internal Derangement of Temporomandibular Joint

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Abstract

Background: The purpose of this study is to study the effectiveness of Eminectomyin the management of the TMJ pain and dysfunction in patient with internal derangement of Temporo-mandibular joint using Mandibular Function Impairment Questionnaire And Clinical Dysfunction Index.

Methods: All the patients with internal derangement of temporomandibular joint having anterior disc displacement without reduction with complaints of pain and limited opening of mouth, of all age group reporting to the Department of Oral & Maxillofacial Surgery, RUHS College of Dental Sciences, Jaipur were included in the study. All the patients were examined using magnetic resonance imaging and diagnosis of TMJ internal derangement was confirmed with MRI. The duration of the study took over from Jan 2019– Dec. 2020. 22 patients were included in the study who were subject to assessment using Mandibular Function Impairment Questionnaire and Clinical Dysfunction Index.

Results: There was significant improvement in symptoms of pain and reduced mouth opening at 3 months follow up as revealed in their evaluation with Mandibular Function Impairment Questionnaire (MFIQ) and Clinical Dysfunction Index (CDI). TMJ clicking was absent in all the patients at 3 months follow up.

INTRODUCTION

Temporomandibular joint (TMJ) is a ginglymoarthroidal joint, it is the only mobile joint in the entire maxillofacial region and is a part of craniomandibular articulation. It is unique because of the fact that both the joints need to move simultaneously for proper functioning and the force per unit area is much larger than most weight bearing joints of the body.

The presence of the disc in the joint capsule prevents the bone-on-bone contact and the possible higher wear of the condylar head and the articular fossa. The bones are held together with ligaments. These ligaments completely surround the TMJ forming the joint capsule. A steep articular eminence is reported to be a predisposing factor for development of disc displacement.

Internal derangement of the temporomandibular joint (TMJ) may be defined as a disruption within the internal aspects of the TMJ in which there is a displacement of the disc from its normal functional relationship with the mandibular condyle and the articular portion of the temporal bone.

Patients with TMJ internal derangement often complain of limited function and pain additional to the clicking. [1] Patients can also have pain or tenderness to palpation within the external auditory canal or to the lateral condylar pole, in addition to limited jaw opening. Headache, neckache earache and tenderness of the masticatory muscles may also be signs and symptoms that accompany the problem.

The aim of this prospective clinical study is to present the clinical experience of using Eminectomy in the surgical management of Non-Reducing type of Internal derangement to return the patient to a regular diet, with some limitations, and to establish an adequate functional range of motion of mouth opening. The procedure preserves the articular tissue, it permits normalization and regeneration of synovium, and a restoration of the articular relations to permit the joint structures to adapt and function through an adequate range of motion[7].

MATERIAL & METHODS

Study Site: The study was conducted in the Department of Oral & Maxillofacial Surgery, RUHS College of Dental Sciences& Hospital, Jaipur, Rajasthan.

Study Subjects: All the patients with internal derangement of temporomandibular joint having anterior disc displacement without reduction with complaints of pain and limited opening of mouth, of all age group reporting to the Department of Oral & Maxillofacial Surgery, GDC Jaipur were included in the study.

Exclusion Criteria:

1. Refused consent
2. Medical contraindication for surgery
3. The patients with TMJ conditions that affect outcomes like arthritis, congenital anomalies
4. Patients with damaged articular disc.

Equipment used:

Basic oral and maxillofacial surgical instruments

Clinical Work-up:

Examination of each patient was done in the following order-

I. Inspection

Clinical examination included the following:

- Joint noise and its relation to jaw movements
- Pain and tenderness in relation to the joint, muscles of mastication, and jaw movement
- Movements of the jaw on opening, protrusion, and any deviation.

Extra oral examination was carried out to look for

- Facial deformity
- Chin deviation
- Facial nerve function

Intraoral inspection was done for:

- Deviation of midline
- Mouth opening (from incisal edge of maxillary central incisor to incisal edge of mandibular central incisor)
- Mid incisor shifting
- Side to side movement
- Occlusion
- Missing teeth
- Faulty restoration, faulty prosthesis etc.

II. Palpation

Both affected and non affected side TMJ were palpated at rest as well as during function for Joint tenderness and Clicking sounds.

Chin deviation was measured on mouth opening and without mouth opening from midline considering as a guide line.

ASSESSMENT WITH INDICES

After thorough clinical evaluation of patients, they were subject to assessment with following indices-

MANDIBULAR FUNCTION IMPAIRMENT QUESTIONNAIRE (MFIQ):

The MFIQ is a 17-item questionnaire divided into masticatory and non-masticatory activities. Each item is in the form of a 5-point scale on which the patients indicate to what extent they had difficulties in doing that particular mandibular task. The MFIQ reliably assesses the degree of impairment of specific jaw functions without measuring symptoms and signs causing the functional impairment.

CLINICAL DYSFUNCTION INDEX:

The clinical dysfunction index is an objective measure of TMJ disorders based on evaluation of 5 common clinical symptoms, each judged on 3-point scale of severity using 0, 1, or 5 points. No symptoms mean 0 points, mild symptoms 1 and severe symptoms 5. The 5 symptoms are impaired range of mandibular movements, impaired TMJ function, joint sounds, deviation and restriction of movements with locking or luxation or both, TMJ pain with lateral or posterior or lateral palpation and tenderness of number of masticatory muscles sites.

Radiological examination

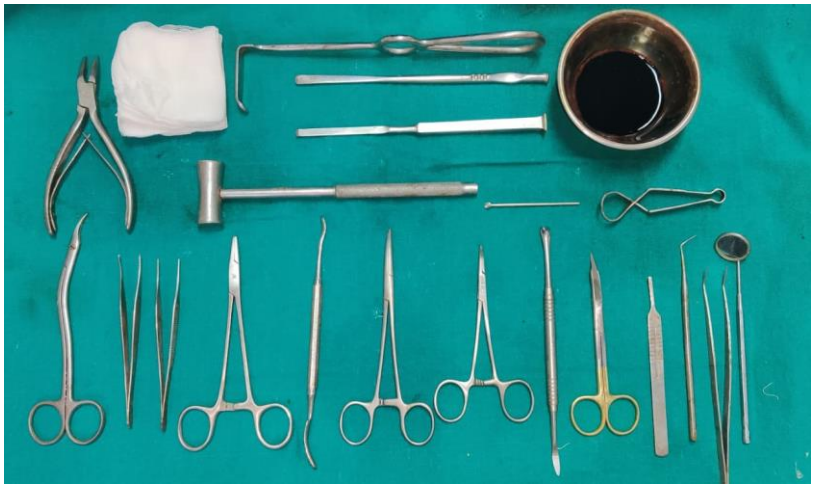
All the patients were examined using magnetic resonance image diagnosis of TMJ internal derangement was confirmed with MRI.

MRI imaging provides an important modality for the evaluation of TMJ internal derangements because it is non-invasive and accurate. Furthermore, MR imaging provides a method in which bilateral examinations can be readily performed.

Photographs: Preoperative, intra-operative and postoperative photographs were taken forComparison and to visualize gradual changes at follow up period.

Pre anaesthetic evaluation: All patients undergoing surgery have undergone pre anaesthetic evaluation using routine blood profile, renal function test, liver function test chest radiograph ECG, HBSAg, HIV, Serum electrolytes and other relevant investigations as the particular case required.

Anaesthesia: All the patients were operated under Local aesthesia with 2% xylocaine with adrenaline.

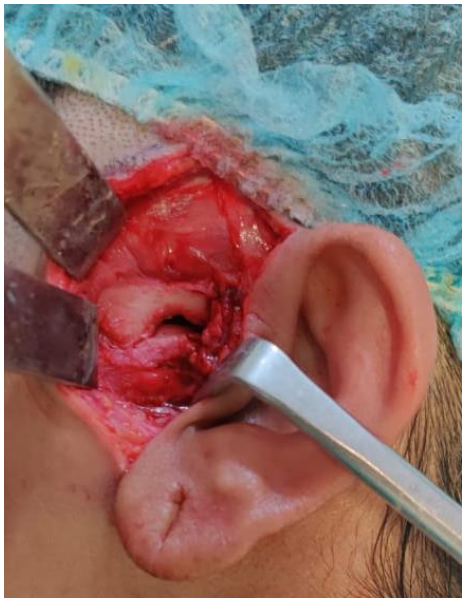


ARMAMENTARI

Surgical Technique for Eminectomy:

The patient is prepared for operation in the usual fashion with local anesthesiawith 2% xylocaine with adrenaline The preauricular hair were be shaved to a height of 1–2 cm above the ear. The initial incision, 2–3 mm deep, begins in the shaved area above the ear in the shape of a hockey stick following the technique of Al-Kayat and Bramley. The incision extends down in front of the ear to be continuous with a suitable skin crease and should not be extended beyond the level of the attachment of the lobe of the ear, as described by Rowe. Superiorly, the incision is deepened down to the temporal fascia and the superficial temporal vein is identified and

either retracted, tied off, or cauterized. Blunt dissection at the level of the temporal fascia is carried downwards and forwards to a point about 2 cm above the zygomaticarch where the temporal fascia splits in two. Beginning at the root of the zygomatic arch, an incision is made at 45° upwards and forwards through the outer layer of the superficial temporal fascia only to create a fatty tissue pocket. The periosteum of the zygomatic arch may then be incised horizontally and turned forward as one flap with the outer layer of the temporal fascia and superficial fascia containing the zygomatic and frontal branches of the facial nerve and skin. The periosteum along the infero-lateral margin of the zygomatic arch within the fatty pocket is reflected forwards and downwards and into the articularfossa and over the articular eminence so that the joint space itself is not entered. The reflection is carried medially to expose these structuresfully, the condylar head having been pulled forward by opening the jaw. Working at a sub-periosteal level, above the superior joint space minimizes disruption of these structures. The eminence is cut awaywith piezoelectric device to a depth not exceeding that of the articular fossa. The articularem4inence is completely removed to its medial margin and contoured anteriorly to produce a shallow angled eminence with meticulous smoothing of the surface and copious irrigation. Disc movement was shown intra-operatively by jaw movement and confirmed postoperatively by clinical examination. Before closure, the wound was meticulously checked for any bleeding points and thoroughly irrigated. Closure of the wound is of extreme importance, for, if done in a carefully layered fashion with taut periosteal closure, the benefits of ligament ligation, disc fixation and lack of the need for a drain are obtained. The skin is closed with interrupted 5–0 monofilament sutures. Drains were not used in this study. All patients were given a loading dose of an antibiotic on induction, followed by a five-day therapeutic course. Non-steroidal anti-inflammatory drugs were used for postoperative pain control and patients were usually discharged on the second postoperative day. The skin sutures were removed five days postoperatively.



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Criteria of assessment

Assessment of patients was done at the end of seven days, and three month interval under following parameters:

1. Mandibular function impairment questionnaire
2. Clinical Dysfunction index

Follow-up

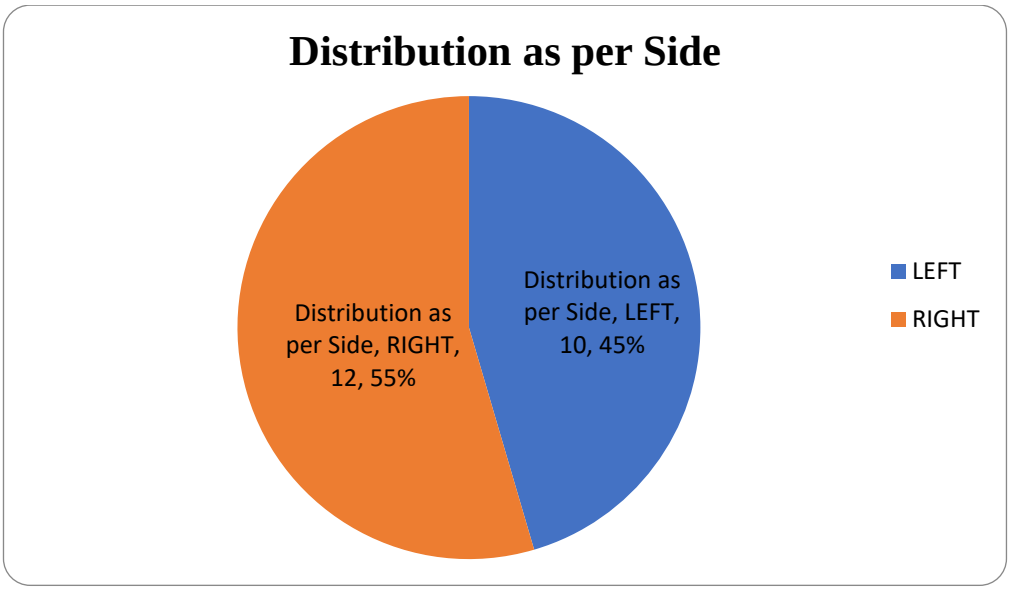
Patients were recalled for regular check up at an interval of seven days and, three month interval.

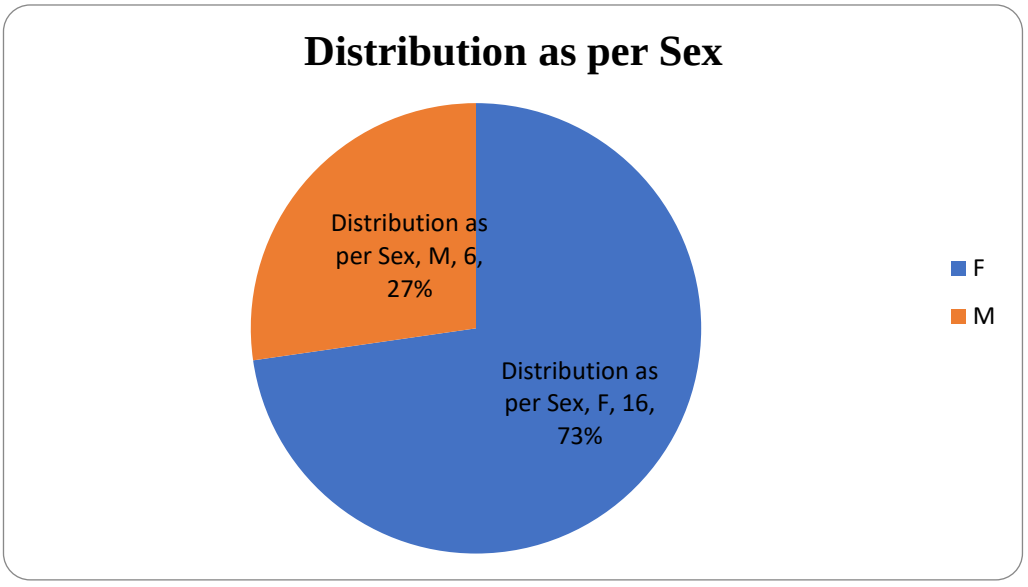
On follow up facial nerve function was checked. Photographs were also taken for comparison. Maximum follow up period was 3 months. The results were recorded on a set format for comparison and subjected to statistical analysis.

OBSERVATIONS AND RESULTS:

22 patients with Internal derangement of temporomandibular joint having anterior disc displacement without reduction with complaints of Noise &/or pain on opening mouth and limited opening of mouth were selected. Patients underwent Eminectomy under local anesthesia. Patients were assessed for relief in symptoms and lifestyle by surgical intervention using the mandibular function impairment questionnaire and clinical dysfunction index.

In our study, out of 22 patients 16 (72. 7 %) patients were female and 6 (27. 3%) patients were male. Age of participants was in between 16 -48 years.



