EVALUATION OF OUTCOME OF SINGLE MANDIBULAR MOLAR TOOTH REPLACEMENT BY TWO NARROW DIAMETER DENTAL IMPLANTS

Dissertation Submitted to

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BRANCH III

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DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation title **"EVALUATION OF OUTCOME OF SINGLE MANDIBULAR MOLAR TOOTH REPLACEMENT BY TWO NARROW DIAMETER DENTAL IMPLANTS"** is a bonafide and genuine research work carried out by me under the guidance of **Dr. D.SANKAR, M.D.S.**, Professor, Department of Oral & Maxillofacial Surgery, Ragas Dental College and Hospital, Chennai.

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This is to certify that this dissertation titled **"EVALUATION OF OUTCOME OF SINGLE MANDIBULAR MOLAR TOOTH REPLACEMENT BY TWO NARROW DIAMETER DENTAL IMPLANTS"** is a bonafide record of work done by **Dr.J.SENTHIL KUMAR** under our guidance and to our satisfaction during his postgraduate study period **2015-2018.**

This Dissertation is submitted to **THE TAMILNADU Dr. M.G.R. MEDICAL UNIVERSITY,** in partial fulfillment for the award of the Degree of **MASTER OF DENTAL SURGERY – ORAL AND MAXILLOFACIAL SURGERY, BRANCH III.** It has not been submitted (partial or full) for the award of any other degree or diploma.

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I would like to dedicate this dissertation to my family who always wish for me to reach great heights and achieve greater goals in my life.

ABSTRACT

AIM: The aim of the present study was to evaluate the outcome of replacement of single mandibular molar tooth with two narrow diameter implants in terms of evaluation of implant success rate, bone loss, soft tissue and hard tissue healing, oral hygiene maintenance, patient satisfaction and complications.

MATERIALS AND METHODS: The study was conducted in the Department Of Oral and Maxillofacial Surgery**,** Ragas Dental college, Tamilnadu. Patients of either sex, having partial edentulism in the posterior mandibular arch who required preferably implant based fixed prosthesis were included in this study. Patients who were willing to undergo the double implant supported molar replacement, were included in this prospective study. After preoperative evaluation, two narrow diameter implants were placed parallel to each other under local anesthesia. All the patients underwent two stage implant protocol. Implants were loaded with screw retained metal ceramic prosthesis after three months of healing. Bone loss was measured using standard intra oral periapical radiograph which were taken periodically at six months and one year post operatively. The implant success were evaluated using International congress of oral implantology's (ICOI) criteria, implant mobility index. Pain was assessed with visual analogue scale, and post-operative oral hygiene was evaluated using modified plaque index and

bleeding index. The overall satisfaction of the implant procedure was evaluated using a standard questionnaire.

RESULTS: Ten patients having partially edentulousness in either mandibular first or second molar area had replaced with twenty narrow diameter implant. The average mesio-distal length of the edentulous space is 12.5mm ± 1mm, average buccolingual width is 6.3mm ± 0.7mm. All 20 implants placed were of 3mm diameter and the length of the implant ranged from 10 mm to 13 mm depending on the available length. Post-operative crestal bone loss at six month follow up (T1) was 0.52± 0.13mm, 0.57± 0.12mm for mesial and distal implant. Post-operative crestal bone loss at 12 month follow up (T2) was 1.05± 0.20mm, 1.08±0.23mm for mesial and distal implant respectively. Comparison of crestal bone loss at 6 months and 12 months was done using paired t test and it was statistically significant(p value >0.05) for mesial and distal implant. Comparison of crestal bone loss between mesial and distal implants at 6 months and 12 months is not statistically significant (p value <0.05).These measurements were made with the help of intra oral periapical radiograph film. Soft tissue and hard tissue wound healing was good in all our patients except in two patients who had mild gingival hyperplasia over the healing abutment.

All the implants were successful as evaluated by ICOI criteria. 90% of all our patients had only mild or no pain at one year follow up. All our patients

had a score of $\leq$ 1 in the modified plaque and bleeding index indicating good oral hygiene.

CONCLUSION: In our study all our mandibular molar tooth replaced with two narrow diameter supported implant prosthesis had 100% success rate, with good soft tissue and hard tissue healing and good oral hygiene maintenance at one year follow up. None of our patients had either implant fracture or abutment screw loosening or any other complications. Therefore, the use of two narrow diameter implants to replace a single molar is a logical treatment solution to avoid prosthodontic complications.

KEYWORDS:

Narrow diameter dental implant, Prosthetic complications, Bone loss, patient satisfaction

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INTRODUCTION

The permanent mandibular Molar is one of the first tooth to be lost over the lifetime of an individual, hence warranting a need for their replacement.[33] The preferred choice for replacement of a missing tooth is by the use of a dental implant as vital tooth preparation necessary for bridge fabrication can be avoided thereby preserving tooth vitality. The placement of an implant to replace a missing molar presents diagnostic, surgical and prosthetic challenges such as an enlarged mesio-distal dimension and balanced distribution of occlusal forces. Poor bone density in the posterior molar regions could affect the short- and long-term implant success. Anatomical factors and nearby vital structures (i.e. maxillary sinus and mandibular canal), occlusal loads and the occlusal table which is always wider than the implant

diameter, should also be considered.[44]

Quality and density of the bone in the posterior molar regions can affect initial implant stability and load transfer to the bone. The most common single molar to be restored is the first mandibular molar, because this tooth is extracted usually[35]. Implant placement in the posterior mandibular area is a successful procedure over time. The reduced rate of complications in addition to the high long-term success rate make implant restoration a genuine solution to treat posterior partial edentulism[24].

It has been constantly proved in short-term studies that the replacement of a molar with single implant is a successful treatment modality.[8] Natural tooth size notably increases in the posterior molar region and correspondingly

the root surface area is almost double as in contrast to the other teeth in the dentition. The mesio-distal extent of a mandibular molar be greater than that of most standard implants (3.75 to 4 mm), generate the possibility of functional overload resulting in the failure of the prosthetic components or the failure of the dental implants. Another result of these dimensional dissimilarity affecting molar restorations on standard implant is disadvantageous contours leading to poor esthetics and hygiene.

Therefore, the clinicians face a distinctive biomechanical challenge. In order to maintain the natural crown root ratio, implant diameter is often increased in the mandibular molar region for immediate loading, especially when the bone density is less or the chewing forces are greater. It is claimed that for the identical length, a wider diameter implant presents a greater surface area, thus bone to implant contact may be greater, thereby compensating for the lack of height or bone density. In recent years, enhancements in component stability have been derived from wider implant platforms, stronger screws, greater torque forces applied to retaining screws, larger hex designs on flat-top implants and the development of internal connections such as cones, internal hex and octagon configurations and combinations of these.[20] These refinements have contributed to greater success with molar restoration.

Wider-diameter implants have authentic use in smaller molar spaces (8 to 11 mm) with a crestal width greater than or equal to 8 mm.[30] Contrarily, the drawbacks of wide-diameter implants are restricted in their ability to fit in

bone receptor sites that are narrow buccolingually, and there have been reports of greater crestal bone loss compared to standard-diameter implant.[7] Even after insertion of widest diameter implant, the existing crown root ratio is not achieved in all cases, especially when the bone height is less. Therefore, single implant-bearing molar restoration has historically presented a challenge in terms of form and function because a single implant does not provide the crown-to-root ratio that previously existed which may predispose the implant to over load and may lead to implant failure.

Replacing a lost mandibular molar with only one implant depicts a biomechanical challenge. Lateral forces create a bending moment relative to the implant at its marginal bone, and axial forces introduce bending if offset from the implant axis in a mesio-distal or bucco-lingual direction. In combination with the fact that the occlusal forces are at their greatest in the molar region, this leads to possible elevated stress on components as well as bone. Furthermore, the screw joint for a single tooth is susceptible to loosening because a torque relative to the implant axis must be counteracted by the screw joint itself.[20] In multiple implant restorations, the adjacent implant performs this counter action.

Misch[44] recommended a modus operandi for replacing a single molar: 4-mm-diameter single implant in case of 7-mm M-D span, 5 mm diameter for 8- to 12-mm M-D span, and 2 implants of 4 mm diameter each in case of 14-mm M-D span, 2 implants of 4 and 5 mm diameter for 15-mm M-D span, and 2 implants of 5 mm diameter when the M-D span is 16 mm. Nevertheless,

when using new available narrow diameter implants, 2 implants could be used even when the distance between the adjacent teeth is smaller. It has further been suggested by Davarpanah and others, Balshi and others, English and others and Bahat and Handelsman that the use of multiple implants may be the ideal solution for single-molar implant restorations.

Use of two implants to restore a molar has been shown to eliminate problems associated with bone volume and prosthetic stability.[27] Small diameter (1.8–3.0 mm diameter) implants have been widely accepted because they can be utilized in regions of the mouth that are deficient in arch length, as well as alveolar width. Most standard implants and their associated prosthetic components, when used to support a double implant molar restoration, will not fit in the space occupied by a molar unless the available space is more than 12mm.[12]Additionally, the associated prosthetic components should ideally not exceed this dimension. Although small diameter single-stage implants have been indicated mainly for the maxillary lateral incisors and the mandibular incisor region, occasionally other clinical situation may warrant their application. Possible clinical drawback with the two implants supported molar is the fact that space adjacent to the implant is narrow, a few milli-metres only which may lead to cleaning difficulties for the patient and may theoretically influence the bone remodeling.[22]

The use of 2 implants might also provide better prosthetic stability and prevent rotational forces on the prosthetic components. One significant barrier to the widespread use of this concept is the limitation of the size of implants and their associated prosthetic components. Nevertheless, when using narrow implants, 2 implants could be used even when the distance between the adjacent teeth is rather limited. The main purpose of the study is to evaluate the outcome of replacing single mandibular molars with two narrow diameter implants radiographically.

AIMS AND OBJECTIVES

To prospectively evaluate the clinical and radiological outcome of two implants supported single molar mandibular prosthesis in terms of

3. Implant success rate

4. Bone loss

5. Soft tissue and hard tissue healing

6. Oral hygiene maintenance

7. Patient satisfaction

8. Complications

REVIEW OF LITERATURE

1. TORGNY HARALDSON, GUNNAR E. CARLSSON & BENGT INGERVALL(1979)discussed in detail about the functional state, bite force and postural muscle activity in patients with osseo integrated oral implant bridges. The function of the masticatory system of 13 women, aged 42-59 years, with osseo integrated oral implant bridges (OIB) made within the last seven years was compared with that of 10 matched dentate controls by means of a questionnaire, clinical examination, bite force measurements and electromyographic recordings of biting and of postural muscle activity . Both groups were satisfied with their masticatory capacity according to the questionnaire. The clinically determined state of the masticatory system, as judged from the clinical dysfunction index, was normal in both groups. Three levels of bite force 1) gentle biting, 2) biting as when chewing and 3) maximal biting, were recorded with a bite force apparatus and electromyographically. There was no statistically significant difference between the groups at any level of bite force for any of the methods of registration. Nor was there any difference of the two groups in the activity of the masticatory muscles with the mandible in the postural position. It is concluded that patients with osseo-integrated oral implant bridges have a masticatory muscle function equal to or approaching that of patients with natural teeth, or with tooth-supported bridges, with the same number of chewing units as the OIB-patients.