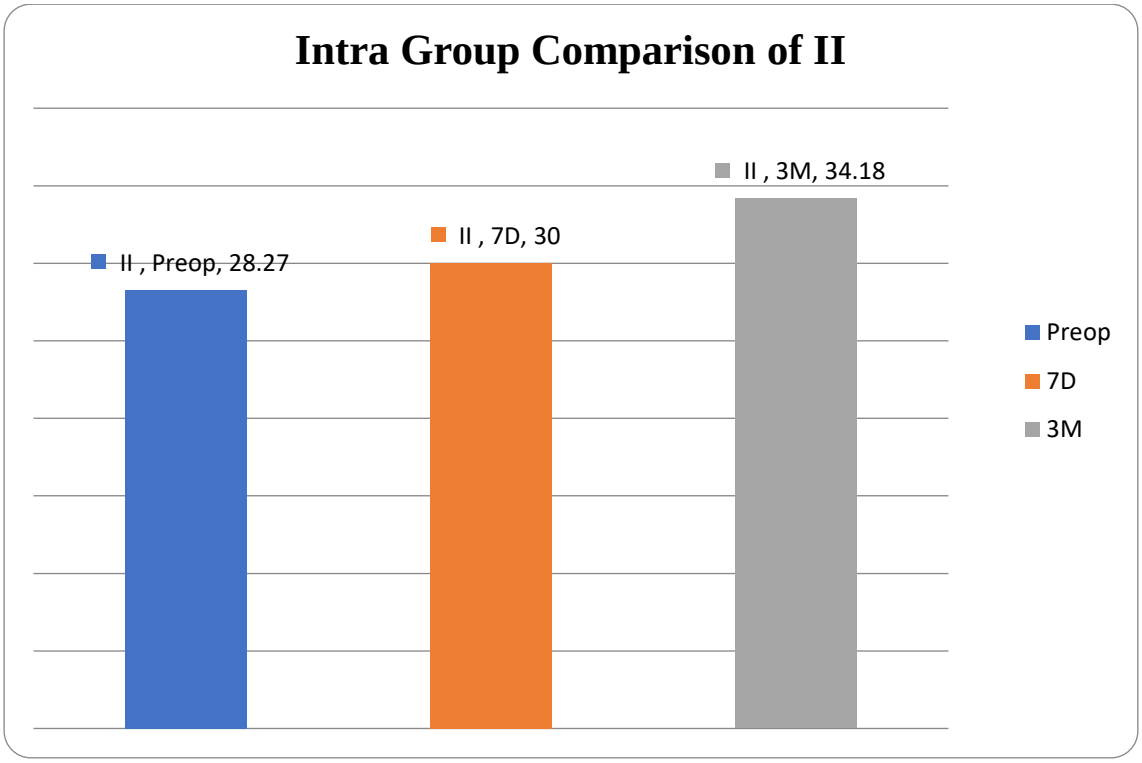


Fisher's Exact Test value = 0. 489, p=0. 646 (NS)

There was a statistically non significant difference seen for the frequencies between the groups (p>0. 05)

Preoperative inter-incisal mouth opening mean was 28. 27 with standard deviation 9. 331.

Inter-incisal mouth opening at three month postoperative follow up mean was 34. 18 Chart shows improvement in mouth opening.



					95% Confidence Interval for Mean					
		Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum	F value	p value of RM ANNOVA
CDIS	1	8. 55	3. 997	. 852	6. 77	10. 32	1	16		
	2	6. 14	4. 291	. 915	4. 23	8. 04	1	16	16. 630	. 000**
	3	2. 36	2. 036	. 434	1. 46	3. 27	0	8		
	Total	**5. 68**	**4. 361**	**. 537**	**4. 61**	**6. 75**	**0**	**16**		
FIS	1	4. 18	1. 006	. 215	3. 74	4. 63	3	5		
	2	2. 77	1. 378	. 294	2. 16	3. 38	1	5	60. 827	. 000**
	3	. 50	. 913	. 195	. 10	. 90	0	3		
	Total	**2. 48**	**1. 883**	**. 232**	**2. 02**	**2. 95**	**0**	**5**		
II	1	28. 27	9. 331	1. 989	24. 14	32. 41	12	48		
	2	30. 00	4. 731	1. 009	27. 90	32. 10	22	38	4. 288	0. 018*
	3	34. 18	5. 712	1. 218	31. 65	36. 71	24	45		
	Total	**30. 82**	**7. 222**	**. 889**	**29. 04**	**32. 59**	**12**	**48**		

DISCUSSION

The first-line management for TMJ dysfunction according to most authors is conservative[6]. Many researchers accept that the majority of TMJ pain is associated with the presence of internal derangement. Although medical treatment may help to alleviate the pain caused by inflammation, it cannot be expected to reverse internal derangement and is only aimed at symptomatic relief. However, surgical procedures are not devoid of complications. Dolwick has stated that: "Surgery of TMJ is best undertaken by surgeons who maintain the philosophy that surgery should aim to avoid further harm to the joint and also consider more

conservative surgical procedures whenever possible."

In our study the diagnosis of the internal derangement (Disc displacement) was confirmed by MRI study. **Roberto E, Sanchez-Woodworth** also showed the role of MRI in evaluation of internal derangement of TMJ. **Andre L. F. Costa et al** also concluded that temporomandibular joint MRI could be helpful for diagnostic classification and treatment follow up as we had used in our study[4].

A steep articular eminence is reported to be a predisposing factor for development of disc displacement[5]. Among the techniques used on the open joint, Eminectomy is considered to be an extra-capsular procedure. The aim is to improve the potential joint dimension and so result in free movement of the disc. The intra-capsular methods include discoplasty or discectomy, with or without interpositional graft replacement[9]. Finally, a combination of intra-capsular and extra-capsular procedures is also being widely used. This concept was supported by Miloro et al in 2017 who stated: "a definitive combined surgical approach, following the failure of non-surgical and minimally-invasive therapy, could reduce the treatment time, the expenditure, the complications from multiple procedures as well as patient discomfort". Eminectomy, and discectomy with or without disc replacement, are therefore now accepted surgical techniques in the management of internal derangement of the TMJ when conservative management and minimally-invasive procedures, such as arthrocentesis and arthroscopy, have failed to improve function and reduce pain[15].

In our study, 22 patients were treated with Eminectomy. There was significant improvement in symptoms of pain and reduced mouth opening at 3 months follow up as revealed in their evaluation with Mandibular Function Impairment Questionnaire (MFIQ) and Clinical Dysfunction Index (CDI).

At 3 months follow up, mean MFIQ score was 0. 5 as compared to preoperative mean score of 4. 18 and mean CDI score at 3 months was 2. 36 as compared to preoperative mean of 8. 55. Mean preoperative Inter incisal opening was 28. 27 and at 3 months it was 34. 18. This reveals significant improvement in functional capacity and dysfunction related to internal derangement in the patients.

TMJ clicking was absent in all the patients at 3 months follow up.

In conclusion, The dimensions of the bony anatomy of the TMJ are variable. Depending on the posterior surface slope to the eminence, the anatomy is described as high fossa or low fossa, and the angle varies from 89◦to 16◦. Eminectomy will reduce this angle, increase the intra-articular space, and release the restriction of the condylar translation. Stassen and Currie showed that Eminectomy alone can reverse internal derangement and facilitate disc mobility[11].

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The Vision into Advanced Dentistry - Nanotechnology: A Review

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Abstract

Dentistry is presently undergoing a great revolution, emerging into the eon of nanotechnology. In recent years, Nanotechnology becomes an emerging interdisciplinary field in dentistry.

It has been recognized that the potential of many biomaterials used in dentistry has been significantly enhanced after their scales were reduced by nanotechnology, from micron-size into nanosize. With developments in material science and biotechnology, nanotechnology is specially anticipated to provide advances in dentistry and innovations in oral health-related diagnostic and therapeutic methods. This article reviews the current trends and the future perspective of nanotechnology in different branches of dentistry.

Keywords: nanodentistry, nanotechnology, nanomaterials

INTRODUCTION

One constant since the beginning of time is the "Change". These significant changes have transformed technology from solely macro to nano level. Today nanotechnology has a profound effect on the way we live, largely through modern technology and the use of scientific knowledge for practical purpose. Nanotechnology refers broadly to a field of engineering and technology whose unifying theme is that the control of matter on the molecular level. Nanotechnology has many applications in optical engineering, agriculture & food, metallurgy, defense security, textile, drug delivery, medical field, cosmetics.

Dentistry is also facing major revolution in the wake of this technology having already been targeted with nanomaterial and nanotechnology- NANODENTISTRY.

What is Nanotechnology?

"Nano" - from the Greek word "dwarf". It is the science of manipulating matter measured in the billionths of meters or nanometer, roughly the size of 2 or 3 atoms.[1] It is also known as molecular nanotechnology or molecular engineering. It refers to creating material & structures in the range of 0.1 to 100 nanometer by various physical or chemical methods.[2] In its original sense, it refers to the projected ability to make items using modern techniques and instrument to produce high performance products.

HISTORY

Nanotechnology - the term was coined by Prof. Kerie E. Drexlar researcher of nantechnology.[3] The conceptual underpinnings of nanotechnologies were first laid out in 1959 by the noble prize winning physicist Richard Feynman in his lecture, "There's plenty of room at the bottom". In his historic lecture, he concluded saying, "this is a development which I think cannot be avoided".[4]

Two Approaches in Nanodentistry

The fabrication method for the structures can be divided into 2 approaches: "bottom-up" and "top-down".

1) BOTTOM UP APPROACH [5]

The bottom – up approach begins by designing and synthesizing new nanostructure.

It includes - Local anesthesia, Major Tooth Repair, Hypersensitivity Cure, Nanorobotic Dentifrice (dentifrobots), Tooth repositioning, Local drug delivery, Nanodiagnostics, Therapeutic aid in oral diseases.

2) TOP DOWN APPROACH [6]

The top down techniques that are used to manufacture nanoscale structures are mostly extensions of methods already employed in small scale assembly at the micron scale.

It includes - Nano Light-Curing Glass Ionomer Restorative, Nano Impression Materials, Nano-Composite Denture Teeth, Nanosolutions, Nanoencapsulation, Prosthetic Implants, Nanoneedles, Bone replacement materials.

APPLICATIONS IN DENTISTRY

A. Nanotechnology in Implant[7]

One of the major tests of Implantology is to achieve and maintain Osseointegration. Implant surfaces can be modified at nanoscale with the aim of improving the implant surface for better Osseo integration-

' NANO SURFACE MODIFICATION'. It include-

1. Anodization - Voltage and galvanic current are used to create the oxide layer on the implant surface.
2. Acid etching- This process uses strong acids which are effective in creating a thin grid of Nano pits on a titanium surface.
3. Plasma Spray- The process starts by using vacuum to remove all the contaminants, kinetic energy than guides the charged metallic ions or plasma to the surface.
4. Grid blasting- A porous layer is prepared on the implant surface by collision of microscopic particles.

B. Nanotechnology in Oral surgery

1. Nano Needles
   Modification in suture needle has also been developed. Suture needles are incorporated with nano-sized chrome steel crystals.
2. Surgical Nanorobotics. [8]
   Nano robots are programmed devices to perform specific biological task after they are injected into the body. These surgical nanorobot, are programmed by a dentist, could act as a semi-autonomous on site inside the body. These devices will perform various functions like trying to find pathology and so diagnosing and correcting lesions by nanomanipulation.
3. Local nanoanaesthesia: [9]
   Pain management stands for a part of major therapeutical goal. The utilization of nanotechnology via liposomal formulation has recorded high successfully end in pain control & quick patient recovery. Additionally, controlled release of an anaesthetic drug is alleged to prevent overdosing, reduced side effects, especially cardiotoxicity, neurotoxicity and tissue lesions.
4. Vibrotactile devices (VibraJact, DentalVibe)
   It uses the concept of gate control theory, that is simultaneous activation of nerve fibers via vibrations.
5. Computer controlled local anaesthesia system (CCLAD) (WandTM/ CompuDentTM system)-

It controls the flow rate of local anaesthetic solution through light weight hand piece and foot control.

6. Jet injection technology
   It uses mechanical force developing sufficient pressure to push LA via small orifice. It creates a skinny column of fluid which might penetrate soft tissues without needle.
7. Safety dental syringes
   By covering the needle with a sheath after it is off from patient's tissue, it reduces the risk of accidental needle prick injury Eg.Ultra Safety Plus XL syringe, UltraSafe Syringe.
8. Nano-encapsulation:
   This include controlled drug delivery, which comprises of hollow spheres, core–shell & nanotubes. E.g., arestin and minocycline are incorporated into microspheres for drug delivery by local means into the periodontal pocket.
9. Surface modified silicone nanowires -
   It delivers bio-molecule in mammalian cells without modifying its chemical structures hence allowing assessment of phenotypic sequences DNA, RNA, peptides, proteins and tiny molecules.
10. Trans-dermal drug delivery system - [10]
    It comprises of drug delivery system which, bypasses the primary metabolism and goes into systemic circulation with more targeted effect thus leading to least toxicity.
11. Bone replacement materials: [11]
    Bone is consist of organic compounds which is reinforced with inorganic compounds. This bone replacement material include,the nanocrystallites which shows a loose microstructure, with nanopores situated between the crystallites. From this process, a rough surface area is formed on the boundary layer between the biomaterial and cell, which is incredibly important for fast cell growth.
    Advantage of this material include- osteoinduction, fully synthetic, can't be sintered, highly porous.

C. **Nanotechnology in Orthodontics**:[12]

Nano - robots have major role in orthodontic. These nano-robots could directly manipulate the periodontal tissues which allows rapid tooth straightening, rotating and vertical repositioning within minutes to hours. With nanotechnology orthodontic realignments can be completed in a single office visit.

Application of Nanotechnology in Orthodontics-

- Orthodontic bands
- Orthodontic power chains
- Orthodontic elastomeric ligatures
- Orthodontic miniscrews
- Coated orthodontic archwires
- Control of oral biofilm

D. Nanotechnology in Prosthodontic

Impression materials [18]

Impression materials are used to copy the teeth and surrounding oral structures by creating a dental impression poured with dental plaster to fabricate a dental cast.Impression materials are available now with nanomaterials. Nanofillers in Poly Vinyl Siloxane (PVS) have shown good flow, improved hydrophilic properties and superior detail precision, hence fewer voids at margin and better model pouring. (Trade name: Nanotech Elite H-D)

IN FIXED PROSTHODONTICS

Nanoceramics: [13, 14]

'Nanoceramic' are the ceramics, which have superior mechanical properties, like strength and hardness. The hardness and strength of the many nanoceramics has increased four to five times higher over those of the available materials.

Nano-Glass ceramics have good translucency, excellent corrosion resistance, higher hardness and low modulus of elasticity when produced with sol-gel method. Carbon nanotubes (CNTs) have exceptional mechanical and electronic properties, result of their reinforcement. Lava Ultimate Resin Nano Ceramic blocks are innovative new CAD/CAM materials with superior esthetic results, durability and fracture resistance.

Nano resin based materials [15,16,17]

Organic fillers are incorporated in nanomers to boost the desirable rheological properties of nano resin based materials. These materials are available as titanium dioxide, aluminum oxide and silica oxide are employed in small amounts (1%–5%) to improve powder flow of the material.

Examples

- TIO2 Reinforced Resin Based Composite
- Ormocers (Organically Modified Ceramics)

- Nanocomposites With Alumina Nanoparticles
- Calcium Phosphate and Calcium Fluoride Nanoparticles Based Composites

IN REMOVABLE PROSTHODONTICS

Nano Composite Teeth [19]

Nanocomposite denture teeth are made of Polymethyl methacrylate (PMMA) and distributed nanofillers.

Advantages

- It has excellent polishing ability and stain-resistant
- It increases aesthetics & surface structure
- It alsoenhances wear resistance and surface hardness.

Nanoadhesives [22]

By adding nano- particles, the properties are improved without increasing the viscosity of the adhesive. The silica nano filler technology also contributes to higher bond strength performance.

Tissue Conditioners And Soft Liners [23,24]

Addition of silver nano-particles in these materials have displayed antimicrobial properties against S.mutans and S.aureus. Solutions of chlorhexidine mixed with sodium triphosphate (TP), trimetaphosphate (TMP) o r Hexametaphosphate (HMP) were investigated for antifungal property on silicone soft liners and obturators and Chlorhexidine-HMP coating has been proved to be the foremost effective antifungal agent thus enhancing the lifetime of the prosthesis.

Nanoparticles In Polymethyl Methacrylate Resin. [20, 21]

PMMA resin are commonly used as a denture base material and in making orthodontic appliances. However because of the surface porosities they have been prone to plaque accumulation, thus increasing the cariogenic oral flora. Nanoparticles are added to polymethyl methacrylate as antimicrobial agents to improve the viscoelastic property of resins. Similarly incorporation of nanoparticles like silver, platinum, titanium and iron have shown increase in flexural strength, antimicrobial properties, surface hydrophobicity, viscoelasticity, decrease in porosity.

MAXILLO-FACIAL PROSTHESIS [25,26]

Among all the different materials, silicone is the most popularly used for the fabrication of maxillofacial prostheses. Titanium dioxide, Zinc oxide and Cerium dioxide nano particles are added as opacifiers for silicone elastomers. Titanium dioxide and Cerium dioxide nano particles have exhibited the least colour instability. Addition of surface treated Silicone dioxide nano particles in 3% concentration have improved the mechanical properties like the tear strength.

E. Nanotechnology in Periodontics:

1. Dentinal Hypersensitivity:[27]
   Dental nanorobots occlude specific dentinal tubules instantly. These nanorobots enter dentinal tubular holes and proceed toward the pulp.When the dentist presses the icon for the desired tooth on the hand held controlled display monitor, it is immediately anesthetized. Besides this, Nanohydroxyapatite containing toothpastes are also shown to give promising results.
2. Oral Hygiene Maintenace:[27]
   The mouthwash and dentifrices containing nanoparticles are shown improvement in oral hygiene maintenance. The mouthwash incorporated with nanorobots and selenium nanoparticles controls halitosis through the destruction of volatile sulphur compound producing bacteria. Dentifrices incorporated with nanorobots are employed to destroy the pathogenic flora.
3. Lab on chip Method: [27]
   These device merge numerous devices on single chip and they are employed in Periodontics for detection of IL-1ß, CRP, MMP-8 and TNF-α from whole saliva with minimum amount of sample.
4. Nanomaterials for periodontal drug delivery:[28]
   An effective and satisfactory drug delivery system for the treatment of periodontal diseases has been developed by producing nanoparticles impregnated with triclosan. They have increased biocompatibility, targeted release, decreased antimicrobial resistance, long duration of action and less toxicity. Various drug delivery agents include liposomes, micelles, dentrimer, polymers, nanorattels, nanowires and niosomes. Nanoencapsulation technique is a recent technique developed by SWRI for delivering antibiotics and vaccines.
5. Nanomembranes: [29]

KS Hong et al have used silk fibroin nanomembrane (Nanoguide) in guided bone regeneration and declared them to exhibit superior bone formation in comparison to biomesh.

6. Subgingival Irrigation: [30]
   Hayakumo et al has described the use of ozone nanobubble water produced by nanobubble technology in subgingival irrigation. The results of their study demonstrated that it can be used as an adjunct to periodontal therapy because of their enhanced antibacterial activity.
7. Laser and nanoparticles: [31]
   Laser irradiation on nanotitaniumparticles coated surface are shown to increase collagen production. Using this principle, gingival depigmentation and other periodontal procedures can be carried out. Sadony and Abozaidillucidated that nanoparticles along with diode laser has the potential to decontaminate dentin surface.[10]
8. Bone Grafts: [32]
   Nanoscale based grafts are seen to have superior outcome, because of their small dimensions that mimic the natural bone particles. They can be successfully used for the treatment of intrabony defects, socket preservation and sinus augmentation procedures. Biologically, inspired rosette nanotubes and nanocrystalline hydroapatite hydrogel nanocomposites can be used as improved bone substitutes.

E. Nanotechnology in Conservative dentistry:

1. Nanocomposites: [15]
   Nanotechnology has made possible the creation of nano-dimensional filler particles, which are added either singly or as nanoclusters into composite resins. These composites produce a smooth surface after the polishing process are also superior in esthetic features. These fillers in nano- composites have higher translucence as they're smaller than the wavelength of light, which creates more esthetic restorations.
2. Tooth Repair [33]
   Nanorobotic manufacture and installation of a biologically autologous whole replacement tooth that includes both mineral and cellular components (ie, complete dentition replacement therapy) should become feasible within the time and economic constraints of a typical office visit through the employment of a reasonable desktop manufacturing facility.
3. Cavity Preparation : [34]
   Nano robots may be used for cavity preparation and restoration of teeth. Multiple nano robots working on the teeth in unison, invisible to the naked eye. As the cavity preparation is restricted to the demineralised enamel and dentin, thus providing maximum conservation of sound tooth structure.
4. Nanofilled glass ionomer cement: [35]
   Nano glass ionomers are designed to meet the various requirements, same as other materials used in the mouth. Nanotechnology was used in the development to provide some value added features not typically associated with glass ionomer restorative materials. By using bonded nanofillers and nanocluster fillers, along with FAS glass newer type of GIC was formulated using nanotechnology along with its fluoride releasing property. This product meets a wide range of clinical indications ranging from Class I, II, V and core buildup. Nano GIC is an ideal restorative material for everyday dentistry. Advantages of this material are: superb polish, excellent esthetics, higher wear resistance, It is faster, easier to mix and dispense.
5. Nanozone: [36]
   Nano technology based ozone therapy. It provides strongly oxidizing ozone. When given in adequate doses allows removal of 99.9% of bacteria which are responsible for the development of dental caries.

F. Nanotechnology in Oral medicine and radiology: [37,38]

Nanodiagnostics: Nano diagnostics is the use of nano devices for the first disease identification. In in-vitro diagnostics, nano medicine could increase the efficiency and reliability of the diagnostics using human fluids saliva or tissues samples by using selective nano devices, ready to work multiple analyses at sub cellular scale. In in- vivo diagnostics, nano medicine could develop devices able to work inside body to spot the early presence of a disease, to identify and quantify toxic molecules, tumor cells.

Diagnosis and Imaging: Scientists have successfully produced microchips that are coated with human molecules. The chip is designed to emit an electrical impulse signal when the molecules detect signs of a disease. Special sensor nanobots can be inserted into the blood under the skin where they check blood contents and warn of any possible diseases. They can also be used to monitor the sugar level in the blood. Advantages of using such nanobots are that they are very cheap to produce and easily portable.

Diagnosis and Management of Oral Cancer: Nanoscale cantilevers These are flexible beams resembling a row of diving boards that can be engineered to bind to molecules associated with cancer are-

a. Nanopores These are tiny holes that allow DNA to pass through one strand at a time. They will make DNA sequencing more efficient.

b. Nanotubes These are carbon rods about half the diameter of a molecule of DNA that not only can detect the presence of altered genes but also may help researchers pinpoint the exact location of those changes.

c. Quantum dots are nanomaterials that glow very brightly when illuminated by ultraviolet light. They can be coated with a material that makes the dots attach specifically to the molecule to be tracked. Quantum dots bind themselves to proteins unique to cancer cells, literally bringing tumors to light.

d. Dendrimers These are highly branched macromolecules with a controlled three-dimensional architecture. The branched structure makes it possible to attach other molecules like drugs and contrast agents to the cancer cell surface.

e. Nanoshells These are miniscule beads coated with gold. By manipulating the thickness of the layers making up the nanoshells, scientists can design these beads to absorb near-infrared light, creating an intense heat that is lethal to cancer cells. Nanoshells have a core of silica and a metallic outer layer.

Nanotechnology in cancer pain: Nanotechnology has exhibited a remarkable progress over the past 20 years in the management of pain in cancer patients. Recent applications at the nanoscale level include novel drug-delivery systems, such implantable drugdelivery devices, transdermal or transmucosal patches, and micro-needles. Oral transmucosal fentanyl citrate (OTFC; Actiq®, Cephalon, UK) is the first medication developed specifically for the treatment of breakthrough pain and provides its active ingredient, fentanyl, in a unique oral transmucosal delivery system, utilizing microfabrication technology, offering personal pain control for cancer patients.

Digital Dental Imaging: In digital radiographies obtained by nanophosphor scintillators, the radiation dose is diminished and high quality images obtained.

G. Nanotechnology in Tissue Engineering: [39]

Potential applications of tissue engineering and stem cell research in dentistry include the treatment of orofacial fractures, bone augmentation, cartilage regeneration of the temperomandibular joint, pulp repair, periodontal ligament regeneration, and implant osseointegration.

F. Nanotechnology in Pandemic Situation [40]

Rhinocerebral Mucormycosis is a potentially life-threatening disease, which affects mainly immunocompromised patients. Treatment options include reversing immunosuppression, surgery and systemic and local administration of anti-fungal medication. Amphotericin B is the primary agent employed, but its use is often limited by frequent side effects. Complexing Amphotericin B with lipid structures avoids most of the negative side effects, most importantly the dose-limiting nephrotoxicity.

Nanoplasmic Sensors: With the emergence of COVID-19 pandemic the need for rapid detection kits are increasing. This sensor rapidly detects live viruses using their corresponding antibodies.

CONCLUSION

Nanotechnology will change dentistry, healthcare, and human life more profoundly than many developments of the past. As with all technologies, nanotechnology carries a major potential for misuse and abuse on a scale and scope never seen before. However, they also have potential to achieve significant benefits, like improved health, better use of natural resources, and reduced environmental pollution. These truly are the time of miracle and wonder. Nanodentistry still faces many significant challenges in realizing its tremendous potential.

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Peripheral Ossifying Fibroma: A Case Report

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Abstract

Background: Peripheral ossifying fibroma is a reactive hyperplastic mass that is believed to be derived from connective tissue of the submucosa or periodontal ligament. It has a predilection for young adults, though it may occur at any age. Females are more predisposed towards developing these lesions than males and the gingiva anterior to the molars is the most common site. Here is a case report discussing the etiopathogenesis and classical histological features of the lesion.

Keywords: Ossifying Fibroma, Hyperplastic, Periodontal Ligament.

INTRODUCTION

Gingiva is often the site of localized overgrowths that are considered to be reactive rather than neoplastic. Many of these lesions can be specified as specific entities on the basis of typical and consistent histomorphology. These include the Peripheral giant cell granuloma, pyogenic granuloma (including pregnancy tumour), and fibrous hyperplasia (fibrous epulis). There is, however, another gingival overgrowth that is usually composed of cellular fibroblastic tissue and that contains one or more mineralised tissues bone (woven and lamellar), cementum like material or dystrophic calcification. Lee included some of these lesions in the fibrous epulis group, whereas for the others he proposed the term calcifying fibroblastic granuloma. Other authors have proposed various names for this lesion, such as soft fibroma, peripheral fibroma with calcification, peripheral ordontogenic fibroma, and peripheral ossifying fibroma. Finally, WHO suggested that, of the various names mentioned in literature, only the term peripheral ossifying fibroma should be retained.

CASE REPORT

A 45 year old female patient reported to pacific dental college & hospital, with a chief complaint of swollen gums in the left upper front region since last 4-5 years. History of present illness revealed a firm to hard swelling, and no pain associated with it. Extraorally, the lesion is present on the middle 3rd of the face with an extension superiorly to lateral border of ala of nose, inferiorly to vermillion border of lip, anteriorly to philtrum of nose and posterior a line is drawn from lateral canthus of left eye upto the commissure of lip. It was ovoid in shape with a size of 4.8 x 3.5 cm. It was hard, non tender and non fluctuant. Intraoral examination revealed a soft tissue overgrowth present on the gingiva, extending from 21 to 23 (distally) with shiny texture, reddish pink in color. It was sessile, loculated (bilobed) growth. The right lobe was soft, non tender and non fluctuant extending from middle third of 22 to 23 distally. It had a size of 3.5 x 3 cms. Its extension superiorly was upto gingival sulcus, inferiorly to proximal region between 22 and 23, anteriorly to distal side of 21 and posteriorly to distal of 23. There was grade one mobility in relation to 21, 22, 23 and stains (++) and calculus (+ +) was also evident.

The differential diagnosis of peripheral ossifying fibroma and giant cell granuloma was made. An excisional biopsy was carried out. The histopathological sections revealed a hyperplastic parakeratinizaed stratified squamous epithelium and the loose fibrous connective tissue stroma with plump proliferating fibroblasts, scanty vasculature and dense interconnecting hematoxyphilic calcifications resembling bone comprising lacunar spaces and osteocytes. The overall features were suggestive of Peripheral ossifying fibroma.

A follow up of 1 year was done and no recurrence was seen.

DISCUSSION

The peripheral ossifying fibroma is a relatively common gingival overgrowth that is considered to be reactive rather than neoplastic in nature. It accounts for 9.6 % of all the biopsied gingival lesions (Layfield, Shopper and Weir, 1995). While it's etiology is unclear, they are frequently associated with irritants like calculus, dental plaque, dental appliances, ill fitting crowns and rough restorations (Gardner, 1982). Since it occurs exclusively on gingiva (Kenny, 1989), it's occurrence is correlated with the periodontal ligament (Layfield, 1995). They are also thought to originate from the gingival corium or periodontium (Buckmen, 1958). While In the case reported by us, the oral hygiene status was poor and the overgrowth was arising from gingiva.

The fibrous lesions of gingiva with or without calcifications are documented under a variety of terms such as, fibrous epulis (cooke, 1952 ; Lee, 1968), fibroepithelial polyp, calcifying fibroblasic granuloma, soft fibroma (stones, 1941), peripheral odontogenic fibroma (shafer, 1983), peripheral fibroma with osteogenesis (Bruce, 1953), peripheral fibroma with or without calcifications (Bhasker, 1965, 1966), peripheral odontogenic fibroma with or without calcifications (Mulcahy and Dahle, 1995), peripheral odontogeinc fibroma with cementogenesis (Buckman, 1958), peripheral ossifying fibroma (Eversole, 1972) and ossifying fibrous epulis (Orkin and Amaidas, 1984). It has been suggested that these lesions are stages in the spectrum of a single disease process and should be collectively termed as "fibroblastic gingival lesions". (Zain R.B. and Fei Y.J. 'fibrous lesions of gingiva'. "A histopathologic analysis of 204 cases." Oral medicine Oral pathol,(1990) 70: 466 – 470).

Gardner (1982) has suggested that peripheral ossifying fibroma and peripheral odontogenic fibroma are two distinct lesions, the former being a common reactive lesion and the latter a rare extra-osseous counterpart to the central odontogenic fibroma (WHO type). He also suggested that, of the various names mentioned in the literature, only the term, "peripheral ossifying fibroma" should be retained. Buchner (1987) and Kenney (1989) also concluded that, there were sufficient histologic differences to distinguish between these two lesions. Also inspite of similarity in the names, the peripheral ossifying fibroma does not represent the soft tissue counterpart of central ossifying fibroma (Neville, 1995).

Clinically, peripheral ossifying fibroma occur more frequently in the second and third decade, with distinct decrease in incidence after 29 years of age.

This predilection for young people coincides with the findings of the previous studies of Lee (1968). Anderson (1973) noted that these lesions occurred in patients who are younger than those in which the fibrous hyperplasia appears. Most of the authors, noted that they occur approximately 2- 4 times more frequently in females than in males, conversly to the findings of Anderson (1973), who reported male predilection with a ration of 9:15. However the present case, was of a female patient with 45 years of age.