2.Skalak (1983) proposed that close apposition of bone to titanium is the essential feature that allows a transmission of stress from the implant to the bone without any appreciable relative motion or abrasion. The use of threaded screw provides a form of interlocking with the bone in shear or compression. A smooth cylindrical implant may require an adhesive bond for satisfactory performance ,but screw shape is able to work as long as the apposition of bone and implant is close ,whether or not true adhesive bond is developed.

3.Bass SL.Triplett RG (1991) evaluated the outcome of 1097 consecutively implanted endosteal implants into 303 jaws ,between September 1983 and may 1990. All implants were placed using the prescribed technique suggested by manufacturer, and were restored with fixed or removable prosthesis. Alveolar bone resorption was scored from lesser to greater degree by assigning a value of 1-5 to each jaw , and jaw anatomy was scored from 1-4, based on decreasing cortical and cancellous bone quality. The data were separated into fixed and removable prosthesis and analyzed to determine the correlation between success and scored resorption and jaw anatomy, as well as implant position. Assessment demonstrated a maxillary success rate of 93.4% and mandibular success rate of 97.2% over a 36 month period. Results of correlations of success with jaw anatomy for both fixed and removable prosthesis revealed that bone quality 4 exhibited the greatest failure rate. Preoperative resorption values had little effect on failure, and quality appears to influence failure more than quantity.

4. Oded Bahat, Mark Handelsman (1996), as experience with osseointegrated implants has grown, greater use has been made of placement in the posterior jaw. To reduce the risk of implant failure and increase the ability of posterior implants to tolerate the occlusal forces, it is beneficial to create a wider base either by using wider (eg, 5-mm) implants or by placing two or even three standard implants at one site. In the present series, unpaired 5-mm Nobel pharma implants were placed in 38 sites in the mandible and 21 sites in the maxilla. All implants were uncovered and restored with ceramometal crowns, with follow-up ranging from 3 to 26 months (mean 16 months) post loading. Two implants in one patient failed and were replaced successfully at 14 months. At 20 sites, pairs of 5-mm implants were placed and restored, and with a loading period of 3 to 26 months (mean 14 months), all of these implants were successful. At 34 sites, a 5-mm implant was paired with a 3.75-mm or 4-mm implant. With a loading period of 3 to 24 months (mean 13 months), one implant 5 mm wide and 8 mm long failed and was replaced successfully at 13 months, and an implant 4 mm wide and 10 mm long failed and was not replaced. The failure rate for this group of implants therefore was 3%. Double 3.75-mm or 4-mm implants were placed at 149 sites in the mandible and 13 sites in the maxilla. All of these double-root implants were uncovered and restored with ceramo-metal crowns. With follow-up ranging from 4 to 78 months (mean 37 months) post loading, there were five implant failures in four patients, for a failure rate of 1.2%. The failure rate for

all 5-mm implants was 2.3%, and that for all double implants was 1.6%. The use of either 5-mm or double implants necessitates changes in surgical technique, and both are highly dependent for their success on proper surgical execution.

5.Thomas J .Balshi,Ramon E.Hernandez,(1996) compared one implant versus two replacing a single molar. A comparative study between one and two brane mark implants replacing a single molar was conducted. Fortyseven individuals comprised two groups of 22 patients treated with one implant and 25 with two implants. A total of 72 implants were placed, 66(92%) in the mandible and six (8%)in the maxilla. After the first year of function, the success rate was 99%, with only one implant lost. Between the second and third year follow ups, 100% of the implant continued to function in the remaining 46 patients, giving three year cumulative success rate of99%.The marginal bone loss between 1 and 3 year of function was 0.10mm (SD 0.20) for the group with one implant and 0.24mm (SD0.20)for the group with two implants. No change were observed in sulcular bleeding index during the three year follow up. Prosthesis mobility and screw loosening was the predominant in the group with one implant (48%), but was substantially reduced in the group using two implants(8%). These mechanical problems, using one implant only , seem to be preventable using stronger screw joint (cera one abutment).Precise centric occlusal contact was established and maintained over the study period, which was thought to very high success rate

for the single implant supported molar restoration, despite their high degree of mechanical problems. This study suggests that implant supported molars can be effective therapy, and the results confirm the biomechanical analysis that two implants provide more advantageous support than does one.

9. Thomas J. Balshi, Glenn J. Wolfinger (1997) described two-implant-supported single molar replacement: Interdental Space Requirements and Comparison to Alternative Options. Posterior single-tooth implant restorations are subjected to an increased risk of bending overload. A high incidence of implant fracture has been reported when using a single standard 3.75-mm-diameter implant to support a molar restoration. The purpose of this article is to demonstrate the clinical feasibility of placing two implants to support a molar restoration and to compare this treatment option to the use of a single standard implant or a wide-diameter implant. Two osseointegrated dental implants used to support a molar restoration in interdental spaces as small as 10 mm is shown to be effective and predictable in 60 restorations over the past 7 years. The use of two implants provides more surface area for osseointegration and spreads the occlusal loading forces out over a wider area, reducing the potential bending forces that would otherwise exist in a single-implant molar restoration.

10. S. Ross Bryant, George A. Zarb,(1998) evaluated the osseointegration of oral implants in older and younger adults. Osseointegration involves an osseous healing response that may be compromised by aging. This

study aimed to test the hypothesis that there is no difference between older and younger adults in osseointegration success. A comparison was made between closely matched groups of 39 older adults who had 190 implants supporting 45 oral prostheses and 43 younger adults who had 184 implants supporting 45 oral prostheses. Patients were monitored for a period of 4 to 16 years after prosthetic loading. At the most recent follow-up, the cumulative implant success was 92.0% for the older group compared to 86.5% for the younger group. No statistical significance could be attributed to the difference in implant survival between the groups throughout the study period. Furthermore, the most common outcome for individual prosthetic sites was 100% implant success, and the original prosthetic design was maintained for as long as each patient was monitored in 41 of 45 prosthetic prescriptions for the older patients, and in 39 of 45 prescriptions for the younger patients.

8. Franck Renouard,Jean-Pierre Arnoux,David P. Sarment, (1999)

Conducted a study on Five-mm-Diameter Implants without a Smooth Surface Collar. dental implants initially showed very high survival rates in completely edentulous patients. Subsequently, the indications for implants were extended to include partially edentulous jaws with areas of limited bone density and/or bone volume. In addition, to facilitate the replacement of a failing standard implant and to improve the success rate in compromised situations, wide diameter implants were introduced. The 5-mmdiameter implant without a smooth surface collar has threads machined to the level of the hexagonal head. These threads are also deeper than those found on a standard implant (0.4 mm

instead of 0.3 mm) . These features allow an implant 5 mm wide and 6 mm long to maintain the same area of bone contact as a 3.75 _ 10 mm implant. The absence of a smooth collar at the level of the hexagonal head eliminates the need to countersink the implant site and enables visual control of the depth of the implant . Although Langer et al2 have advocated the use of these implants in posterior areas, very little new information has been published since then.3 Therefore, the purpose of this paper is to report on 98 consecutively placed 5-mm-diameter implants without a smooth surface collar.

9. Devorah Schwartz-Arad, Naama Samet, and Nachum Samet

(1999) evaluated the single tooth replacement of molars. as experience with osseo integrated implants has grown, greater use has been made of placement in the posterior jaw. The aim of this study is to present the survival rate of 78 osseointegrated single implants, inserted in the molar area and to evaluate the prosthetic rehabilitation on these teeth. This retrospective study presents findings of 55 consecutive patients with 78 restored single osseointegrated implants in the molar area. The patients went through a clinical and radiological evaluation. The same maxillofacial surgeon inserted all implants.Three of the implants were inserted into the maxilla and 75 into the mandible; 4 of the 78 implants were immediate implants. The cumulative survival rate after one year was 93.6%. Follow-up was up to 80 months, with an average of 27 months. Out of all the implants, 6 failed (7.7%): 5 failed in the surgical stage, and 1 after prosthetic loading. The main implant failures were among the titanium screw implants. Prosthetic complications occurred

in11 cases (14%), which included loosening of the abutment and/or the crown (9 cases), fracture of the abutment (1 case), and porcelain fracture (1 case). No incident of implant fracture occurred. Within the limits of this study, replacement of a single molar by a single implant is a valid and successful surgical treatment modality, with a high survival rate. Since Bränemark introduced osseointegrated implants more than 25 years ago, there has been an increased interest in the use of implants in partially edentulous patients. Replacement of a single tooth using a single osseointegrated implant (SOI) is an accepted and satisfactory treatment. It allows greater preservation of adjacent teeth and solves the potential problems caused by other alternative procedures.While there are many articles in the literature concerning replacement of a single anterior tooth using SOI, very few refer to its use in the molar area.

10. Y. SATO, N. SHINDOI, R. HOSOKAWA, K. TSUGA & Y. AKAGAWA (2000) double implants have been thought to have biomechanical advantages for single molar replacement. To evaluate the effectiveness of double implants versus wide implant, vertical forces and torque on each implant were calculated by three dimensional geometric analysis. Buccal load (100N) perpendicular to cuspal inclination (20 degree) was applied at the occlusal surface of super structure .Three kinds of load points (A,B,C) were 1.5,3.5,and 5.5mm from the mesial contact point, respectively. Three implants were compared; mesial and distal double implants(3.3mm) and wide implant (5mm). The wide implant showed torque

around the long axis (1.8-15 N .cm) whereas double implants had no torque. On the other hand, the vertical forces on the mesial double implant were both smaller (60% loaded at point C) and larger (140% ;loaded at point A) than the wide implant .Given the smaller surface area of the mesial double implant, this large force may generate much higher stress in peri implant bone. These results suggest that the biomechanical advantage of double implant for single molar replacement is questionable when the occlusal force is loaded at the occlusal surface near the contact point.

11. L. K. McCaul,W. M. M. Jenkins, and E. J. Kayet (2001)

described the reasons for extraction of permanent teeth in scotland. Although Scotland has the highest proportion of edentulous adults in the UK, the frequency of edentulousness has fallen by 21% during the last 20 years. This study, carried out in 1999, was designed to establish whether the reasons for tooth loss have also changed since 1984 when they were last determined. The Scottish Dental Practice Board provided the names of every fourth dentist on its list among which 425 general dental practitioners were identified. They were asked to record permanent tooth extractions for 1 week, specifying the age, sex and dental attendance of patients who underwent extractions and the reasons for these extractions. 352 dentists took part: a response rate of 82.8%. The study confirmed that there has been a reduction in the number of extractions between 1984 and 1999: there were 25% fewer teeth extracted per patient and 30% fewer per dentist per week. From 0–20 years of age, orthodontics has replaced caries as the commonest reason for extraction and

in all age groups over 20 years, caries has become the commonest reason in contrast to 1984 when periodontal disease was the principal reason in patients over 40 years old. Caries and its sequelae remain the most important cause of tooth loss throughout adult life in Scotland and, therefore, caries prevention and maintenance of restorations are of great importance at all ages**.**

12. **Michael Moscovitch,(2001)** evaluated the use of 2 implants to restore a molar has been shown to eliminate problems associated with bone volume and prosthetic stability. One of the most significant barriers to the widespread use of this concept has been the limitation of the size of implants and their associated prosthetic components. This paper presents the use of 2 implants to replace a single molar using implants and prosthetic components in the Astra Tech Dental Implant System.