Buchner and Hansen (1987) showed that the peripheral ossifying fibroma has got a slight predilection for anterior maxilla with more than 50% of all the lesions occuring in incisor – cuspid region. Whereas some authors showed nearly equal distribution of lesions in maxilla and mandible. Several investigators reported a similar findings that, Peripheral ossifying fibroma is a well demarcated mass of tissue, located on the gingiva, having a sessile or pedunculated base, which may be lobulated or cauliflower like. The color ranged from pink to slightly red or red. The surface may be either intact or ulcerated. The present case showed a sessile overgrowth in the anterior maxillary cuspid region, reddish pink in color, and was lobulated and shiny.

Anderson (1973) noted that the lesions ranged in size from 0.2 to 0.3 cms at their greatest dimension. However, in the case which has been reported by us was 4.8 x 3.5 cms Extraorally and 3.5 x 3cms intraorally in dimension.

Histologically it consisted of bundles of collagen fibres running in all directions in a dense, fibrocellular stroma, in cases where there are focal deposits of calcified material, or in a highly cellular to predominantly fibrous stroma where there is calcified osseous lamellae or trabeculae (Kfir, 1980).

Orkin and Amaidas (1984) suggested that, in a long standing case of fibrous epulis, calcification or bone formation may occur, as a result of metaplasia of connective tissue in the centre of the lesion or as a result of chronic irritation to the periosteum or to the periodontal ligament. They may exhibit diffuse radiopaque calcifications, but not all lesions exhibit these radiographic features. The vast majority of these lesions are not associated with the radiographic destruction of bone (Abitol and Santi, 1997). In the case reported by us contains we clearly see diffused radiopaque calcifications.

Bhaskar and Jacoway (1966) noted 1.6% of these lesions contained giant cells, whereas Buchner and Hansen (1987) found 14 % with giant cells and Kenney (1989) encountered 3.8 % of cases with giant cells. Bhasker and Jacoway (1966) and Lee (1968) described fibroblastic tissue in epulides, being often associated with ulceration and preceeding calcification and ossification. Buchner and Hansen (1987) stated that ulcerated lesions were composed of highly cellular fibroblastic connective tissue and dystrophic calcifications, whereas in the non ulcerated lesions, the tissue was more collagenized. They also proposed that ulcerated and non- ulcerated lesions represent a spectrum of one lesion with different stages of maturation.

Eversol and Rovin (1972) in their series encountered two distinct histological pattern of lesion. The first is characterized by randomly dispersed focal deposits of calcified material which vary from ovoid to irregular and from metaplastic or dystrophic- like calcifications to laminated or concentric concretions which resemble liesegang phenomenon. But the second tissue pattern characterized by deposits of calcified osseous lamellae and trabecular with circumferential osteoid.

Anderson (1973) and Buchner (1987) reported lesions with three characterstic zones. The zone 1: - characterized by the superficial ulceration covered with fibrinous exudate with inflammatory cells. The zone 2: - This intermediate zone was characterized exclusively by proliferating fibroblast, with numerous straight capillary sprouts seen at right angles to the mucosal surface. No collagen or elastic fibres were observed. The hyalinization was prominent around vascular channels were mineralization often initiated. The zone 3: Deeper zone was characterized by more collagenous tissue and less vascular connective tissue but still with high cellularity. Chronic inflammatory cells were few or absent. Osteogenesis was a prominent feature of this zone.

A few multinucleated giant cells were observed close to the calcified globules and osteoid materials.

Southam and Venkatraman (1973) upon investigation showed that calcification occurred initially in highly cellular fibroblastic tissue as granular foci in irregular condensation of collagen and argyrophilic fibres, which were P.A.S – positive and sudan black – positive. They also suggested that ossifications in such epulides are preceeded by, and occur around, such an initial granular type of calcification.

Kenney (1989) noted that 12% of peripheral ossifying fibroma has small islands of odontogenic epithelium that did not appear to be related to the calcifications, and suggested that they represent remnants of the dental lamina and not a component of the lesion. Bhasker and Jacoway (1966) also noted 5.3% of their lesions contained odontogenic epithelium but did not elaborated.

Daley et al. (1990) suggested that a typical cellular area in a lesion that otherwise resembles a focal fibrous hyperplasia is sufficient for the diagnosis. Walters et al. (2001) recognized that the deeper fibroblastic component in peripheral ossifying fibroma is highly cellular with central areas of calcifications. Such as bone, cementum-like material, dystrophic calcification or a combination of each. The case reported by us also consists of calcifications in the lesion. He also noted that, they are more cellular than focal fibrous hyperplasia and less vascular than pyogenic granuloma.

Unfortunately, peripheral ossifying fibroma has a relatively high rate of recurrance of approx. 16 – 20% (Bhasker, 1966; Eversol 1972; Layfield, 1995). To minimize this tendency, it is important to completely excise lesion, including the involved periosteum and periodontal ligament and to prevent the repeated injury. Long term follow up is extremely important following surgical excision.

In the reported case, an excisional biopsy was performed and there was no recurrence in a one year follow up series.

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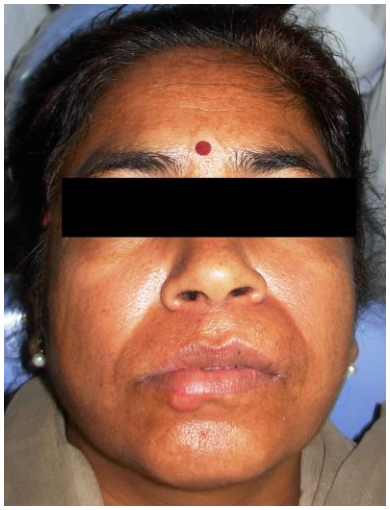

Figure 1

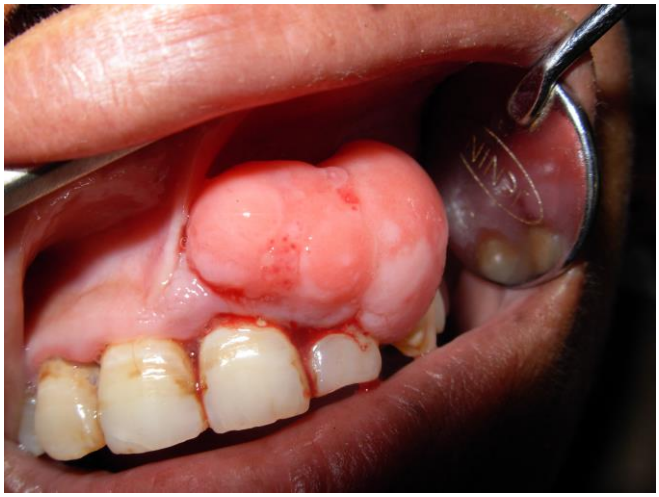

Figure 2

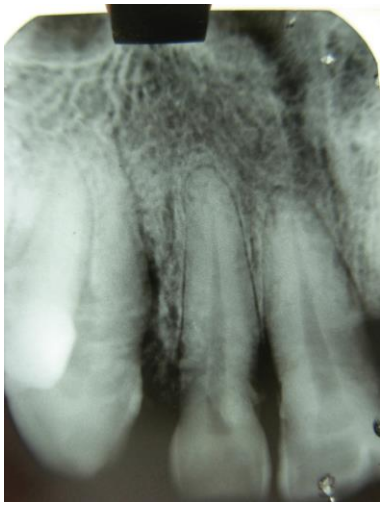

Figure 3

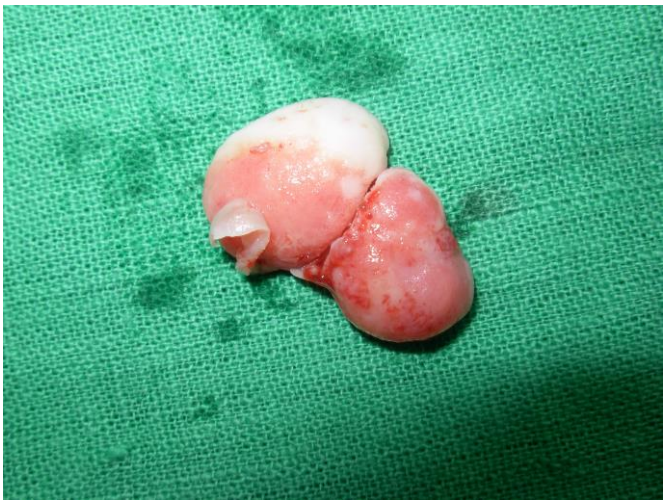

Figure 4

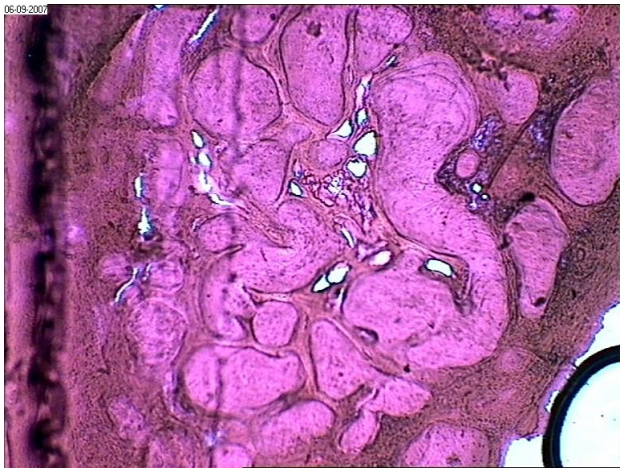

Figure 5

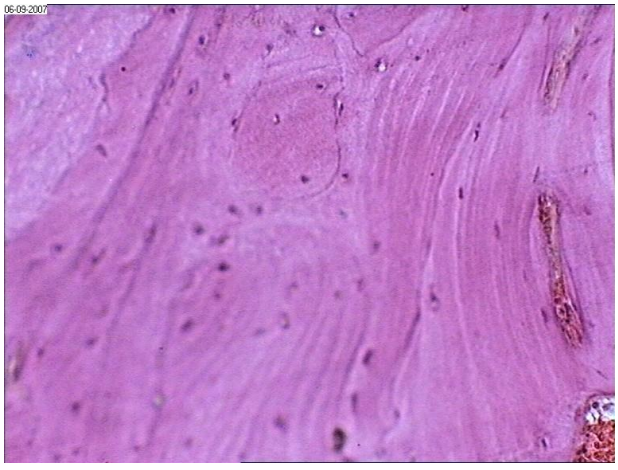

Figure 6

A Study to Evaluate Periodontal Diseases of the Pregnant Women as a Risk Factor for Pre-Term Birth and Low Weight Infants

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Abstract

Pre term (PTB) and low birth (LBW) are the leading perinatal problems worldwide as they are closely related to perinatal mortality and morbidity. Multiple factors have been associated with PLBW. Recently maternal periodontal disease has been reported as a cause of preterm low birth weight (PTLBW) babies. The aim of this study was to establish a correlation between periodontal disease of pregnant women as a risk factor for PTLBW infants and at the same time role of other factors as a cause of PTLBW infants in these cases.

This study indicated a 4.66-fold increase in PTLBW in cases of moderate to severe periodontal infection with CPI score 3 in comparison to periodontal infection with CPI score 1 or 2. Illiteracy of the mother was observed to be an important factor in causation of periodontal disease and PTLBW.

INTRODUCTION

Preterm birth (PTB) and low birth weight (LBW) are the leading perinatal problems worldwide and are closely related to perinatal mortality and morbidity.[1] Multiple factors, some of which are preventable, have been associated with PTB and/or LBW e.g., alcohol, smoking or drug use during pregnancy, high or low maternal age, low socioeconomic status, inadequate prenatal care, low maternal body mass index (BMI), hypertension (HT), generalized infections, genitourinary tract infections, cervical incompetence, diabetes, nutritional status, stress, multiple pregnancies etc.[2,3,4]. It has been proposed that one important factor contributing to the continuing prevalence of infants with preterm low birth weight (PTLBW) is the effect of maternal infection.[5] In this context, new research suggests a new risk factor -periodontal disease.

In recent years, many workers have observed a significant correlation between periodontal infections in mother and PT/LBW babies. [6,7,8,9,10].

Periodontal diseases are a group of infectious diseases resulting in inflammation of gingival and periodontal tissues caused by an overgrowth of putative periodontal pathogens in the subgingival plaque followed by an immuno-inflammatory response in a susceptible host. Cytokines such as TNF-□, IL-l, IL-6 produced by the infected periodontium, appear in systemic circulation may target the placenta. The changes in the level of the hormones during pregnancy affect many organs of the body and periodontium also.

The possibility of maternal periodontal infections, which may adversely influence the birth outcome was raised for the first time in the late 1980s.[11,12]

Tobacco chewing/smoking/ oral use of smokeless tobacco (tobacco toothpaste & tooth powder- *lal dant manjan*) is known factor for PTLBW babies.[13,14,15].

Further it was also reported that at present, however, there is no compelling evidence to indicate that treatment of periodontitis can improve birth outcome.[15,16,17,18,19,20]

Therefore, there is an urgent need to definitely establish the true role of periodontal disease as one of the causative factor in the etiology of PTLBW, hence a study was designed to establish the cause effect relationship between periodontal disease in mother and PTLBW babies

AIMS AND OBJECTIVES

The present study will be conducted with the following aims and objectives:

1. To correlate the association of periodontal disease of pregnant women as a risk factor for preterm low birth weight (PTLBW) infants delivering at Mahila Chikitsalya of S.M.S. Medical College & Attached Hospital, Jaipur between May, 2007 to July, 2008.
2. To correlate the association of hypertension, history of tobacco use, smoking, alcohol intake, socio-economic (family income) and educational status of the mother as risk factor for PTLBW infants.

MATERIALS & METHODS

The study was conducted in the Department of Periodontology and Oral Implantology, Government Dental College and Hospital, Jaipur in association with the Department of Obstetrics and Gynaecology, Mahila Chikitsalya, S.M.S. Medical College & Attached Hospital, Jaipur.

SELECTION OF PATIENTS

A case control study design was chosen including 100 pregnant mothers delivered at Department of Obstetrics and Gynaecology, Mahila Chikitsalya, Jaipur between May, 2007 to July, 2008.

PATIENT GROUP

Two groups were prepared as under:

Case group

50 pregnant mothers with CPI score 3.

Control group

50 pregnant mother with CPI score 1 or 2.

INCLUSION CRITERIA

- Mothers with age group of 18 to 35 years.
- Mothers who had delivered live infant weighing normal (more than 2500g) or PTLBW (less than 2500g and one or more of the following: gestational age <37 weeks, preterm labor (PTL), or premature rupture of membranes (PROM), [6]
- CPI score of mothers in the scale of 1 to 3.
- Associated Risk Factor (RF): hypertension (HT), history of smoking, smokeless tobacco use, alcohol intake, socio–economic and educational status of the mother.

EXCLUSION CRITERIA

- Case with history of abortion, systemic disease such as coronary heart disease, medications or medical problem that may affect study outcome was excluded.

METHODS

A case control study design was chosen involving total 100 pregnant mothers, 50 mothers with presence of periodontal disease with CPI score 3 in the case group and 50 mothers with CPI score 1 or 2 in the control group.

STUDY PROTOCOL

- All mothers were thoroughly briefed about the nature of the study and an informed consent was obtained.
- Each mother included in the study was interviewed directly at the bed side. Information was collected about her educational level, age, family income per

month[101] and details about her husband's education & occupation. Adverse habits such as smoking, smokeless tobacco use, alcohol consumption were also recorded. For smoking and tobacco chew / paste, the type and form in which it was consumed was also noted.

- The mother's data were obtained from medical file. Information on the outcome of the current pregnancy was gathered from mother's medical record. The birth weight of the infant was also noted from the available infant & maternal record. The history of hypertension was noted from gynecologist's record.
- Periodontal clinical examination was carried out upto 48 hours after delivery which included the following recordings:

1) COMMUNITY PERIODONTAL INDEX (CPI Score)
2) CLINICAL ATTACHMENT LOSS (CAL Score)

ASSOCIATED RISK FACTOR	
HYPERTENSION Hypertension history was noted from hospital record	**Yes or No**
SMOKING Types: Cigarette / Bidi / Huka / Others.	Yes / No
TOBACCO US Form used: **C**hewing leaves / Paste/ Others	Yes / No
ALCOHOL CONSUMPTION	Yes / No

STATISTICAL ANALYSIS

For statistical analysis of observations, Chi-square test was applied.

RESULTS

Table No. I

DISTRIBUTION ACCORDING TO BIRTH WEIGHT OF BABY OF CASE & CONTROL GROUP

BIRTH WEIGHT	**CASE GROUP**		**CONTROL GROUP**	
	No.	**%**	**No.**	**%**
PTLBW	14	28.00	3	6.00
NBW	36	72.00	47	94.00
TOTAL	**50**	**100.00**	**50**	**100.00**

The table II shows that out of 50 babies delivered in case group (n=50), 6% babies (14/50) delivered were PTLBW and 72% babies (36/50) delivered were full term normal for gestation age. Whereas in control group 6% babies (3/50) were delivered with PTLBW and 94% babies (47/50) were delivered as full term normal for gestation age. The statistical analysis indicated a significant correlation in both groups ($P < 0.05$, Significant on Chi-square test).

Table No. II

DISTRIBUTION ACCORDING TO AGE GROUP OF MOTHERS & BIRTH WEIGHT OF BABY OF CASE & CONTROL GROUP

AGE GROUP (yrs)	**CASE GROUP**			**CONTROL GROUP**		
	PTLBW	**NBW**	**TOTAL**	**PTLBW**	**NBW**	**TOTAL**
18 - < 25	12 (24.00)	12 (24.00)	24 (48.00)	2 (4.00)	20 (40.00)	22 (44.00)
≥ 25 - < 30	2 (4.00)	19 (38.00)	21 (42.00)	1 (2.00)	23 (46.00)	24 (48.00)
≥ 30 - 35	0 (0.00)	5 (10.00)	5 (10.00)	0 (0.00)	4 (8.00)	4 (8.00)
TOTAL	**14 (28.00)**	**36 (72.00)**	**50 (100.00)**	**3 (6.00)**	**47 (94.00)**	**50 (100.00)**

Table II describes the distribution of deliveries of PTLBW and full term normal delivery according to the age group of mothers in case and control group. In control group, the statistical analysis indicated a significant correlation in both groups ($P < 0.05$ on chi-square test)

Whereas in case group, the statistical analysis indicated a non significant correlation in both groups ($P > 0.05$ on Chi-square test).

Table No.- III

DISTRIBUTION ACCORDING TO EDUCATIONAL STATUS OF MOTHERS AND BIRTH WEIGHT OF BABY OF CASE GROUP

Educational Status	PTLBW		NBW		Total	
	No.	%	No.	%	No.	%
Illiterate	14	28.00	13	26.00	27	54.00
Primary	0	0.00	3	6	3	6.00
Middle	0	0.00	2	4	2	4.00
High School	0	0.00	1	2	1	2.00
Hr. Secondary	0	0.00	4	8	4	8.00
Graduate & above	0	0.00	13	26	13	26.00
TOTAL	**14**	**28.00**	**36**	**72.00**	**50**	**100.00**

Table III shows the distribution of mothers according to educational level and birth weight of baby in case group. Out of 50 mothers in case group, 27 mothers (54%) were illiterate and out of these 27 illiterate mothers, 14 mothers delivered PTLBW babies. The statistical analysis indicated a significant correlation in both groups ($P < 0.05$ on chi-square test).

Table No. IV

DISTRIBUTION ACCORDING TO SOCIO ECONOMIC STATUS (SES) OF MOTHERS AND BIRTH WEIGHT OF BABY OF CASE & CONTROL GROUP

SES	CASE GROUP			CONTROL GROUP		
	PTLBW	NBW	TOTAL	PTLBW	NBW	TOTAL
I	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
II	4 (8.00)	24 (48.00)	28 (56.00)	3 (6.00)	34 (68.00)	37 (74.00)
III	1 (2.00)	6 (12.00)	7 (14.00)	0 (0.00)	5 (10.00)	5 (10.00)
IV	9 (18.00)	6 (12.00)	15 (30.00)	0 (0.00)	8 (16.00)	8 (16.00)
V	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
TOTAL	**14 (28.00)**	**36 (72.00)**	**50 (100.00)**	**3 (6.00)**	**47 (98.00)**	**50 (100.00)**

Statistical analysis indicated that there is definite correlation between PTLBW and SES in case group ($P < 0.05$ Significant) whereas it is not significant in control group ($P > 0.05$ Not Significant).

Table No. V

DISTRIBUTION ACCORDING TO COMMUNITY PERIODONTAL INDEX (CPI SCORE) OF MOTHERS & BIRTH WEIGHT OF BABY OF CASE & CONTROL GROUP

CPI SCORE	CASE GROUP			CONTROL GROUP		
	PTLBW	NBW	TOTAL	PTLBW	NBW	TOTAL
CPI SCORE = 1	0	0	0	1	42	43
CPI SCORE = 2	0	0	0	2	5	7
CPI SCORE = 3	14	36	50	0	0	0
TOTAL	**14**	**36**	**50**	**3**	**47**	**50**

Out of 50 mothers in control group, 43 mothers (86%) were having gingivitis with CPI score 1. Out of these 43 mothers, 1 mother (2%) delivered as PTLBW whereas 42 mothers (84%) delivered as full term normal for gestation age. Remaining 7 mothers (14%) in control group were having gingivitis with CPI score 2. Out of these 7 mothers, 2 mothers (4%) delivered as PTLBW and 5 mothers (10%) delivered as full term normal for gestation age.

In case group, out of 50 mothers of case group (as per study protocol) all mothers (100%) were having periodontitis with CPI score 3. Out of these 50 mothers of case group, 14 mothers (28%) delivered as PTLBW whereas 36 mothers (72%) delivered as full term normal for gestation age.

Table No. VI

DISTRIBUTION ACCORDING TO ASSOCIATED RISK FACTORS OF MOTHERS & BIRTH WEIGHT OF BABY OF CASE & CONTROL GROUP

RISK FACTOR	CASE GROUP			CONTROL GROUP		
	PTLBW	NBW	TOTAL	PTLBW	NBW	TOTAL
HYPERTENSION	3 (6.00)	11 (22.00)	14 (28.00)	0 (0.00)	3 (6.00)	3 (6.00)
TOBACCO	8 (16.00)	6 (12.00)	14 (28.00)	0 (0.00)	3 (6.00)	3 (6.00)
SMOKING	1 (2.00)	13 (26.00)	14 (28.00)	0 (0.00)	3 (6.00)	3 (6.00)
ALCOHOL	0 (0.00)	14 (28.00)	14 (28.00)	0 (0.00)	3 (6.00)	3 (6.00)

Table VI is showing the role of other risk factors viz. Hypertension, Tobacco, Smoking and Alcohol in causation of PTLBW in mothers of case and control group. In case group out of 50 mothers, it was observed that 8 mothers (16%) delivered PTLBW babies. It have been reported in literature that tobacco use (chewing / paste) is playing significant role in causation of PTLBW. In this study, other factors did not play a significant role in causing PTLBW in mothers of both the groups.

Table No. VII

DISTRIBUTION ACCORDING TO HYPERTENSION OF MOTHER AND BIRTH WEIGHT OF BABY OF CASE & CONTROL GROUP

BIRTH WEIGHT	CASE GROUP			CONTROL GROUP		
	HYPER TENSIVE	NORMO TENSIVE	TOTAL	HYPER TENSIVE	NORMO TENSIVE	TOTAL
PTLBW	3 (6.00)	11 (22.00)	14 (28.00)	0 (0.00)	3 (6.00)	3 (100.00)
NBW	3 (6.00)	33 (66.00)	36 (72.00)	4 (8.51)	43 (46.00)	47 (94.00)
TOTAL	**6 (12.00)**	**44 (88.00)**	**50 (100.00)**	**4 (8.00)**	**46 (92.00)**	**50 (100.00)**

Table VII shows the distribution of cases according to prevelance of hypertension in mothers in case and control group. Out of 50 mothers in case group, 6 mothers were having hypertension and out of these 3 mothers delivered PTLBW babies and 3 mothers delivered as full term normal for gestation age. Whereas out of 50 mothers in control group, 3 mothers were having hypertension but all of them delivered as full term normal for gestation age. Statistical correlation between HT of mother and PTLBW in both groups was non significant ($P > 0.05$).

Table No. VIII

DISTRIBUTION ACCORDING TO ALCOHOL INTAKE HABI OF MOTHER AND BIRTH WEIGHT OF BABY OF CASE & CONTROL GROUP

BIRTH WEIGHT	CASE GROUP			CONTROL GROUP		
	ALCOHO LISM	NON ALCOHO LISM	TOTAL	ALCOHO LISM	NON ALCOHO LISM	TOTAL
PTLBW	0 (0.00)	14 (28.00)	14 (28.00)	0 (0.00)	3 (6.00)	3 (6.00)
NBW	0 (0.00)	36 (72.00)	36 (72.00)	1 (2.00)	46 (92.00)	47 (94.00)
TOTAL	**0 (0.00)**	**50 (100.00)**	**50 (100.00)**	**1 (2.00)**	**49 (98.00)**	**50 (100.00)**

Table VIII shows the distribution of cases according to mother's history of alcohol intake and birth weight of baby. No case was reported from the mothers of case group whereas only one case was reported from the control group.

In this study, no correlation was observed between mother's alcohol intake and PTLBW in control group ($P > 0.05$).

Table No. IX

DISTRIBUTION ACCORDING TO TOBACCO CHEWING / PASTE HABIT OF MOTHER AND BIRTH WEIGHT OF BABY OF CASE & CONTROL GROUP

BIRTH WEIGH T	CASE GROUP			CONTROL GROUP		
	TOBACC O CHEWER	NON TABCCO CHEWE R	TOTA L	TOBACC O CHEWER	NON TOBACC O CHEWER	TOTA L
PTLBW	8 (16.00)	6 (12.00)	14 (28.00)	0 (0.00)	3 (6.00)	3 (6.00)
NBW	7	29	36	5	42	47
NBW	7 (14.00)	29 (56.00)	36 (72.00)	5 (10.00)	42 (84.00)	47 (94.00)
TOTAL	**15 (30.00)**	**35 (70.00)**	**50 (100.00)**	**5 (10.00)**	**45 (90.00)**	**50 (100.00)**

Table IX shows the distribution of cases according to habit of tobacco use in mother (tobacco chew / paste use) and birth weight of baby, in case and control group. Out of 50 mothers of case group, 15 mothers (30%) were using tobacco, whereas in control group, only 5 mothers (10%) were using tobacco. Further evaluation indicated that 16% mothers (8/50) delivered with PTLBW in case group ($P < 0.05$), whereas no case was reported from the control group ($P > 0.05$).

Table No. X

DISTRIBUTION ACCORDING TO SMOKING HABIT OF MOTHER AND BIRTH WEIGHT OF BABY OF CASE & CONTROL GROUP

BIRTH WEIGHT	CASE GROUP			CONTROL GROUP		
	SMOKER	NON SMOKER	TOTAL	SMOKER	NON SMOKER	TOTAL
PTLBW	1 (2.00)	13 (26.00)	14 (28.00)	0 (0.00)	3 (6.00)	3 (6.00)
NBW	3 (6.00)	33 (66.00)	36 (72.00)	0 (0.00)	47 (94.00)	47 (94.00)
TOTAL	**4 (8.00)**	**46 (92.00)**	**50 (100.00)**	**0 (0.00)**	**50 (100.00)**	**50 (100.00)**

Table X shows the distribution according to smoking habits of mothers and birth weight of case and control groups. In case group, out of 50 mothers, 4 mothers were smoker whereas in control group, out of 50 mothers there was no case reported as smoker. Out of the 4 mothers of case group only one mother delivered with PTLB and whereas in control group, no case delivered with PTLB.

In this study the data indicated that there is no correlation between smoking and PTLBW ($P > 0.05$). These finding are against the reported studies where pregnant women who smoke cigarettes are nearly twice as likely to have a low birth weight baby as women who do not smoke.

TABLE NO. XI
DISTRIBUTION ACCORDING TO CLINICAL ATTACHMENT LOSS (CAL SCORE) OF MOTHER AND BIRTH WEIGHT OF BABY OF CASE & CONTROL GROUP

CAL SCORE	CASE GROUP			CONTROL GROUP		
	PTLBW	NBW	TOTAL	PTLBW	NBW	TOTAL
0	14	36	50	3	47	50
TOTAL	**14**	**36**	**50**	**3**	**47**	**50**

Table XI shows the distribution according to Clinical Attachment Loss (CAL score) of mothers and birth weight of baby of case and control groups. In both groups, mean CAL was zero.

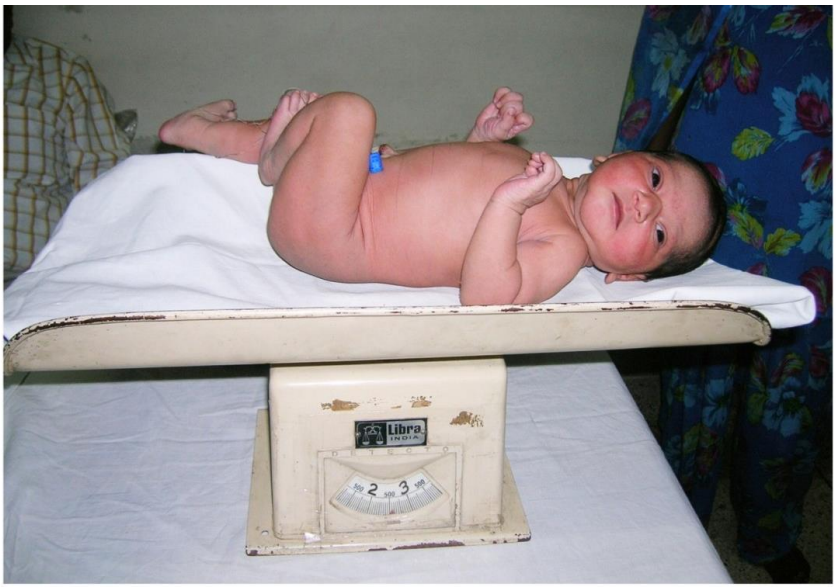

FIG 1. PTLBW BABY ON BABY WEIGHING SCALE

FIG 2. NORMAL BABY WEIGHT ON BABY WEIGHING SCALE

DISCUSSION

This study was undertaken to establish a cause effect relationship between periodontal disease in mother and PTLBW babies. The age group considered for the present study was 18 to 35 years. The rationale selecting the age group between 18 to 35 years is that the periodontal diseases are gram-negative anaerobic infections that can occur in women in the age group of 18 to 34 years[6].

Age group distribution of mothers in case group and control group has indicated that most of deliveries took place in the age group of 18-30 years.

Literacy of mother is an important parameter for the fetal outcome. The findings in this study indicated that there is a significant association between education level of mothers and birth weight of baby. Our observations are in accordance with the reported observations by Garvey A, Douglass C, Chauncey H 1988[21,22].