The clinical cases illustrated are part of a group of 20 individual double-implant molar restorations provided to19 patients (one patient having 2 separate restorations) between 1994 and 2001. Of this group, 16 were mandibular restorations and 4 were maxillary. All restorations are currently in function and none has exhibited any prosthetic complications or any adverse soft or hard tissue responses to date. In general, all implants were placed according to the manufacturer's specifications, with associated bone regeneration procedures to minimize irregular crestal bone discrepancies .A post-surgical period of 4 to 9 months was observed depending on bone quality and the regenerative procedures performed at the time of surgical placement. Standard prosthetic procedures were then followed for either screw-retained or

cementable restoration. Occlusal contacts were adjusted to conform to the patient's acquired centric occlusion and lateral excursions. Access openings in the screw-retained restorations were sealed with a composite material. Cemented crowns were luted with a provisional cement . Radiographs were taken immediately postoperatively and, whenever possible, at 1-year intervals.

The postulated advantages of using 2 implants to support a molar restoration instead of a wide-diameter implant are several. There is wider support of the restoration in both the mesial-distal and the buccolingual dimensions. The dentist has greater flexibility to maximize placement in compromised bone receptor sites without perforation of the cortical plates, and thus there is better subsequent retention of crestal bone levels. The use of 2 implants diminishes the potential of the restoration to loosen under normal or parafunctional forces. The double implant may lessen the possibility of occlusal overload. It allows for greater flexibility in restorative style: cement or screw retained. The possibility of increased cost may be outweighed by the reduced likelihood of failure of the implant or the restoration based on the reported complications described earlier. Finally, the double implant requires no special components or procedures that are not normally used in other restorative applications.

13. Lara G. Bakaeen, Sheldon Winkler, (2001) conducted study to (1) determine in vitro the effect of narrowing the buccolingual width of the occlusal table on the untightening torque required to loosen gold prosthetic screws after subjecting implants and implant-supported restorations to occlusal

loads, and (2) to compare the incidence of screw loosening and values of untightening torque of the screws among crowns supported by 1wide-diameter as opposed to 2 standard implants after loading in vitro. The restorations were divided into 4 groups (group 1, a narrow crown supported by one 5-mm wide-diameter implant; group 2, a narrow crown supported by 2 standard 3.75-mm–diameter implants; group 3, a wide crown supported by one5-mm wide-diameter implant; and group 4, a wide crown supported by 2 standard 3.75-mm–diameter implants). A custom-designed chewing machine was used to simulate the grinding phase of the masticatory cycle and lateral excursions.

The crowns were subjected to a 6-kg load for 16 660 cycles over 5.5 hours and were loaded at the outer and inner inclines and cusp tips with an untightening loading pattern. The untightening torque was measured for the gold screws in the different groups before and after loading at 4 different locations for 8 cycles on the simulated chewing machine. A 1-way analysis of variance indicated a significant difference (*P* .001) among the test groups. Pairwise multiple comparison tests (Scheffe) were carried out on mean

‘‘change scores. ’’Group 3 was significantly different from the other groups, which were not significantly different from each other. Restoring missing molars with 1 wide diameter implant had a greater incidence of screw loosening as compared with 2 implants. Narrowing the occlusal table of the restoration is critical when using1 implant to support a missing molar. The

untightening torque of gold screws was not affected by changing the width of the occlusal table of crowns supported by 2 implants.

14. S. Ross Bryant, George A. Zarb,(2002) evaluated the outcomes of implant prosthodontic treatment in older adults . Older adults are expected to account for an increasingly disproportionate number of individuals needing oral implant prostheses. However, this biotechnology was initially studied for predominantly middle-aged edentulous patients, not elderly people. High rates of success and minimal crestal bone loss have been reported for oral implants mainly in this group. The results of studies at the University of Toronto now clearly support earlier reports that older adults respond to oral implants in the same manner as younger adults, despite their tendency for systemic illness, including osteoporosis. However, unfavourable jawbone quantity and quality, particularly atrophy of the maxilla, impaired implant success. Furthermore, placement of implants in sites that had been edentulous for shorter periods was associated with greater crestal bone loss, a finding that may have implications for younger adults undergoing such treatment. The major decision-making challenge in managing depleted dentitions and complete edentulism in an aging society now lies in differentiating the treatment outcomes, especially patient-mediated assessments (including economic analyses), of the various prosthodontic options available for older adults.

15. Vicki C. Petropoulos,Glenn J. Wolfinger,Thomas J. Balshi, (2004) described complications of mandibular molar replacement with a single implant. This case report describes prosthodontic complications resulting from

the surgical placement of a single implant and treatment following these complications. Both the surgical and prosthodontic procedures are described for the treatment of a 57-year-old man who had previously received a single implant for the replacement of a missing molar. Using 2 implants, 1 mesial and 1 distal to the previously placed single implant proved reliable. A logical treatment solution is to use 2 implants for the replacement of a single molar to avoid prosthodontic complications.

16. Eugenio Romeo,Diego Lops,Leonardo Amorfini (2005) studied the Clinical and radiographic evaluation of small-diameter (3.3-mm) implants followed for 1–7 years. Implants with a small diameter may be used where bone width is reduced or in single-tooth gaps with limited mesio distal space, such as for the replacement of lateral maxillary or mandibular incisors. The purpose of the present longitudinal study was to compare the prognosis of narrow implants (3.3-mm-diameter) to standard (4.1-mmdiameter) implants. Over a 7-year period, 122 narrow implants were inserted in 68 patients to support 45 partial fixed prostheses (PFD) and 23 single-tooth prostheses (ST).

Furthermore, 120 patients received 208 standard implants and were restored with 70 PFD and 50 ST, respectively. Clinical and radiographic assessment data were provided. Six (1.8%) out of 330 implants failed. Cumulative survival and success rates were calculated with lifetable analyses processed by collecting clinical and radiographic data. For narrow implants, the cumulative survival rate was 98.1% in the maxilla and 96.9% in the mandible. The cumulative success rate was 96.1% in the maxilla and 92% in

the mandible. Conversely,standard-diameter implants showed a cumulative survival rate of 96.8% in the maxilla and 97.9% in the mandible. The cumulative success rate was 97.6% in the maxilla and 93.8% in the mandible. Cumulative survival and success rates of small-diameter implants and standard-diameter implants were not statistically different (P40.05). Type 4 bone was a determining failure factor, while marginal bone loss was not influenced by the different implant diameters. The results suggest that small-diameter implants can be successfully used in the treatment of partially edentulous patients.

17. S. Jivraj and W. Chee (2006) described that differences in anatomy and biomechanics make treatment of posterior quadrants with dental implants substantially different to that of anterior areas. Without implants, when posterior teeth were lost, treatment options included a long span fixed partial denture or a removable prosthesis, especially when no terminal abutment was available. Today, with the use of implants, options are available that allow preservation of unrestored teeth. When teeth are missing, implant supported restorations can be considered the treatment of choice from the perspective of occlusal support, preservation of adjacent teeth and avoidance of a removable partial denture.

18. Jeff Brink, Stephen J. Meraw, David P. Sarment (2006)

Described in detail Influence of implant diameter on surrounding bone. Implant osseointegration is dependent upon various factors, such as bone quality and type of implant surface. It is also subject to adaptation in response

to changes in bone metabolism or transmission of masticatory forces. Understanding of long-term physiologic adjustment is critical to prevention of potential loss of osseointegration, especially because excessive occlusal forces lead to failure. To address this issue, wide diameter implants were introduced in part with the hope that greater total implant surface would offer mechanical resistance. Yet, there is little evidence that variation in diameter translates into a different bone response in the implant vicinity. Therefore, this study aimed at comparing the impact of implant diameter on surrounding bone. Twenty standard (3.75mm) and 20 wide (5mm) implants were placed using an animal model. Histo-morphometry was performed to establish initial bone density (IBD), bone to implant contact (BIC) and adjacent bone density (ABD).BIC was 71% and 73%, whereas ABD was 65% and 52%, for standard and wide implants, respectively. These differences were not statistically different (P40.05). Correlation with IBD was then investigated. BIC was not correlated with IBD. ABD was not correlated to IBD for standard implants (r2¼0.126), but it was correlated with wide implants (r2¼0.82). In addition, a 1 : 1 ratio between IBD and ABD was found for wide implants. It can be concluded, within the limits of this study, that ABD may be influenced by implant diameter, perhaps due to differences in force dissipation.

19. Liran Levin,Amir Laviv, and Devorah Schwartz-Arad (2006)

conducted a study to assess the long term success and survival rates of implants replacing a single molar between two natural teeth and to evaluate the influence of implant characteristics on implant success. Methods: The

study was based on a consecutive cohort of 81 patients who received implants to replace a single molar between the years 1994 and 2004. Inclusion criteria for patients were having an implant replacing a molar between two natural teeth and follow-up data of at least 6 months. Data were recorded regarding the incidence of complications and success and survival rates of these implants. Results: The range of follow-up was from 6 to 125 months (mean: 36 months). Smoking was reported by 18.5% of patients. The replacement of a mandibular molar was more frequent (87.7%), with 25.9% of the implants placed immediately after tooth extraction. Two implants were used to replace a single molar in seven patients (8.6%). The failure rate was 7.4% (six implants failed: three had broken necks, and three failed because of infection or bone loss). Complications included suppuration in 11.1% of implants and a pocket around the implant in two patients (2.5%). No relation was found among failure, complications, timing of implant placement, and smoking habits. Conclusion: A single implant can serve as a good long-term and predictable treatment modality to replace a single molar with low complication and failure rates.

20. Len Tolstunov (2007) described the implant zones of the jaws: implant location and related success rate. The article demonstrates the factors of importance in the early and late failures of dental implants based on literature review. An implant location is one of many factors that can influence a success or failure of dental implants. The author identifies and describe four alveolar jaw regions—functional implant zones—with unique characteristics

of anatomy, blood supply, pattern of bone resorption, bone quality and quantity, need for bone grafting and other supplemental surgical procedures, and a location related implant success rate. The article discusses predisposing factors that can lead to early implant failures in different jaw zones. An implant location is investigated as one of these factors. A prior history of trauma to premaxillary region is described in the context of implant success in anterior maxilla. This zone is being referred by the author as the ‘‘traumatic zone.’’ The challenges of mandibular posterior implant reconstruction are presented in the context of blood supply to the mandible. A deficiency of vascularization in this region, especially in elderly and edentulous patients, lead the author to refer to this zone as the ‘‘ischemic zone.’’ The concept of relative ischemia of the posterior mandible that can develop with age and tooth loss is discussed. A thorough understanding of specifics of each functional implant zone should help to improve successes and prevent failures of dental implants.

21. Heather J. Conrad, John K. Schulte, and Mark C. Vallee,

(2008) This clinical report describes 2 patient situations in which fractures related to occlusal overload occurred with single posterior implants. The initial clinical presentation of both patients appeared to be screw loosening, but upon further examination, implant and abutment fractures were identified. Several factors are described that have been implicated in the etiology of implant fractures, including occlusal overload, implant location, inadequate fit of the prosthesis design of the prosthesis, progressive bone loss, metal fatigue,

implant diameter, manufacturing defects, and galvanic activity. This article describes the management of implant and abutment fractures and discusses possible mechanisms of failure for the patient situations presented. Careful treatment planning and execution of implant therapy is necessary to minimize the risk of implant and component fractures.