Socio-economic distribution in studied population indicated that in both groups, the maximum number of mother were from SES II (upper middle SE class) but at the same time it was observed that PTLBW deliveries were more in SES IV in
case group. This finding was further evaluated and it was observed that inspite of good Socio-economic Status IV in the case group (who delivered 9 (18%) PTLBWs) all of these mothers were illiterate. As reported that positive correlation exists between lower socio-economic status and periodontal disease leading to PTLBW[23,24,25] in this study illiteracy had been found to be more significant factor in comparison to SES as a cause of periodontal disease leading to PTLBW.

In this study, the babies delivered with PTLBW were 6 % (3/50) in the control group mothers with CPI score 1 or 2 which is comparable with the reported prevelance of 10% of PTLBW in India[26,27,28]. Whereas in the case group mother with CPI score 3, PTLBW was 28%, which is much higher than the reported in Indian situations ($p < 0.05$). With this observation it is clearly evident that periodontal disease with CPI score 1 and 2 did not contributed to adverse outcome of pregnancy but periodontitis with CPI score 3 have definite role in adverse outcome of pregnancy causing PTLBW babies.

It had been reported that systemic inflammation leading to release of chemical mediators play a major role in the pathogenesis of preterm delivery, including preeclampsia, intrauterine growth restriction, and preterm delivery[29].

It had reported that periodontal disease causes increased levels of biological fluids that induce labor. When periodontal disease is present, the number of bacteria significantly increases by as much as 10,000 times the original population [30]. The bleeding gums in periodontal disease gives the way to bacteria, who enters in the blood stream, travel through the mother's body, and enter the placenta causing poor fetal growth and as a result PTLBW baby.

Role of other risk factors as a cause of PTLBW was evaluated. The main factors which were evaluated were hypertension, Tobacco, Smoking and Alcohol in both groups. In this study, no other factor was found to play a significant role in causing PTLBW in mothers of both the groups.

As the CPI index selected under our study was restricted to score 1 to 3 and the CPI index of 4 or more were exclude. The CAL score expectedly shows the score of zero, rendering the relationship of our study as insignificant. Although CAL does not yield any data on the activity or the presence of periodontal disease, it is the only value that can be compared with other studies, so we used it.

CONCLUSION

In conclude, this study indicated a 4.66 fold increase in PTLBW in cases of periodontal infection with CPI score 3 in comparison to periodontal infection with CPI score 1 or 2. Many Other workers reported a 4.5 to 7 fold increase in incidence of PTLBW in cases of periodontitis with CPI score ≥ 3. The important observation made in this study was illiteracy of the mother plays a major role in causation of periodontal disease as well as to PTLBW.

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Radiological Evaluation of the Dimensions of Lower MolarAlveoli

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Abstract

Aim: The aim of this study to analyze the alveolar bone morphology of the lower first and second molars. This analysisaims to evaluate the morphology of a hypothetical postextractive site in the lower molar area to diagnose the possibility of immediate postextraction implant placement using cone beamcomputed tomography (CBCT).

Materials and Methods: Conebeam CT scans of 45 patients were examined. The measurements were made using a dedicated 3D software. Reference points were identified to allow clear and repeatable measurements.

Results: The mean available bone height was **14.17 +/- 3.56** mm in lower first molars and **12.90 +/- 3.45** mm in lowersecond molars. The inter-radicular septum was present in 92% in first molar sites and in 70% in second molar sites.

Conclusions: Preoperative cone-beam scan and the knowledge of anatomical measurements fromthe present analysis are fundamental before planning immediate postextractive implants in the lower molar area.

Keywords: Dental alveoli, Human anatomy, Postextractive implant, Oral implantology, Cone beam CT

INTRODUCTION

Implant treatment is a common procedure in dental practice. Immediate or early placement approach increases the attractiveness of implant therapy. After extraction, the alveolar process undergoes marked alterations because of which alveolar bone width and height of buccal bone changes significantly.

Postextraction implant sites often require bone augmentation procedures to achieve and maintain successful osseointegration. Alveolar bone dimensions prior toextraction may be an important determinant of bone morphological changes that occur postextraction.[1]

The precise knowledge of the anatomical structures of dental alveolus appears useful when tooth extraction and subsequent immediate implant insertion are planned. [2] The outcome of implant therapy is no longer defined only by successful osseointegration. Rather, the success depends on a variety of factors that affect the implant-prosthetic complex, including the health and stability of peri-implant soft and hard tissues, esthetic outcomes, and patient satisfaction.

In the mandible, the first and second molars septum have 2 roots; mesial, and distal, that are similar in size and dimension, so the shape of interradicular septum is rhomboidal with a narrow mesiodistal dimension . The interradicular septum of the first and second teeth of maxillary molars is surrounded by 3 roots: bucco mesial, bucco distal, and palatal , which provides a triangular shape and wider dimensions of the septum. The average width of mandibular molars is 9 mm buccolingual and 9 mm mesiodistal, relative to maxillary 10 mm buccolingual and 8mm mesiodistal, which explains the triangular shape and wider interradicular septum.[3] The type of bone in the posterior mandible region (second premolar and molars) is described by Misch et al., and presents usually as D3 bone, while the posterior maxilla region (molar region) usually as D4 bone, still in cases of sinus grafting it may have D3 bone 6 months after grafting. "D3 bone describes fine trabecular bone surrounded by thin porous cortical bone **while** D4 boneis fine trabecular bone with almost no cortical bone". [4]

For a successful osseointegration, the main requisite is the primary stability of implant. It is achieved with some complications in molar alveoli sites due to some anatomical complexities like the inferior alveolar nerve canal. **Due to the presence of submandibular gland fossa, there is lingual bone concavity in mandibular posterior region which increase the complications.** Dental implants in the region, if not placed properly, can perforate the lingual bone or damage the lingual nerve leading to treatment failure.[4,5]

Watanabe et al. categorized the cross-sectional morphology of the mandible. Their data demonstrated that lingual concavity is prevalent in 36% to 39% of the study population. Although biomechanically it is best that bucco-lingualimplant inclination follows the long axis of the opposing tooth, ignoring the presence of a lingual undercut may lead to perforation of the lingual plate. On the same note, manually fabricated surgical guides following the ideal prosthetic position without considering underlying anatomic limitations may run the risk of lingual plate perforationthus leading to severe surgical complications. Furthermore, the residual gap between bone plates and implant neck, after immediate implant positioning, should be previously evaluated to understand the need for graft when standard diameter implants are used.[3,4,5]

The radiograph analyses are required diagnostics procedure in everyday dental practice, and also are used in the treatment plan and follow-up the results of therapy. **The conventional 2D radiographic techniques have multiple visual limitations like magnification, distortion, and superimpresion, which altogether may lead to misrepresentation of anatomical structures. The triumph of CBCT is its capability to gather patients** information of volumetric jaw bone imaging, which can be used for preoperative field review and treatment plan. The equipment that's included in CBCT is viewing software, containing 3D database, and a wide range of extensive tools that provide analysis of images. The software tools that are usually used in presurgical implant placement are: oblique slicing (nonorthogonal)- which creates 2D image at any angle by cutting across a set of axial images; curved slicing (panorama like view), cross-sectional (oblique coronal) view provide images in thickness and spacing, that's important for evaluation of morphometric characteristics of alveolar bone for immediate placement, and others like ray sum and volume rendering .[6,7] Using 3D CBCT in implantology, it is possible to fully integrate the preoperative transfer to the surgical field, virtual implants placement, and preoperative transfer to the surgical field with further prosthetic **rehabilitation.**[7]

Cone beam computed tomography (CBCT) is a promising diagnostic and prognostic tool in the implant therapy. It provides high resolution images of oral and maxillofacial region with lower radiation dose than conventional computed tomography. It provides the clinician with third dimension that makes it better than

two-dimensional imaging modalities such as intraoral periapical radiographs, orthopantomographs, etc. today, CBCT is preferred over CT, because this new technology offers better image quality and lower radiation exposure

The study by **R Pauwels et al in 2015** showed that CBCT is reliable in morphometric analyses of the anterior maxilla,to notice interconnections between the structure measures, and preliminary examination for implant **planning.**[8] Moreover, another studies using CBCT in anterior maxilla analyze that detection of various anatomic structures, may be useful in the prevention of complications during surgical intervention, as implant placement. Still, the morphological observed algorithms of the anterior maxilla may offer detailed information that can be used for planning orthodontic teeth movement. The justification of CBCT for preoperative implant plan is based on accurate information about vital structures, height, and width of bone, bone density, and alveoli profile. The European Association for Osseointegration in 2011, and the American Academy of Oral and Maxillofacial Radiology 2012, represented the guidelines of using CBCT in implant dentistry.[7,8]

According to the knowledge of CBCT usage, the study of Agostinelli et al. investigated the morphology of a hypothetical postextractive site in the upper molar area to diagnose the possibility of immediate postextraction implant placement and concluded that these alveolar sites do not present ideal conditions for immediate implant insertion in a correct position.[5]

Hence, it is imperative to evaluate bone dimensions of mandibular posterior teeth, such as buccal and lingual bone plate thickness, alveolar bone width, and distance from the inferior alveolar canal using CBCT. The radiographic evaluation of the alveolar bone morphology and sizes represents a key element to place and adequately stabilize the immediate implant in a predictable way.[8,9,10]

AIM & OBJECTIVE

- To analyze the **alveolar bone morphology** of the **mandibular first and second molars** in **hypothetically post extractive site** to diagnose the **possibility of immediate implant placement and its success.**

MATERIALS AND METHODS

This is a retrospective done from May 2018 to August 2018 in which CBCT scans of 45 patients reporting in Department of Periodontics, RUHS College of Dental Sciences, Jaipur were examined.

- Each "tooth site" was verified the presence of:
  i. Healthy or decayed tooth;
  ii. Endodontic injury or Osteolysis from periodontal disease and/or from root fracture
- The alveolar sites with the following criteria were excluded from the study:
  - Sites with large bone lesions like reactive bone diseases, fibro-osseous lesions, and giant cell lesions were notincluded in the study to exclude pathological condition that should influence the measurements in a significant way.
  - Teeth having periapical pathologies, like chronic periapical abscess, chronic apical periodontitis, apicalperiodontitis, perioendo lesion, infected periapical cyst, periapical cyst, and radicular cyst, which are indicated for apical surgery, were excluded from the study owing to the possible effects of periapical pathologies on alveolar bone dimensions at the analyzed sites.
  - Patients with systemic diseases were excluded from the study.
  - Due to varying anatomy, third molars were not considered in the study.
- Panorex, axial, and paraxial sections were analyzed (Figure 1) & the measurements in millimeters were made using the One Scan 3D software.
- To measure the bone available, there are series of some precise reference points for the alveoli thickness and size in CBCT scan which allow clear and repeatable measurements.

PANOREX SECTIONS

- Apical-mesial point (AM)
- Apical-distal point (AD)
- Most coronal point at tooth furcation (F)

AXIAL SECTIONS

- P1 (distal point of mesial root)
- P2 (mesial point on distal root)
- Pm (mesial point on mesial root)

- Pd (distal point on distal wall)
- Pb (buccal point on the root)
- PI (lingual point on the root) Paraxial sections
- PCB (bone peak of buccal wall)
- PCL (bone peak of lingual wall)
- A (apical point)

Li (MANDIBULAR CANAL)

Parameters for Alveolar Dental Sites

Measurements

- Average number of bony walls in each alveolus: The numbers of bony walls that surround the entire alveolar site (ie, the cortical lingual, cortical buccal, and mesial and distal cortical) wereevaluated in the axial sections and paraxial sections
- Mean height of useful bone from the mandibular canal: The measurement carried out on the paraxial section after establishing the alveolar reference site in the axial plane. Standard references are the mandibular canal (Li) and the coronal part of the alveolus (points PCB and PCL).
- Inter-radicular septum and extension of the Interseptal basis: The interradicular septum describesarea in the root furcation that separate alveoli of multi-rooted teeth. The shape and dimension depend of the topography of the extraction socket, the geometry of residual root and anatomy of molars alveoli. The clinical implications of this anatomic structure may be used in oral surgery resection procedures, periodontology and implantology. There is an opinion from the surgical and prosthodontic side that center of interradicular septum may be adequate place for immediate implantation. Presence of the septum observed in the axial and paraxial sections:
  - Present, it indicates when the septum is present and its thickness and height are measurable. The measurement is carried out on the Panorex section (distance between points F and AD and between F and AM) after having established the corresponding point on axial section.
  - Absent, it indicates that the roots are in close contact with each other, when the roots are open in the first section and converging at the apex otherwise the apex is affected by osteolytic disease. Width and height cannot be measured.
- Mean thickness of the lingual cortex: The measurement was made at the two most apical levels compared to the previous measurement. The average of the 3 measurements was then calculated (including the most coronal measurement).
- Mean thickness of the buccal cortex: The measurement was made at the two most apical levels compared to the previous measurement. The average of the 3 measurements (including the most coronal measurement) was then calculated.
- Buccal-lingual width of the dental alveolus: The measurement was evaluated on the paraxial section, after establishing the reference points on the corresponding axial section, in the most apical coronal bone peak (PCB-PCL). The mean distance between the measurements, both on the mesial and on the distal root, was calculated.
- Mesial-distal width of the dental alveolus: The measurement was made on axial section after establishing the point F on corresponding root furcation (in the Panorex section). The distance between the most distal point of distal alveolus (Pd) and the most mesial point of mesial alveolus (Pm) was calculated.

RESULT

- A total of 65 dental sites of first lower molar and 57 of second lower molars were examined. Tooth alveoli, surrounded by all 4 bone walls, were detected with a percentage of 72% in lower first molars (mean of 3.64 ± 0.53 mm bone plates) and in 82% of cases in lower second molars (mean of 3.70 ± 0.45 mm bone plates). The mean useful bone height measured was 14.17 ± 3.56 mm in firstmolar alveoli and 12.90 ± 3.45 mm in the second molar alveoli. (Figure 2)
- The inter-radicular septum was present in 92% in first molar sites and in 70% in second molar sites. This bone septum was 6.79 ± 2.66 mm thick in the first molar alveoli and 5.19 ± 1.88 mm in the second molar alveoli. The mean buccal-lingual alveolus width was 8.81 ± 0.67 mm in first molar alveoli and 8.80 ± 0.60 in second molar. The

mean mesio-distal alveolus width was 8.93 ± 0.84 mm in first molars and 8.98 ± 0.87 mm in second molars. All data about lower molars alveoli measurements are summarized in Table1.

DISCUSSION

Efforts have been taken to decrease overall treatment time and surgical interventions in implant therapy recently.[11] Alternative to conventional approach, immediate or early implant placement approaches have been proposed.

According to the survey of Swiss dental practitioners in 1994, most frequent indications for implant therapy were found to be completely edentulous mandible followed by edentulous posterior mandible. Knowledge of the exact location and course of the mandibular canal is of great importance to avoid neurosensory disturbances following placement of dental implants. Perforation of the lingual cortical plate during implant placement in the posterior mandible can be a severe surgical complication, and the presence of a lingual undercut is considered an importantanatomical risk factor.

Hence, **analysis of bone dimensions in posterior mandible for implant placement is important**.[12,13] **Tomasi et al[14]** stated that the thickness of the buccal bone wall is a key determinant of implant treatment success following extraction. The thickness of the buccal bone wall is associated with the degree of defect fill following implant placement. **Importance of analysis of bone dimensions before future implant placement is well documented in the literature.[14]**

Analysis of bone dimensions is a must before immediate implant placement to determine the need of bone augmentation and appropriate treatment planning. Inadequate amount of remaining bone following implant therapy can cause treatment failure. Following extraction, bony alterations are most commonly seen in the coronal portion of the alveolar ridge.[15,16]

Bone dimensions of the posterior mandible have been evaluated using different radiographic methods in several studies. However, in the majority of those studies imaging was not based on CBCT. Studies analyzing CBCT imagesof the posterior mandible were done either on fully dentate subjects or were cadaveric studies focusing mainly on theaccuracy of CBCT measurements.[17,18]

Lingual plate perforation is difficult to assess from radiographic images because of potential artifacts around implants. The beam-hardening effect of implants in CT or CBCT images complicates the establishment of a definitive diagnosis of lingual perforation, hindering investigations on the incidence of lingual perforations after implant placement. The beam-hardening effect is an inherent artifact resulting from the polychromatic absorption of low-energy x-ray photons by metallic objects resulting in an exiting x-ray beam that contains mainly high-energy x-ray photons (e.g., a harder beam). Although artifact reduction technique algorithms have been developed, they are computationally demanding and time consuming. Unless potential artifact caused by metallic objects (e.g., dental implants) can be resolved, the use of CT/CBCT for postoperative evaluation is not justifiable at this time.