22. C. ManganoF. Mangano, A. Piattelli G. Iezzi A (2009) this study evaluated the survival rate and the clinical, radiographic and prosthetic success of 1920 Morse taper connection implants. One thousand nine hundred and twenty Morse taper connection implants were inserted in 689 consecutive patients, from January 2003 until December 2006.Implants were clinically and radiographically evaluated at 12, 24, 36 and 48 months after insertion (mean follow-up per implant: 25.42 months). Modified plaque index (mPI), modified sulcus bleeding index, probing depth (PD) and the distance between implant shoulder and first crestal bone–implant contact (DIB) were measured in mm. Success criteria included the absence of suppuration and clinically detectable implant mobility, PDo5mm, DIBo1.5mm after 12 months of functional loading and not exceeding 0.2mm for each following year, the absence of recurrent prosthetic complications at the implant–abutment interface. Prosthetic restorations were fixed partial prostheses (364 units), single crowns (SCs: 307 units), fixed full-arch prostheses (53 units) and overdentures (67 units). The overall cumulative implant survival rate was 97.56% (96.12% in the maxilla and 98.91% in the mandible). The cumulative implant success rate was 96.61% (95.25% in the maxilla and 98.64% in the mandible). Only a few

prosthetic complications were reported (0.65% of loosening at implant–abutment interface in SCs).The use of Morse taper connection implants represents a successful procedure for the rehabilitation of partially and completely edentulous arches. The absence of an implant–abutment interface (micro gap) is associated with minimal crestal bone loss. The high mechanical stability significantly reduces prosthetic complications.

23. Young -kyun kim , Pil YoungYun, (2010) conducted study to evaluate the short and mid- term prognosis of maxillary and mandibular single molar implants, prosthetic complications, and factors mediating the effects seen on them. Eighty seven patients were enrolled consecutively in this study and 96 implants were placed into single molar defect site by one oral and maxillofacial surgeon from march 2004 to December 2006. Primary osseointegration failure developed in two implants and delayed implant failure occurred at four implants. The fraction surviving interval was 97% to 100%, and at the last follow- up observation, the cumulative survival rate was 91.1%. All failed implants occurred in second molar sites, and the failure rate, according to implant site ,showed a significant difference. Prosthetic complications, such as screw loosening, showed a significant correlation to the mesiodistal cantilever. furthermore, crestal bone loss 3 years after loading was 0.2mm on average and a very stable results was obtained. Based on the results, the risk of failure for maxillary and mandibular single molar implants is high and the possibility of developing prosthetic complications during

loading is also high. Therefore, to minimize the cantilever, implants must be placed precisely and followed carefully and maintained for a long period of time

24. Moon-Sun Kim, Jae-Kwan Lee, Beom-Seok Chang (2011), evaluated the masticatory function following implants replacing a second molar. The study was done to obtain objective and standardized information on masticatory function and patient satisfaction following second molar single implant therapy. Twenty adult patients, who had restored second molar single implants more than 1 month before the study, were enrolled in this study. All patients received a chewing test using peanuts before and after insertion of the implant prosthesis, with a questionnaire and visual analogue scale (VAS) to evaluate the effect of second molar single implant therapy. This study obtained standardized information on the masticatory function objectively (e.g., P, R, X50) before (Pre-insertion) and after insertion (Post-insertion) of the implant prosthesis. Masticatory performance (P) after insertion of the im-plant prosthesis significantly increased from 67.8±9.9 to 84.3±8.5% (P<0.0001). With the implant prosthesis, the P value increased by 24%. The masticatory efficiency index (R) of Post-insertion is higher than that of Pre-insertion (P<0.0001). With the implant prosthesis, the R value increased by 29%. The median particle size (X50) of Post-insertion is lower than that of Pre-insertion (P<0.0001). More than 90% of the patients were satisfied with the second molar single implant therapy from a functional point of view.

These findings indicate that a second molar single implant can increase masticatory function.

25. Brian J. Jackson (2011) discussed about utilization of small diameter implants in limited osseous regions increases patients' ability to choose implants as a viable restorative option. Although small diameter implants have been indicated in the incisor region for the maxilla and mandible primarily, their usage should be considered in select posterior regions. These 2 case reports demonstrate the incorporation of small diameter implants to replace missing mandibular posterior teeth. Small diameter (1.8– 3.0 mm diameter) implants have been widely accepted because they can be utilized in regions of the mouth that are deficient in arch length, as well as alveolar width. Although small diameter single-stage implants have been indicated mainly for the maxillary lateral incisors and the mandibular incisor region, another clinical situation may warrant their application. Loss of maxillary and mandibular molars results in a mesial-distal dimension that may be insufficient in length for the placement of 2 conventional, standard size implants (3.75 mm diameter). In addition, a single large implant (4.7 mm or 6.0 mm diameter) may demonstrate limitations caused by existing osseous structures or with regard to established implant occlusal principles.

The incorporation of small diameter implants for oral reconstruction heightens the requirement for an applied understanding of implant occlusal principles. The reduced size of small diameter implants increases the level of

stress under load to the crestal bone. This concept is consistent with the mathematical formula that stress is equal to force divided by area. Small diameter implants have reduced surface area compared with standard conventional implants. Therefore, when a force remains constant, overall stress to the crestal bone around small diameter implants will always be greater. It is the responsibility of the restorative dentist to minimize stress to the crestal bone to improve long-term success. The implant occlusal principles of prime importance are to develop a passive prosthesis with a reduced buccal-lingual dimension, direct the force of occlusion through the long axis of the abutments, and avoid eccentric interferences on the final prosthesis.

26. RS Bedi, Pardeep Verma,Poonam Goel, Puneet Kathutia (2011)conducted a study in 5 patients were two standard size implants were used to replace one missing mandibular molar and compared with single wide diameter implant on the other side in the same patient on the basis of radiographic evaluation.

The patients were divided into two groups as follows:

Group I: Two standard-size implants (SSI) of 3.3 mm diameter and 11.5mm length were placed in the right missing mandibular molar site.

Group II: In left mandibular molar edentulous site of the same patient, one single wide diameter implant (WDI) of 4.2mm diameter and 10 mm length was inserted.

Comparative study was performed at each interval to detect and analyze the bony changes around the dental implants by making the following observations:

1. Marginal bone level (MBL).
2. Bone density (BD).

Accurate measurements of the bony changes were performed at standardized points on mesial and distal surfaces of all fifteen implants. Bone changes regarding bone quantity and quality were recorded. Measurements were taken as follows:

1. Assessment of marginal bone level (MBL) around the implants:

Mesial and distal bone height changes of implants were evaluated using the linear measurement system supplied by the digital OPG and digital intraoral sensor for periapical radiograph software. Measurement results were recorded in millimeters. The distance from the most apical part of the implant and the first point of bone-implant contact in cervical region mesially and distally were used to measure the bone level.

In Group I measurements, mean of mesial bone height and distal bone height for both the Standard Sized implants, were taken and tabulated. While in Group II similar measurements were taken in relation to the single WDI.

2. Assessment of the bone density around the implants:

From the area of selection tools on the toolbar, the rectangular selection tool was used to specify the area. Two controlled and standardized

dimension square areas were made just mesial and distal to the implant including the bone implant interface at the selected region of interest. The bone density measurement tool was selected and data recorded.

In the present study, the mean marginal bone level around implants showed that there was statistical significant decrease of marginal bone level comparing the values of immediate post-operative measurement and 9 months measurements in group I and group II. Comparison between marginal bone level in both groups showed statistical non-significant difference in both groups. However, the bone loss was greater in group II with WDI. Moscovitch et al results also show that Wide-diameter implants are limited in their ability to fit in bone recipient sites that are narrow buccolingually and there have been reports of greater crestal bone loss compared to standard-diameter implants15.

However, in the present study although no statistically significant differences in clinical and radiographic results were observed between both groups, yet two SSI implants were relatively superior to WDI. This is in agreement with Blatz et al who comprehensively, suggested the use of both techniques, however, they concluded that two SSI are better options to replace a single mandibular posterior molar and provide more surface area and better biomechanical properties than one WDI implant.

27. Ziv Mazor, AdiLorean ,Eitan Mijiritsky, and Liran Levin, (2012) conducted a study to present results of single molar area rehabilitated by 2 narrow diameter dental implants. A retrospective cohort of 33

consecutive patients from 2 private practices between the years 2008 and 2009 had been evaluated. Patients who had a first molar single replaced by 2 narrow diameter implants (3 mm wide) were included in this case series. Patients' demographics, site and implant characteristics, time of follow-up were recorded from the medical files. Overall, 33 patients received 66 implants replacing 33 missing first molars. Patients' age ranged from 23 to 76 years with an average of 49.2 - 12.7 years. Most of the implants were used to replace a mandibular molar (76%) and 16 were used to replace 8 maxillary molars. In 2 patients, immediate implantation was performed. The mean distance between the adjacent teeth was 12.1 -1.0 mm. Follow-up time ranged from 10 to 18 months (average, 12.2 - 1.9 months). All implants survived the follow-up time. One implant presented with 1 mm of bone loss at 12-month follow-up. Replacing a single missing molar with 2 narrow diameter dental implants might serve as a viable treatment option providing good and predictable long-term results.

28. Vidya Kamalaksh Shenoy (2012) described the pretreatment consideration and pretreatment evaluation for single tooth implants. Today, implants are considered as a first treatment option to replace missing teeth due to the considerable advantages over the other available options. The ultimate goal of implant treatment is to restore natural esthetics, function, long term health, and patient comfort. Hence, case selection and treatment planning are very crucial to achieve longevity and predictability of the restoration. This article presents a step‐by‐step protocol for gathering and analyzing the

various factors at the pretreatment evaluation stage to set the groundwork for a dentist to consider implant as a restorative option.

29. B K Biswas , S Bag & S Pal (2012) described the biomechanical analysis of normal and implanted tooth using biting force measurement. Success of dental implant procedure means it restore the function of the teeth just like original one such as chewing, biting, aesthetics and other oral functions. Under normal circumstances, a single freestanding tooth or implant is commonly exposed to chewing forces that are usually compressive. Biting force measurement on the implanted teeth is one of the most important tests to compare the implanted tooth with normal one because the main function performed by teeth is cutting, tearing, crumbling or grinding of food or other materials**.** Biting force is applied in the loading end of the specially designed transduction device through a disposable polyethylene tubing cover. The biting force values were recorded for the normal subject and the subject having dental implants in their mouth from left molar to the right molar was also compared and presented as line diagram. Data obtained from the biting force experiments with human patients show that the axial forces during biting can range from low value such as 77 N to much higher value such as 2440 N. the lateral force components are much less, e.g., less than 100 N.. From the graphical representation it was clear that the difference in average biting force for both pairs in the normal subject and the subject having dental implant is not large but it was so close that they are not really distinct from each other**.**

This result can be used to design and evaluate any dental prosthesis so far its strength is concerned.

30. Andrea Mascolo, Paresh Patel (2012) described the technique of splinted zirconia fixed partial denture supported by small diameter (mini implants) in the posterior mandible. Implant-supported fixed partial dentures can restore a patient's missing posterior dentition. However, in sites that are atrophic, standard body end-osseous implants may not be properly contained by the available bone, thus violating the principle of encasing the implant in a minimum of 1 mm of bone. Alternatively, solid core one-piece, small-diameter (mini) dental implants can be used in highly selected sites with great circumspection. Mini dental implants have been successfully used to support fixed prosthesis that restore missing maxillary and mandibular incisors as well as mandibular posterior teeth. The purpose of this case letter is to demonstrate that splinted mini implants may successfully support a fixed zirconia partial denture in the posterior mandible in highly selected patients and with an appropriate prosthetic design. the use of 2 small diameter (mini) implants can reduce the cantilever effect created when using the procedure recommended by misch (4-mm implant for a 7-mm mesial distal width).