Therefore, alveolar ridge dimensional changes after tooth extraction have been widely studied. A systematic review by Tan et al[15] reported that the mean amount of alveolar ridge resorption during the first 6 months following tooth extraction is 3.79 ± 0.23 mm in horizontal dimension and 1.24 ± 0.11 mm in vertical dimension. Another systematic review by Van der Weijden and colleagues[15] reported that a mean clinical loss of 3.87 ± 0.82 mm in horizontal dimension and 0.64 ± 0.19 mm in vertical dimension occurs following tooth extraction.

Data, emerging from the present study, similar to those provided by another **study (Agostinelli C et al. 2018)[5,6.]** The radiographic evaluation of the alveolar bone morphology and sizes represents a key element for the proper planning ofthe postextraction immediate implant treatment. **Proper clinical conditions, for scheduling a postextraction immediate implant placement surgery, inevitably involve the presence of 4 bone walls showing sufficient heightand width. Measurements of the present study clearly demonstrated that the postextraction alveolar site in lower molars alveoli could be too large to place a standard diameter implant with good primary stability with small peri-implant gap.**

It is demonstrated that the postextractive alveolar

site has more osteogenetic potential than mature bone.[8] Bone defects, surrounding immediate post extractive implants, showed the tendency to be filled more easily and quickly than the same size defects surrounding implants inserted after 3 months from the extraction **(Esposito M et al. 2010)** [9] Peri-implant gap should be filled by graft materials rather than titanium, could prevent bone resorption if its size is more than 1.5 to 2 mm. **(Chen ST et al. 2005)** [10] The inter-radicular septum represents an usual ideal position during immediate postextractive dental implant insertion procedures. The presence of **thick inter-radicular septum** is an important **prognostic factor** to evaluate before planning an immediate implant. Thick bone septum was detected, in the present study, in 92% of first lower molars examined and only in 70% of cases in second lower molars.

The measurements of alveolus bone dimensions appear fundamental to correctly plan a hypothetical postextractive implant. For this reason, the radiological evaluation of human molar alveoli bone dimensions could act as a preoperative guide able to integrate clinical and radiological data before planning immediate postextractive implants.

CONCLUSION

The present retrospective radiological study analyzed human mandibular molar alveoli by measuring the cone beam computed tomography (CBCT) scans. **The measurements made described the bone anatomy of lower molar alveoli before a hypothetical tooth extraction. The accurate knowledge of alveolus bone morphology in mandibular molars could be an important guide in planning immediate postextractive implant insertion to avoid potential failures due to non-ideal anatomical features to fixture stabilization. Careful CBCT analysis of each single case, however, is highly recommended before planning immediate postextractive implants in mandibular molar sites.**

Data from the present study demonstrated **that lower molar alveoli have typical anatomical features different from anterior or premolar teeth. These differences should be cautiously evaluated during the case planning toadjust the surgical approach to the alveolus anatomy and morphology. From a clinical point of view, the bone anatomy of lower molar sites does not allow an easy immediate postextractive implant insertion with sufficient primary stability, especially when the inter-root septum is thin or absent.**

Inadequate bone may result in implant failure. To prevent this, bone augmentation procedures are required. Currently, there is insufficient data regarding preoperative bone dimension analysis of mandibular posterior teeth. As CBCT is the preferred imaging modality for oral and maxillofacial structures, careful preoperative analysis of alveolar bone dimensions may determine the need for bone augmentation. Thus, it will significantly increase the success rate of immediate implant treatment in the mandibular posterior teeth.

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TABLES

Table1: Measured Parameters in Mandibular Molar Alveoli

	First Lower Molars		Second Lower Molars	
	Mean	**SD**	**Mean**	**SD**
No. examined alveoli	65	--	57	--
Average no. bone walls ineach alveolus	3.64	0.53	3.70	0.45
Mean available bone heightvalue (mm) from the mandibular canal	14.17	3.56	12.90	3.45
Mean height (mm) of inter- radicular septum (if present)	6.79	2.66	5.19	1.88
Mean bucco-lingual dimension (mm) of wholedental alveolus	8.81	0.67	8.80	0.60
Mean mesio-distal dimension(mm) of whole dental alveolus	8.93	0.84	8.98	0.87

FIGURES

Fig 1. a) Panorex Section; b) Axial Section; c) Paraxial Sections

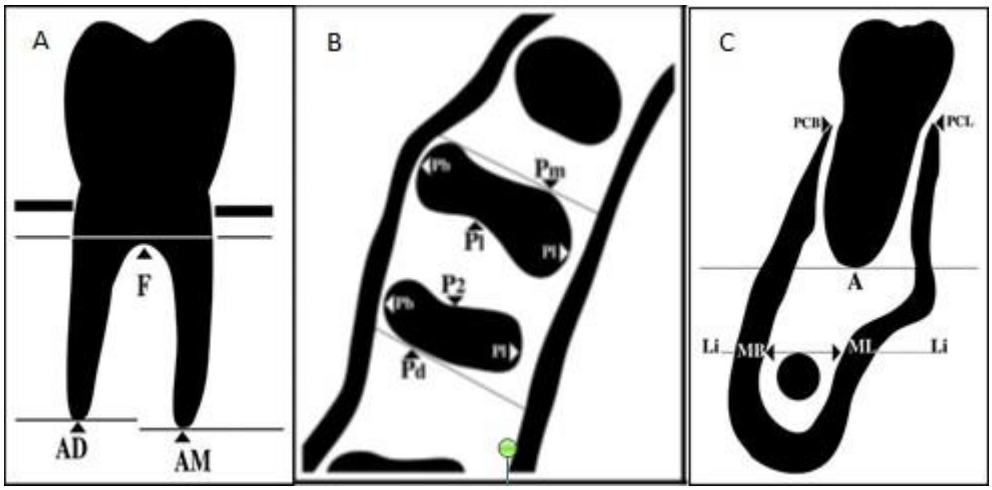
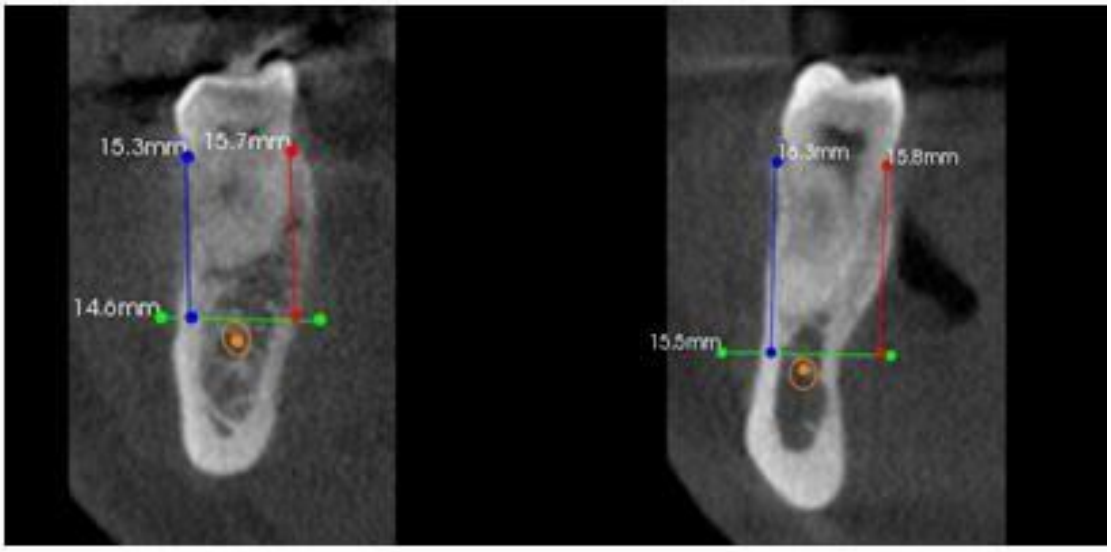


Fig 2. Mean available bone height in first molars & second molars



Efficacy of Single Piece Basal Implant in Maxillo-Mandibular and Dentoalveolar Rehabilitation

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Abstract

Background: For over a thousand years, dentists have dreamed of restoring lost teeth with artificial replicas. Concept of basal implantology the jaw bone comprises of two parts the tooth bearing alveolus or crestal part and the basal bone. The basal bone is heavily corticated and is rarely subject to infections and resorption. The first single piece implant was developed and used by Dr. Jean-Marc Julliet in 1972.

Aim: The aim of this study was to evaluate the success of single piece basal implant (Basal Cortical Screw) in maxillo-mandibular & dentoalveolar rehabilitation.

Materials and methods: A total of 93 Basal implants (BCES) which comprised of 18 males and 10 females, with ages ranging between 16 and 78 years. Efficacy of implants were evaluated by pain, implant stability, mean probing depth, gingival inflammation, nerve injury and marginal bone loss at 0, 1, 3 & 6 months.

Results: This study out of 93 implants, 89 implants were free of mobility, peri implant radiolucency, sinus discharge for the first 4-6 months. 4 implants were failed after 1 month due to overload osteolysis and non-achievement of bilateral equal and symmetrical occlusion. All the 89 implants were perfectly engaged in cortical bone except for 1 implant that was not engaged in cortical bone and was replaced after 7 days. The overall survival rate of implants in the present study was 95.6%, which was in accordance with most of the long term clinical studies done on implants.

Conclusion: Basal implant is successful treatment modality in cases of immediate loading. Since the study was of a very short duration with a small sample size further longitudinal clinical studies with large sample size and also with histological evaluation are required to

actually assess the changes in crestal bone level around implants.

INTRODUCTION

According to the concept of basal implantology the jaw bone comprises of two parts the tooth bearing alveolus or crestal part and the basal bone. The crestal bone is less dense in nature and is exposed to infections from tooth borne pathologies, injuries or iatrogenic factors and is therefore subject to higher rate of resorption whereas the basal bone is heavily corticated and is rarely subject to infections and resorption. It is this, i.e.; the basal bone that can offer excellent support to the implants because of its densely corticated nature, at the same time the load bearing capacity of the basal bone is many times higher than that offered by the spongy crestal bone.

First single-piece implant was developed and used by Dr. Jean-Marc Julliet in 1972. In the mid-1980s French dentist, Dr. Gerard Scortecci, invented an improved basal implant system complete with matching cutting tools. Together with a group of dental surgeons, he developed Disk-implants. Since the mid-1990s, a group of dentists in Germany have developed new implant types and more appropriate tools, based on the Disk-implant systems. These efforts then gave rise to the development of the modern BOI (Basal Osseointegrated Implant or lateral basal implants. **Dr. Stefan Ihde** introduced bending areas in the vertical implant shaft. In 2005 the lateral basal implants were modified to screwable designs (BCS).[1]

For BCS implants Basal implantologists do not advocate raising a flap for these implants as it results in a decreased blood supply and also because of the design of these implants raising a flap is pointless, another factor to be considered is the immediate loading of these implants; a sutured site is not a favorable area to receive an immediate prosthesis.[2]

For the BOI implant the approach towards the bone is gained by raising a flap laterally and cutting into the bone with disk drills of required size in a lateral direction to form a "T" shaped osteotomy. The implant consequently is placed laterally and the flap is closed over it.[3]

What conventional implantologists call as "Osseointegration" is called as "Osseoadaptation" by basal implantologists, this stems from the fact that the bone with continuous functional loads remodels and adapts over the surface of the implant, the remodeling of bone under functional loads is considered to be the 4th Dimension.[4]

According to philosophy of basal implantology the process of Osseoadaptation is carried out by a "Bone Multicellular Unit" (BMU), it is said to be like a cutting cone with a tail, the cutting cone comprises of osteoclastic cells that eat away the peri-implant bone and the tail comprises of osteoblastic cells that lay down bone, as this unit moves in the bone the osteoclastic activity is subsequently followed by osteoblastic activity. The formation of this BMU takes place when the BOI and BCS implant are subject to immediate loading which leads to remodeling of bone under functional stresses leading to development of this unit, and thus initiates the healing phase and leads to formation of a dense peri-implant bone.

AIM

The aim of this study was to evaluate the success of single piece basal implant (Basal Cortical Screw) in maxillo-mandibular & dentoalveolar rehabilitation.

METHODOLOGY

The Present study was conducted on 28 Patients (18 Male and 10 Female) in the Department of Oral & Maxillofacial Surgery RUHS College of Dental Sciences, Jaipur to clinically evaluate the basal cortical implant. A total of 93 basal implants (BCES) were placed.

Inclusion Criteria

- Patient above age of 16 years and medically fit.
- Two stage implant or bone augmentation has failed.
- All kind of bone atrophy, Poor prognosis or missing teeth.

Exclusion Criteria

- Medically unfit patient for implant surgery
- Patient with large periapical pathology, Irradiated cancer patients
- Medicines- drugs like Biphoshphonates
- If immediate loading is contraindicated like deep bite, bruxism etc.