31. Maj Gen J.P. Singh, Col A.K. Gupta ,Col R.K. Dhiman (2013)

Described the Comparative study of immediate functional loading and immediate non-functional loading of mono cortical implants. Attempts to shorten the overall length of treatment have focused on immediate loading, subsequent to implant placement. Prosthetic rehabilitation immediately after

implant placement can be either functional or non-functional in nature. There is paucity of literature on the comparative evaluation of immediate functional and immediate non-functional loading of implants. This in-vivo study was undertaken to comparatively evaluate Immediate Functional Loading and Immediate Non-Functional Loading of Mono cortical implants with a follow-up period of 18 months. 50 partially edentulous cases were selected for the study. The cases were divided into two groups. In first group (Group-1), 25 implants were subjected to immediate functional loading. In second group (Group-2), 25 implants were subjected to immediate non- functional loading. The crestal bone loss, clinical stability and degree of osseointegration of these two groups were comparatively evaluated. The crestal bone loss in both groups was within acceptable limits.

The implant stability, which is a reflection of the status of bone-to-implant interface, was comparable in both the groups at different time intervals. Although, the ISQ values in Group-2 were slightly higher than those in Group-1, the results were not statistically significant. Radiodensity indicating degree of osseointegration at different time intervals in both groups was also comparable. Both the IFL and INFL protocols can be undertaken satisfactorily in rehabilitation using end-osseous implants; however, the main factors for success in IFL and INFL are case selection, meticulous treatment planning and the precision of technique.

32. Moustapha Saad, André Assaf (2013) they compared the outcome of narrow diameter implant and lateral bone augmentation. For optimizing functional and esthetic implant therapy results, sufficient bone amount is required at the reception site. A reduced buccolingual ridge dimension may not allow the placement of a standard-diameter implant without the risk of implant thread exposure. In such situations, lateral bone augmentation procedures can be performed that would allow a restorative-driven placement of standard-diameter implants. Conversely, the use of narrow-diameter implants (diameter ≤ 3.5mm) could be another predictable solution to avoid any invasive surgical management. The aim of this review is to analyze the survival rate of narrow-diameter implants as well as the effectiveness of different techniques for lateral bone augmentation in improving implant clinical outcomes. The use of narrow-diameter implant as well as lateral bone augmentation are well documented in the literature as a treatment modality in reduced ridge width . Each treatment approach has its advantages and downsides. On one hand, narrow diameter implant is a simple and predictable treatment when used properly. On the other hand, hard tissue management improves implant survival rate together with soft tissue contour and phonetics. Moreover, lateral bone augmentations are sometimes required to optimize the sagittal intermaxillary relationship.

33. Eitan Mijiritsky, Ziv Mazor, Adi Lorean, and Liran Levin (2013) conducted a study to evaluate the influence of implant length and diameter on implant survival. Methods: A retrospective cohort of 787

consecutive patients from 2 private practices between the years 2008 and 2011 had been evaluated .Patient demographics, site and implant characteristics, and time of follow-up were recorded from the medical files. Overall, 3043 implants were investigated. Overall survival rate was 98.7% with 39 implant failures recorded. Survival rates for narrow- (,3.75 mm), regular- (3.75– 5 mm), and wide- (.5 mm) diameter implants were 98.2%, 98.7%, and 98.5%, respectively (P ¼ 0.89). Survival rates of short (,10 mm) and regular (10 mm and above) implants were 97% and 98.7%, respectively (P ¼ 0.22). Conclusions: Implant length and diameter were not found to be significant factors affecting implant survival during the first 2 years of function in the present investigation of this specific implant system by a single manufacturer. Further long term follow-up studies are warranted because 2-years are only interim short-term results when dealing with dental implants.

34. De Souza Tolentino L, Garcez-Filho J, Tormena M, Lima LA and Araújo (2014) evaluated the outcome of Narrow Diameter Implants Compared to Regular Diameter Implants Installed in the Posterior Region of the Jaws . The aim of this prospective clinical study was to analyze marginal bone loss around Narrow Diameter Implants (NDIs) in comparison with that of Regular Diameter Implants (RDIs) installed in the posterior region of the jaws after one year of loading with single prostheses. A total of 21 patients with a mean age of 57.2 years were included in the study. The patients received one implant of each diameter in the maxilla or in the mandible. Panoramic radiographs were realized immediately after prostheses installation

(T0) and one year after loading (T1). Measurements were performed from implant shoulder to the first point of bone/implant contact. The differences in marginal bone change between the groups were analyzed by Student t-test for paired samples. A level of 95% of significance was adopted. A total of 42 implants were installed (21 RDIs and 21 NDIs). At the end of the follow-up period (12months of loading), implant success and survival rates of 100% were observed. The bone loss around implants atT0 was 0.41 (± 0.45) mm for NDIs and 0.47 (± 0.60) mm for RDIs and at T1 was 1.3 (± 0.3) mm for NDIs and 1.24 (±0.3) mm for RDIs. No statistically significant differences between the groups were found ($p>0.05$). This study demonstrated that RDIs and NDIs produced similar marginal bone alterations patterns after one year of loading, regardless the implant location, indicating that NDIs may be used in the posterior region of the jaws with single unit prostheses in selected patients.

35. Douglas R Monteiro, Emily V F Silva, (2015), conducted study on Posterior partially edentulous jaws, planning a rehabilitation with dental implants. The treatment plan for rehabilitation with dental implants in posterior quadrants of edentulousjaws must be meticulous. The professional must cautiously evaluate the treatment parameters to guarantee predictable and long-term restorations. The treatment plan includes detailed analysis of space for restoration, bone quantity and density, radiographic techniques, selection of number, diameter, and length of the implants, and occlusion.

36. **Dr. Mayur Kaushik, Dr. Sakshi Khattar (2016)** described the treatment of thin tissue biotype around an implant using sub epithelial connective tissue graft. Implant dentistry has come a long way since 1965, with great improvements made to achieve primary implant stability and to improve bone-to-implant contact with the introduction of the concept of osteointegration. The focus has been shifted towards creating an esthetic restoration that is indistinguishable from natural teeth and is stable over time. Just as bone volume is crucial for ideal positioning of the implant, soft tissue volume predicts the ideal emergence profile and esthetics of the eventual implant restoration. The correct recognition of gingival biotypes is important for the treatment of planning process in restorative and implant dentistry. Patients with thin biotype are more prone to recession, inflammation, and compromised soft tissue response. This paper presents a case of management of the thin gingival biotype over the implant surface to a more favourable one using the sub epithelial connective tissue graft to achieve a more stable and esthetic result.

37. Zankhana Shah, Amar Shah, Priyanka Raiyani (2016)

described that Most frequent single molar to be replaced is the first mandibular molar because this tooth is lost first. Implantation in the posterior area is a predictable procedure over time. The low rate of complications in addition to the high long- term success rate makes implant restoration a reliable solution to treat posterior partial edentulism. The use of two implants to replace a single molar seems a logical treatment solution. The following

case deals with the replacement of the lower right first molar having a previously failed root canal treatment with two narrow implants of diameter 3.5 mm and height 10 mm. Replacing a single missing molar with two narrow dental implants serves as a viable treatment option providing good and predictable long- term results.

38. Ho-Yong Song, Yoon-Hyuk Huh, Chan-Jin Park, Lee-Ra Cho

(2016) Conducted a study to investigate the stress distribution of 2-short implants (2SIs) installed in a severely atrophic maxillary molar site. Three different diameters of internal connection implants were modeled: narrow platform (NP), regular platform (RP), and wide platform (WP). The maxillary first molars were restored with one implant or two short implants. Three 2SI models (NP- oblique , NP-vertical, and NP-horizontal) and four single implant models (RP and WP in a centered or cantilevered position) were used. Axial and oblique loadings were applied on the occlusal surface of the crown. The von Mises stress values were measured at the bone-implant, peri-implant bone, and implant/abutment complex. The highest stress distribution at the bone-implant interface and the peri-implant bone was noticed I the RP group, and the lowest stress distribution was observed in the 2SI groups. Cantilevered position showed unfavorable stress distribution with axial loading. 2SI types did not affect the stress distribution in oblique loading. The number and installation positions of the implant, rather than the bone level, influenced the stress distribution of 2SIs. The implant/abutment complex of WP presented the highest stress concentration while that of 2SIs showed the lowest stress

concentration. 2SIs may be useful for achieving stable stress distribution on the surrounding bone and implant-abutment complex in the atrophic posterior maxilla.

39. Hadi Antoun, Pierre Cherfane, and Bouchra Sojodet (2016)

discussed the consecutive case series of healed single-molar sites immediately restored with wide-diameter implants. Described the out-comes of wide-diameter (6 mm) implants immediately provisionalized with cement-retained single crowns in posterior molar sites. Forty-eight consecutive patients received a total of 53 moderately rough surface, 6mmdiameter implants in healed sites. All implants were immediately provisionalized with a cement-retained provisional crown. Final prosthesis with cement-retained porcelain fused to metal crowns was delivered 3–6 months later. Patients were followed up for 1 year. Outcome measures were implant failures and success rate, complications, marginal bone levels, bone level changes, papilla index, bleeding on probing, and inflammation. One patient was lost to follow-up. At one year, the implant survival and success rate were 98.1%. The mean marginal bone loss after 1 year was −0.17-1.84 mm. Ideal papilla score was recorded at 83.8% of the sites. More than 95.6% of the sites showed no bleeding or inflammation. No procedure-related or device-related adverse events were reported. Wide-diameter (6 mm) implants can safely and successfully replace single posterior molars. Longer follow-up studies are necessary to evaluate the long-term success of these implants.

MATERIALS AND METHODS

This study was conducted at the department of Oral and maxillofacial surgery, Ragas dental college and hospital from December 2015 to December 2018. Ethical approval was obtained from the Institutional review board. Patients requiring replacement of single missing mandibular molar tooth were explained about both the single implant supported and double implant supported prosthesis. Patients who were willing to undergo the double implant supported molar replacement, were included in this prospective study. All the patients were systematically examined (Annexure III) preoperatively to rule out any systemic disorder or medically compromised condition or allergic reactions that will contradict the implant placement or post-operative medical management. The study protocol and the implant procedure were explained to the patient and informed consent (Annexure IV) was obtained prior to the procedure and the source data were collected accordingly.

INCLUSION CRITERIA

11. Patient with missing mandibular molar teeth with adjacent natural teeth and as well as natural teeth antagonist.
12. Good oral hygiene.
13. Absence of chronic periodontal or periapical pathology in the adjacent teeth.

2 Sufficient residual bone volume to receive implants of minimum 3.0 mm in diameter and minimum 10 mm in length with mesio distal edentulous space of 12- 14 mm.

3 Minimum crown height space of 7mm.

EXCLUSION CRITERIA

(2) Presence of para-functional habits such as bruxism.

(3) Chronic smokers.

(4) Patients under radiation therapy, chemotherapy, immunosuppressive drugs like corticosteroids

(5) Pregnancy.

(6) Insufficient bone quality or quantity, insufficient interarch space, poor oral status.

(7) Inflammatory and autoimmune conditions of the oral cavity.

DIAGNOSTIC PHASE:

Patients who reported to the department with the complaint of missing mandibular molar teeth desiring fixed prosthesis having either type I and type II alveolar ridge according to Atwood's classification were included in study. The procedure was explained to the patient in their own language and informed consent from each patient was taken prior to the procedure. All these patients underwent routine blood investigations followed by complete physical evaluation before procedure. Diagnostic impressions were taken with alginate or rubber base material and diagnostic models were poured by orthocal.

Preoperatively all the patients were evaluated clinically and radiographically using (OPG) and intra-oral periapical views, to detect for

16. The absence of pathological lesion at the area of implant insertion, alveolar height above the inferior alveolar canal and condition of the adjoining teeth.
17. The condition of the bone and its suitability for implant placement.
18. Any root angulation in adjacent tooth, periodontal defects & amount of interdental bone
19. The vertical height of bone to select the suitable implant length.
20. For all these patients bone mapping was done using sectioned impression casts to assess the width of bone available for selection of appropriate diameter of the Implant. Custom fabricated stents were fabricated to accurately locate the implant site and direction of insertion.

SURGICAL PHASE:

ARMAMENTARIUM:

19. 2% Lignocaine with 1:80,000 Epinephrine
20. 27 Gauze, 40 x 35mm disposable needle.
21. No 15 bard parker blade & handle with No 3 handle.
22. Molt no 9 Periosteal elevators.
23. Physio dispenser motor and contra angle handpiece

3. Marking drill, Pilot burs with diameter of 2mm ,2.8mm ,Torque wrench , ratchet ,
4. Vernier caliper or Divider with Metal scale.
5. Narrow diameter endosseous implant which is 3 mm in diameter and varying length of 10mm,11.5 mm and 13mm were used in this study
6. 3-0 silk suture material.

Surgical room was disinfected by fumigating the room with formaldehyde. Drills, implant components and the hand pieces were sterilized using an autoclave while ensuring peak performance and quality control. The patient is led into the surgery room to avoid contact with sterile items, and seated. Lighting unit handles were covered with sterile lead foil.

SURGICAL PROCEDURE:

All the patients were given prophylactic antibiotic one day prior to the procedure. Patients were positioned at semi reclined position on the dental chair. Patients were prepared and draped. The surgical site was irrigated by saline and hexidine mouth wash was given. The inferior alveolar nerve block was given with 2% lignocaine with 1:80,000 adrenaline. Mid crestal incision were made in surgical site followed by crevicular incision involving Mesial papilla of the mesial tooth and Distal papilla of the distal tooth present using 15 surgical blades. A full thickness mucoperiosteal flap was raised exposing Labial / buccal aspect of the edentulous ridge(fig.3). Minimal periosteal

reflection was done towards the lingual side to maintain blood supply to the bone.

The custom-made stent which was trailed before in patient's mouth were kept in Glutaraldehyde solution for 2 hours before surgery. With the guidance of stent, a pilot drill was introduced into the bone, and two osteotomy sites were created. First on the mesial and the second on the distal side. They were taken to the desired depth. The sites were progressively enlarged and finished with the dedicated osteotomy drill. The profile gauge was inserted, and depth checked to ensure that the implant would sit just sub crestal. The dedicated tap was then introduced into the site to the depth established. Two mini implants of size 3.0 mm × 10 mm were carefully threaded into the prepared sites with minimum of 30 N/cm(fig.4). The flaps

were closed with 3-0 silk sutures.(fig.5)

POST SURGICAL PROTOCOL:

All patients were administered with a single dose of analgesic (inj.voveron 75mg) intramuscularly immediately after the procedure. They were prescribed with a regime of oral antibiotics cap.Amoxicillin 500mg TDS, Tab.Metronidazole 400mg TDS, analgesics Tab.Paracetamol 650mg TDS and antacid Tab.Ranitine hydrochloride 150mg BD before food for a period of 5 days.

Regular oral prophylaxis was advised. Suture

removal was performed after 7 days.

POST-OPERATIVE INSTRUCTIONS:

1. The prescription for the post-operative medication were handed over to the patient preoperatively and requested to keep in hand during the procedure.
2. Intermittent ice application for 48 hours.
3. Chlorhexidine rinses should be used gently three to four times daily for 2 weeks.
4. Brushing at the operative site should be discouraged for the first 24 hours. Then, a very soft brush (e.g., Oral B-20 or -30) can be used carefully for cleansing. Any dentifrice is satisfactory.
5. Eat very soft foods as tolerated. Mastication of food of challenging texture that might injure the operative site should be avoided. Plan a reasonable, nutritionally balanced diet. Good choices are soft boiled eggs, milk, ice cream, malts, boiled chicken and soup, cheeses, and junior foods.
6. For the first 24 postoperative hours, drink plenty of fluids: juice, soda, water, or milk.
7. Expect some amount of swelling, pain and discomfort. These are common and do not indicate infection or other problems. Sleep with your head well elevated.
8. If severe bleeding occurs, bite on a piece of wet gauze for 25 minutes. If the bleeding persists, come to the hospital immediately.

9. Do not hesitate to telephone if any questions arise about your condition or the operation. In an emergency, you should call us at (telephone number).

Patients were recalled for follow up regularly at 1 week, 1 month and 3 months post-operative period. The two-stage surgical technique was chosen in this study for implant placement. In the first stage, the implants were placed and were left undisturbed for a healing period of three months for complete osseointegration.

PROSTHETIC PHASE:

The patient were recalled for the prosthetic rehabilitation after 3 months from the time of implant placement. The healing caps were placed after removing cover screw under local anesthesia(fig.6). Healing caps removed after one week of healing. Indirect open tray impression with putty impression material made. Impression coping trial and Zigtrail were checked for accurate fit of prosthesis using intra oral periapical radiograph(fig.8). Screw retained Metal ceramic crown was fabricated and fixed(fig.10). No provisional prosthesis was used by the patients during the healing period. The final restoration material was metal ceramic. Occlusal function for all molars was established utilizing a firm centric contact with little pressure in lateral excursion. This condition was checked at patient revisits every 6 months and adjusted if needed. At each visit, mobility of the prosthesis was assessed regarding implant stability and screw loosening. If the prosthetic screw could

be retightened, the prosthesis were considered mobile. If the screw was completely loose or fractured, this condition was registered separately.

The radiographs were taken 1 week after abutment connection, 6 and 12 months post operatively and once every 12 months thereafter. Radiographs were analyzed with respect to bone loss and change of density of the bone around the implants. The marginal bone height of each implant was measured mesially and distally by using the implant threads as the dimensional reference. The numerical mean of the mesial and distal measurements was used as a value for each implant. The marginal bone loss was calculated for each site.

IMPLANT EVALUATION

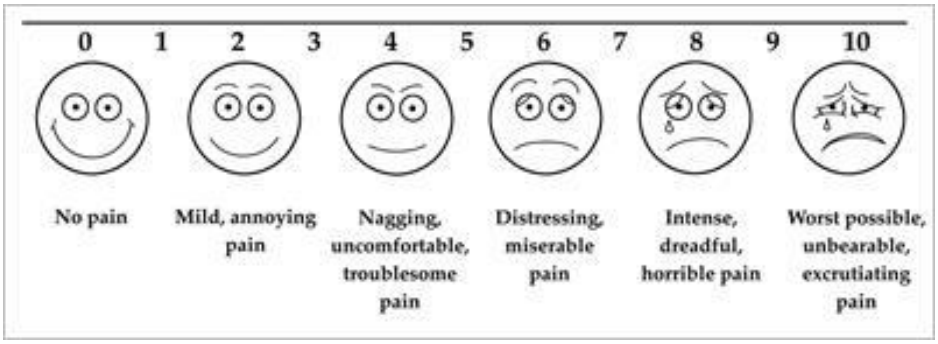
At the follow-up sessions, scheduled for 0, 6, 12 months after implant insertion, the following clinical parameters (primary and secondary endpoints of the study) were investigated.

I. International Congress of Oral Implantologist (ICOI) Pisa Implant quality of health scale:

Grading	Group	Clinical condition
1	Success (optimal health)	No pain or tenderness upon function Zero mobility Less than 2 mm radiographic bone loss from initial surgery No exudate

2	Satisfactory Survival	No pain on function Zero mobility 2-4 mm radiographic bone loss No exudate history
3	Compromised Survival	May have sensitivity on function No mobility Bone loss more than 4 mm Probing depth more than 7mm May have Exudate history
4	Failure	Pain on function Mobility Radiographic bone loss more than half the length of implant Uncontrolled exudate No longer in mouth

II. Visual analog scale (VAS): **Pain evaluation intra operative and 1 year)**



VAS scale Pain grading:

Pain score	Grading
0	Absent
1-3	Mild
4-7	Moderate
8-10	Severe

III.Wound healing index:

SCORE	DESCRIPTION
1	Uneventful wound healing with no gingival oedema,erythema,suppuration,patient discomfort or flap dehiscence.
2	Uneventful wound healing with slight gingival edema,patient discomfort,or flap dehiscence,but no suppuration.
3	Poor wound healing with significant gingival edema, erythema,patient discomfort,flap dehiscence or any suppuration

IV. Implant mobility Index :

Scale	Description
0	Absence of clinical mobility with 500 g in any direction.
1	Slight detectable horizontal movement.
2	Moderate visible horizontal mobility upto 0.5mm.
3	Severe horizontal movement greater than 0.5mm.
4	Visible moderate to severe horizontal and any visible vertical movement.

V. Modified plaque index:

Modified plaque index* (mPI), determined on the mesial, distal, buccal and palatal surface of the implants. For each implant, the mPI value was calculated based on the average of the four obtained values. The following scores were assigned on the basis of the amount of plaque:

Score 0: No plaque detected

Score 1: Plaque only recognized by running a probe across the marginal surface of the implant

Score 2: Plaque visible with the naked eye

Score 3: Abundance of soft matter

Modified plaque index:

Score 0	Score 1	Score 2	Score 3

VI. Modified bleeding index:

Modified bleeding index* (mBI), assessed at the same surfaces, as an indicator of the existence and severity of peri-implant gingivitis. For each implant, the mBI value was calculated based on the average of the four obtained values:

Score 0: No bleeding running a periodontal probe along the gingival margin adjacent to the implant;

Score 1: Isolated bleeding spots evidenced;

Score 2: Blood forming a confluent line on the mucosal margin; Score 3: Profuse bleeding

Modified bleeding index:

Score 0	Score 1	Score 2	Score 3

VII. Patient satisfaction:

a. Your overall experience with implant therapy?

«Patient satisfaction»						
Non-satisfied		Slight		Moderate		Very satisfied
1	2	3	4	5	6	7

b. Are you satisfied with esthetics outcome of final prosthetic crown?

«Patient satisfaction»						
Non-satisfied		Slight		Moderate		Very satisfied
1	2	3	4	5	6	7

c. Are you having functional difficulty with final prosthesis?

«Patient satisfaction»						
Non-satisfied		Slight		Moderate		Very satisfied
1	2	3	4	5	6	7

d. Are you having difficulties in maintaining oral hygiene?

«Patient satisfaction»						
Non-satisfied		Slight		Moderate		Very satisfied
1	2	3	4	5	6	7

Patient satisfaction score :

Case	Average score	Grading
	1-2	Not satisfied
	3-4	Slightly satisfied
	5-6	Moderately satisfied
	7	Very satisfied

VIII. Bone loss:

The distance between the implant shoulder and the first visible bone contact (DIB) in millimeters. To perform this evaluation, intraoral periapical radiographs were taken for each implant, with a rigid film-object X-ray source at the baseline (immediately after implant insertion) and at the follow-up sessions (0, 6, and12 months after implant insertion).