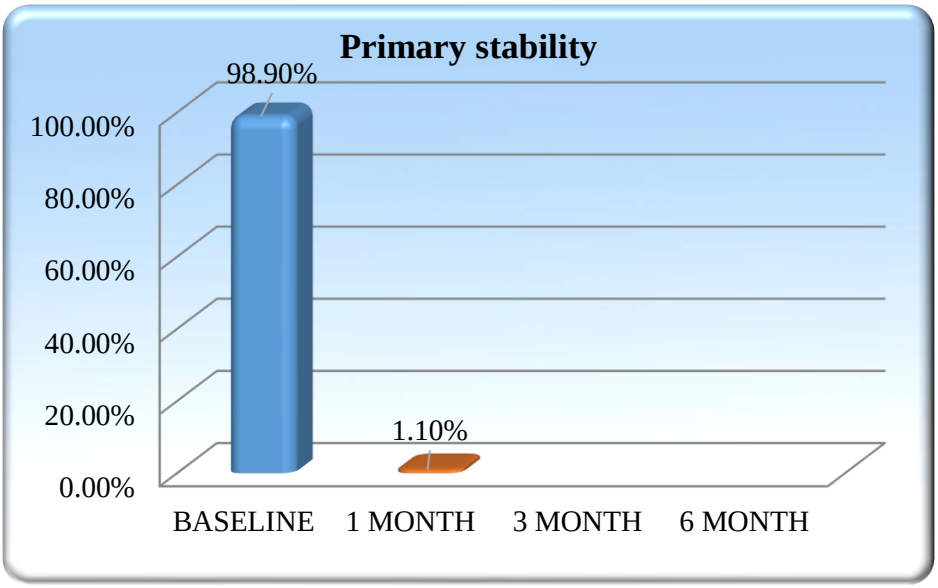
Criteria for Implant Success

Clinical and radiographic interpretation was done prior to and after placement of implants and follow up. The following parameters were evaluated on the recall visits to determine the success of the implant

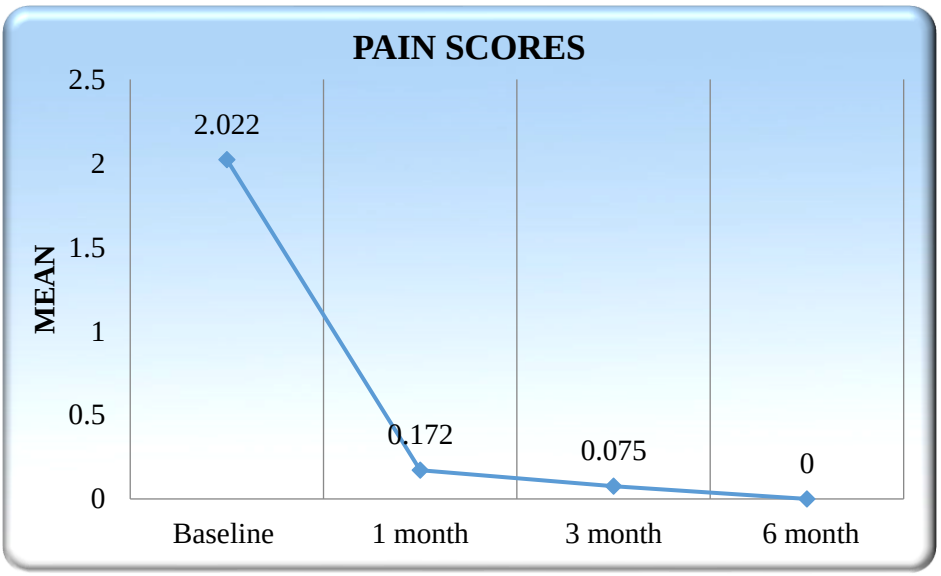
1) **Implant Stability- Present/Absent** The individual implant was tested clinically by reverse torque (Present/ absent).
2) **Inflammation Present/absent:** Gingival index by Loe and Silness (1963) was used.
3) **Pain (Visual analogue scale) and Swelling present or absent**
4) **Radiograph taken at 1, 3 & 6 month.** Marginal bone loss (in mm) of each implant was assessed by periapical radiographic examination. The marginal bone level of each implant was evaluated from the standardized periapical radiographs and was measured as the distance in 0.1 mm increments from the implant shoulder to the most coronal point where the marginal bone met the implant.
5) **Plaque -** Mombelli Plaque index was used
6) **Periodontal pocket**
7) **Nerve injury: Present/Absent**

RESULTS

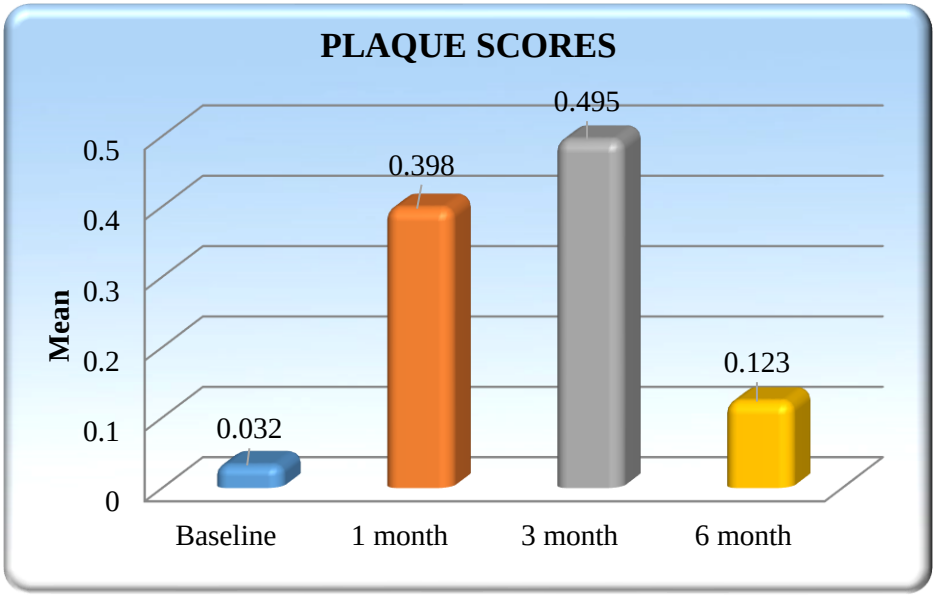
The data obtained was analysed by SPSS (21.0 version). Shapiro Wilk test was used to check which all variables were following normal distribution. None of the study subject were found to have nerve injury.



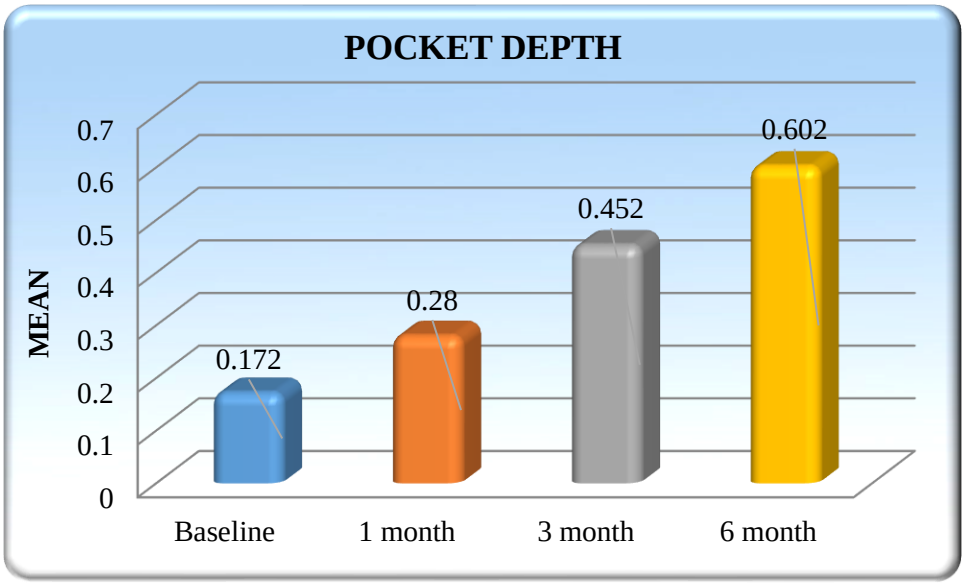
Graph 1: Distribution according to Primary Implant stability



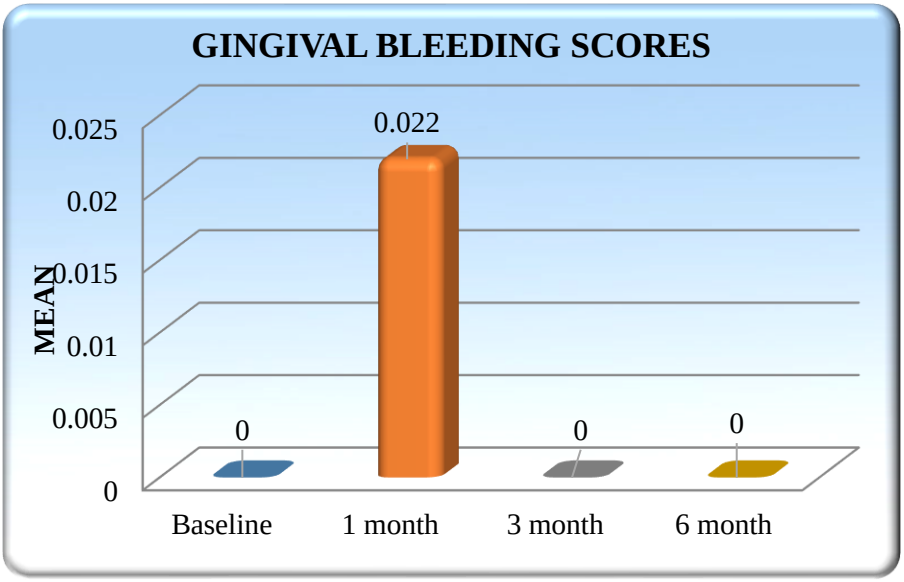
Graph 2: Distribution of Mean Pain scores



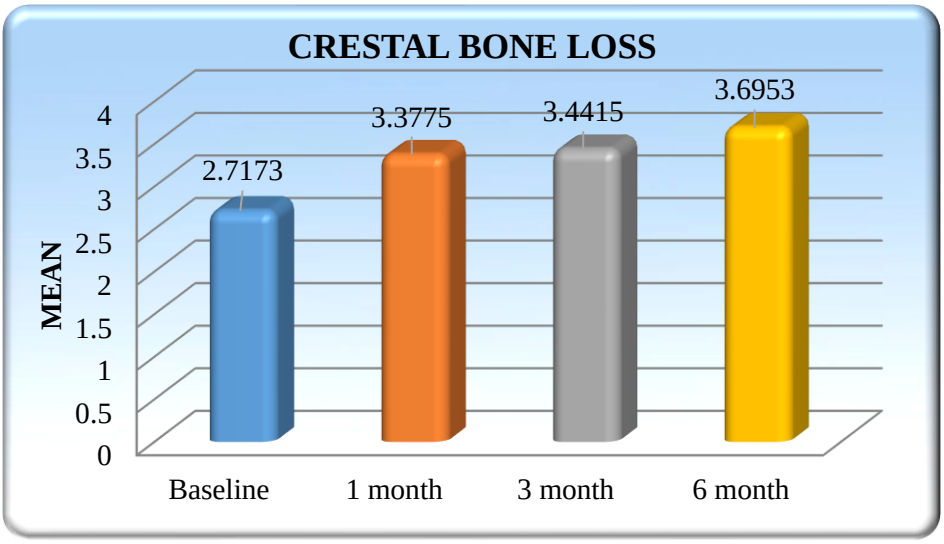
Graph 3: Distribution of Mean Plaque score



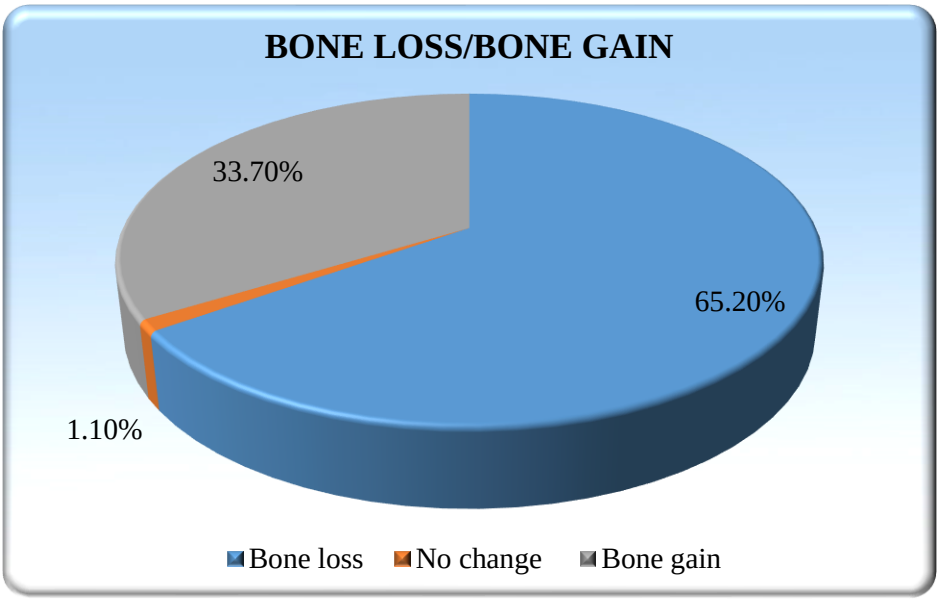
Graph 4: Mean pocket depth



Graph 5: Mean Gingival bleeding



Graph 6: Mean crestal bone loss



Graph 7: Frequency distribution according to bone gain or loss from baseline to 6 months

DISCUSSION

Present study examined in vivo the clinical and radiographic results of 93 basal cortical screw implants placed in various 2nd corticals of mandible ad maxilla in extraction as well as healed socket. Out of which 89 are successfully in function and 4 implants are failed. Bone loss present in 58 implants and bone gain present in 30 implants.

Subjective findings of pain and tenderness associated with an implant body are more difficult to assess than these conditions with natural teeth. In our study the pain score ranges 1 to 4 on visual analogue scale on the next post operative day to 1 week after placement of implant, this was highest than any other time in our follow ups. Pain can have several origins: the skill of the surgeon the procedure used, flap design, trauma to periosteum. Pain can be experienced by postoperative edema or hematoma, it is also related to patients anxiety and stress. Just like pain mild swelling also seen in 1st week only.

This finding is supported by **Carle Misch** according to them pain from implant body does not occur unless the implant is mobile and surrounded by inflamed tissue or has rigid fixation but impinges on nerve.

Probing depth around implants is an important diagnostic process for the assessment of peri-implant soft tissue health and increased probing depth could be correlated with a higher degree of inflammation of the peri-implant mucosa. Since the soft tissue seal inhibited probe tip penetration in healthy and only slightly inflamed periimplant soft tissues, but did not do so in periimplantitis, probing around oral implants must be considered as a sensitive and reliable clinical parameter for long-term clinical monitoring of periimplant mucosal tissues.

In this study gingival inflammation are also documented in every follow up appointment, mean gingival bleeding noted at 1st month is 0.022 for single piece basal implants which is gradually decrease with time and at the time of 6 months of follow up it is decreased upto 0.0 this result shows the improvement In gingival health over time.

The marginal bone around the implant crestal region is usually a significant indicator of implant health. The most common method to assess bone loss after healing is by radiographic evaluation. Of course conventional radiographs only monitor the mesial or distal aspect of bone loss around the implant. In general the long cone paralleling technique supported by positioning device is used.

Daiel-Tamas Szava (2017)[5] average Bone resorption was 1.59mm after 6 months of functional loading and 2.05mm after 12 months. Bone resorption was slightly higher in the mandible than in maxilla. Bone resorption was higher near single tooth implants (2.18) than in case of multiple splinted implants (1.99). **Aleksandar Lazarov (2019)[6] stated** that mean bone level around the single implant did not change after up to 57 months of functional loading.

Sumit Narang (2014)[7] The immediate-loading dental implants are more predictable than before, though the chances of crestal bone loss are comparatively higher. In order to achieve primary stability, osteotomy was done 3mm apical to extraction socket, which is the main factor determining the success of immediate implants. Single-piece implants work well in D1 and D2 bone. So, the BCS implants are well suited not only for immediate loading but also for immediate placement.

Pankaj Ghalaut (2019)[8] Immediate loading of basal implants can be done, when they are placed in the dense cortical bone, as they attain high primary stability there. Since the remodeling of the bone starts within 72 h and weakens the peri-implant bone structures, rigid splinting of the metal framework should be done as early as possible. The splinting distributes the masticatory forces from the bone around the implants to other cortical areas as well. This procedure and its principles are known in Traumatology.

The overall survival rate of implants in the present study was 95.6%. **Pankaj Ghalaut(2018)[8]** reported a 100% survival rate, **Ashish (2020)[9]** have reported a high success rate of 97.7% with corticobasal implant, **Dobrinin (2019)[10]** reported Immediate

functional loading using multiple, cortically anchored basal screw implants for fixed full arch demonstrated an implant survival rate (95.7%) after an average observation period of 18.93 months, **Aleksandar et al (2019)[6]** reported a cumulative survival rate for cortically anchored screw implants was 97.5% after 4 years.

CONCLUSION

We can say that though the survival rate in present study was good and the study shows some amount of gain in crestal bone level in 33.7% patients, yet since the study was of very short duration with small sample size and no histological evaluation was done to measure the crestal bone level changes and bone implant integration and success rate of the implants. Further longitudinal clinical studies with large sample size and also with histological evaluation are required to actually assess the change in crestal bone level around implant. The chance for survival of the individual implant depends on the location of 2nd cortical anchorage, and the prosthetic construction to which it was connected.

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