With these values, crestal bone level changes were registered as modifications in the distance from the implant shoulder to the bone level on the mesial and distal implant side. In order to correct dimensional distortion, the apparent dimension of each implant was measured on the radiograph and then compared with the real implant length. The radiographs were also analyzed for the presence or absence of continuous peri-implant radiolucencies.

IX. Complications:

Patients were also evaluated during the review for the presence of any of the following complications and the findings were recorded.

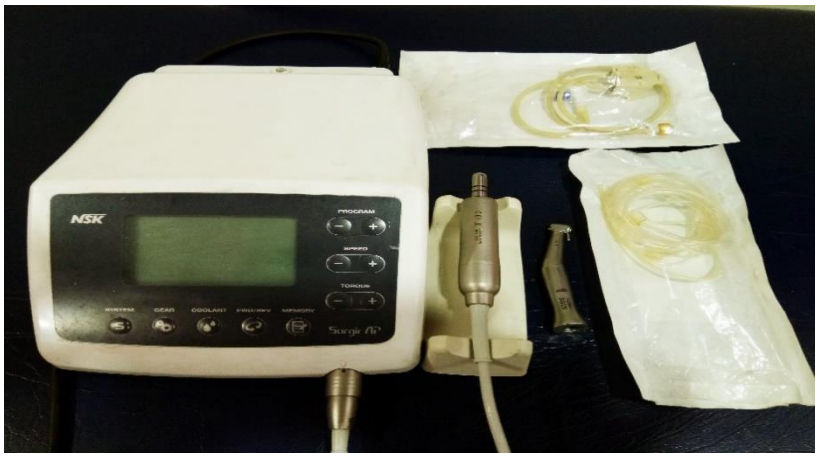
1. The presence or absence of pain or suppuration
2. The presence or absence of implant mobility tested manually using the handles of two dental mirrors
3. Probing depth (PD) in mm, measured using a periodontal probe at the same surfaces. For each implant, the PD value was calculated based on the average of the four obtained values.

4. Soft tissue complications:

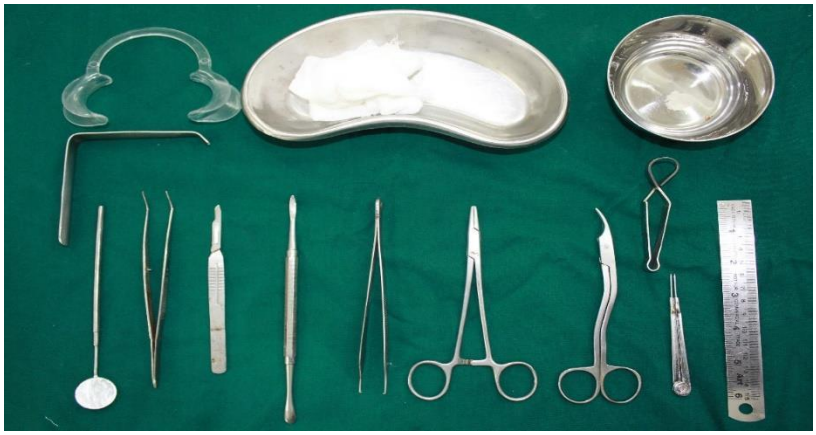
5. Prosthetic complications:

ARMAMENTARIUM

PHYSIODISPENSER



INSTRUMENT SETUP



ADIN IMPLANT SYSTEM KIT

CASE 1

Fig. 1: PROFILE PHOTO

FIG. 2: INTRA ORAL VIEW

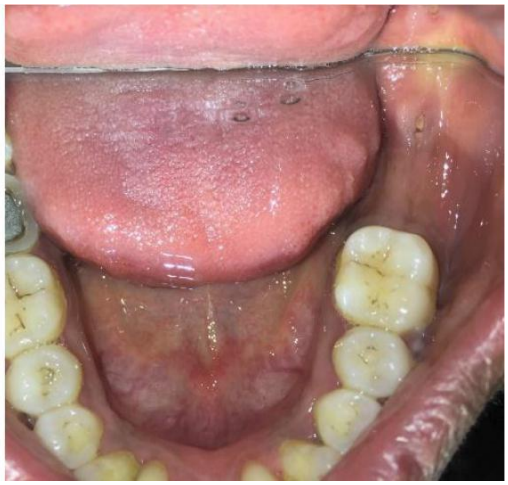


FIG. 3: MUCOPERIOSTEAL REFLECTION

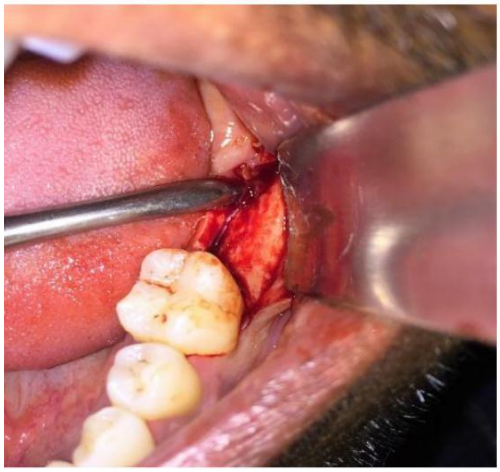


FIG. 4: MESIAL AND DISTAL IMPLANT PLACEMENT

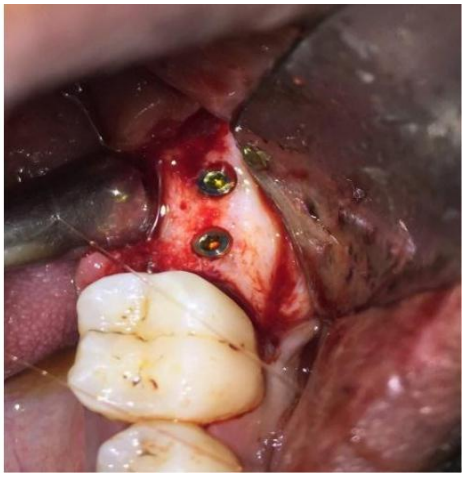


FIG. 5: SUTURING DONE

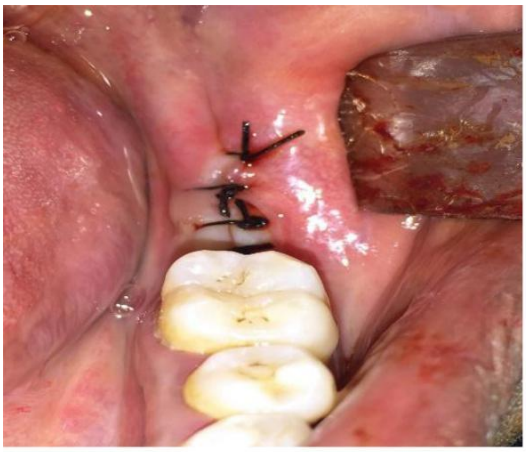


FIG. 6: HEALING ABUTMENT

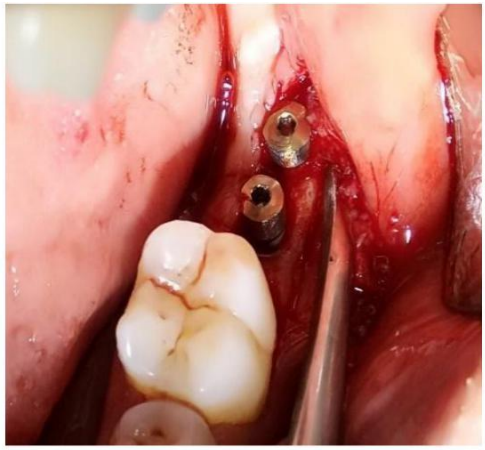


FIG. 7: SUTURING DONE

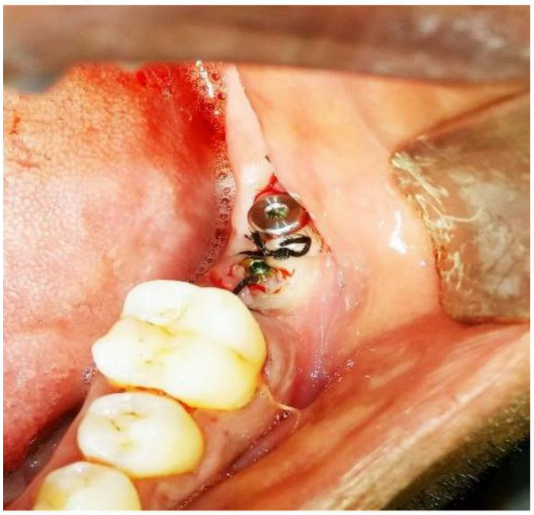


FIG.8: ZIG TRIAL VERIFICATION

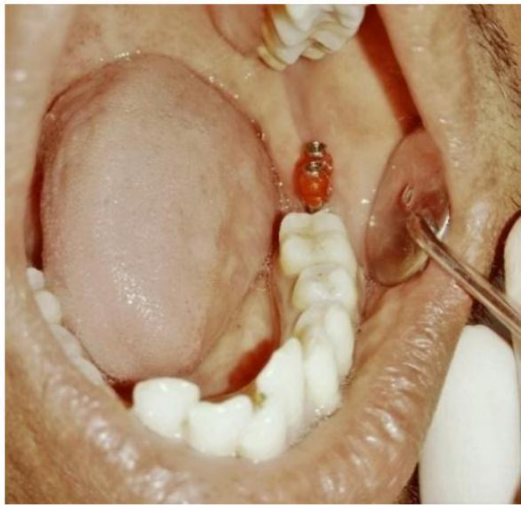
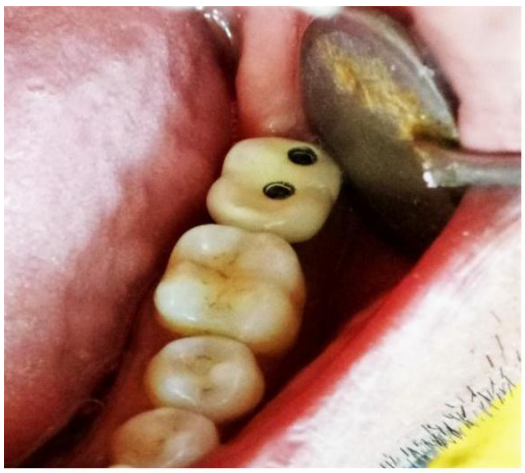


FIG. 10 : SCREW TIGHTENED FIG. 9:

SCREW RETAINED TO 20 N TORQUE
METAL CERAMIC PROSTHESIS



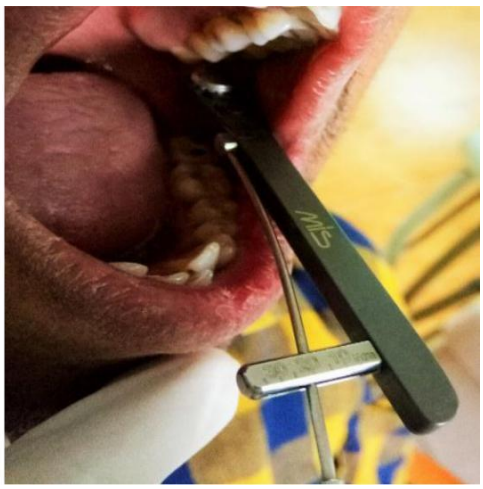
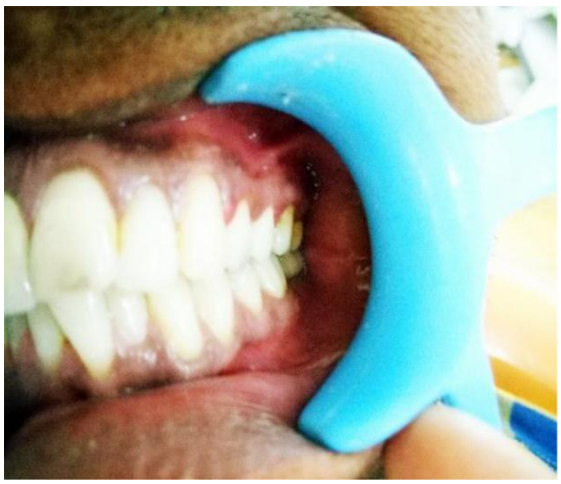


FIG. 12: OCCLUSAL ENTRY
CLOSED WITH COMPOSITE RESTORATION

Fig; OCCLUSION



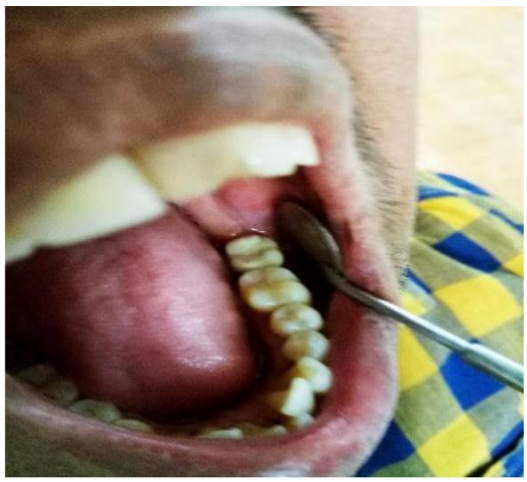


FIG. 13: PREOPERATIVE IOPA

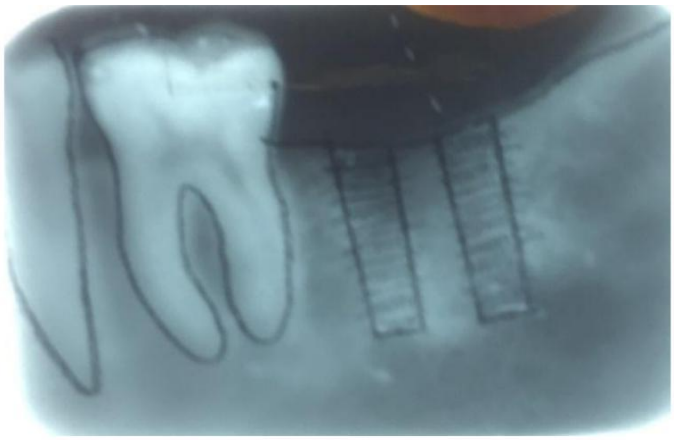


FIG. 14: IOPA AFTER IMPLANT PLACEMENT

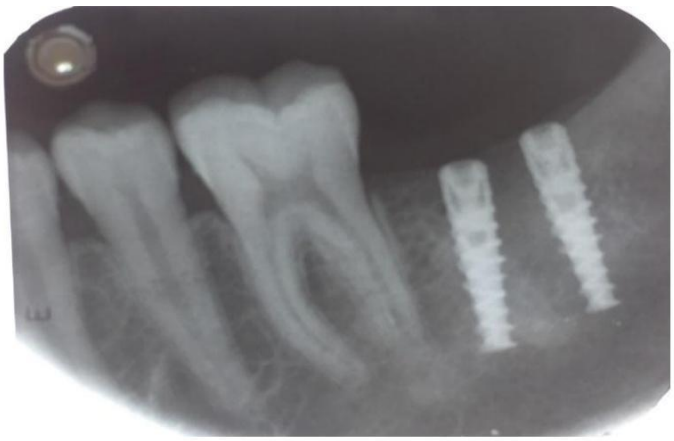


FIG. 15: IOPA AFTER PROSTHESIS PLACEMENT

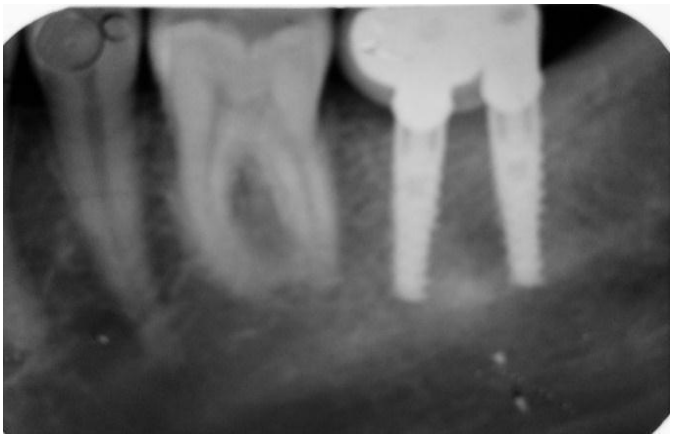


FIG. 16: PREOPERATIVE OPG

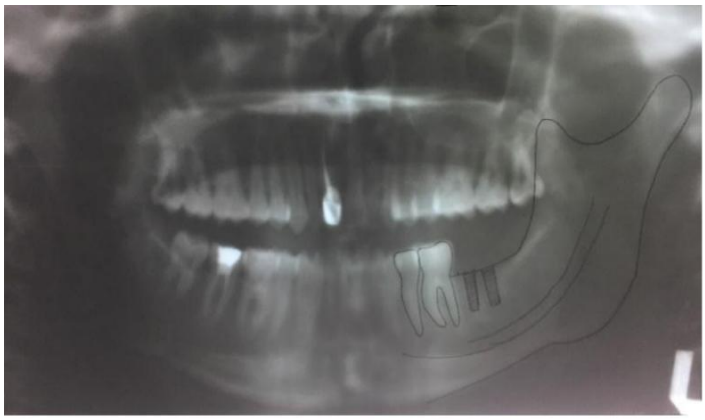


FIG. 17: OPG AFTER IMPLANT PLACEMENT

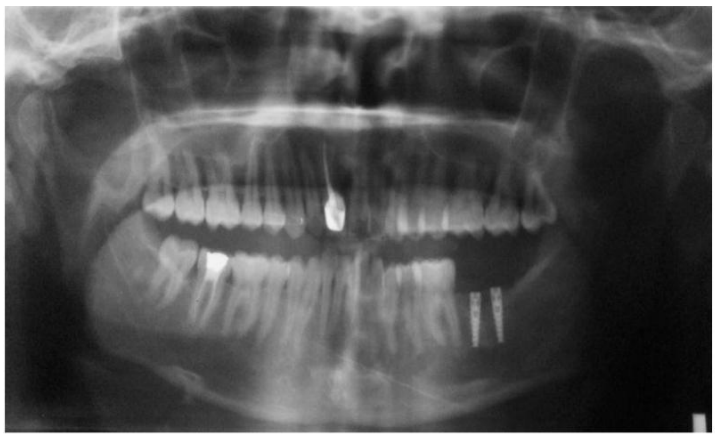
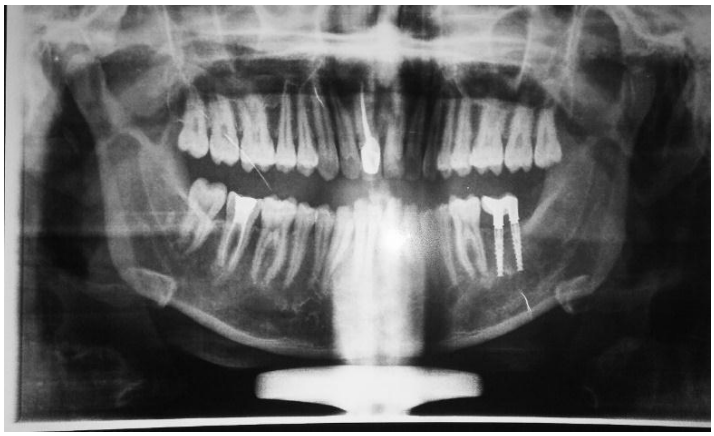


FIG. 18: OPG AFTER PROSTHESIS PLACEMENT



RESULT

This study was conducted in the Department of Oral and Maxillofacial Surgery at Ragas Dental College and Hospital, Tamilnadu. Patients of either sex, having partial edentulism in the posterior mandibular arch with narrow crestal width who required preferably implant based fixed prosthesis were included in this study. Ten patients (4 male and 6 female) received 20 implants for replacing either the first or second mandibular molar tooth (Table 1). Patients age ranged from 25 to 55 years with an average of 31.9 years (Table 2.). None of the patients had the habit of smoking at the time of implantation.

Implant location and implant characteristics are as follows: In five patients implants were placed in 36 region, three patients received implants at 37 region and in the other 2 patients implants were placed in 47 region. The average mesiodistal length of the edentulous space is 12.5mm ± 1mm, average buccolingual width is 6.3mm ± 0.7mm. All 20 implants placed were of 3mm diameter and the length of the implant ranged from 10 mm to 13 mm depending on the available length. (TABLE 3). All The implants belong to ADIN IMPLANT SYSTEMS with tapered Mors internal connection.

All the implants were loaded following two stage technique. Patients were evaluated at 6months and 12 months (average 6 months) according to ICOI criteria. On evaluation all implants were successful (Table 4.). All the implants were also evaluated for Implant mobility with two point scale and tap test. If the tap elicits a solid ring there is no mobility but if the sound is dull, the implant is not osseointegrated and surrounded by fibrous tissue. Among the 10 patient, none of the patient reported with clinically detectable implant mobility in horizontal and vertical direction. (TABLE 6)

None of the implant patient experienced pain or tenderness on function (Table 5.). All ten implants showed zero mobility and less than 2mm radiographic bone loss from initial surgery. None of the implants showed any exudate (TABLE 6). Among the ten patients, eight patient had uneventful wound healing with no gingival oedema, erythema, suppuration, patient discomfort or flap dehiscence, and two patient had uneventful wound healing with slight gingival oedema, patient discomfort, or flap dehiscence, but no suppuration (TABLE 6). There was no peri – implant radiolucency present in any of the cases on routine radiographic follow up. On patient Satisfaction Index 3 patient were very satisfied and 3 patient were moderately satisfied and four patient were slightly satisfied.(TABLE 7)

Modified plaque index (mPI), determined on the mesial, distal, buccal and palatal surface of the implants. For each implant, the mPI value was calculated based on the average of the four obtained values. No plaque was

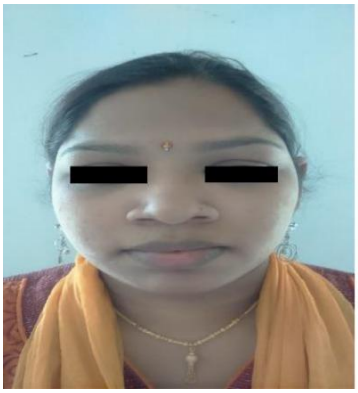
detected on six patients and plaque was detected only on running the periodontal probe across the marginal surface of the implant in four patients.(TABLE 6). Modified bleeding index (mBI) and modified plaque index were assessed at the same surfaces, as an indicator of the existence and severity of peri-implant gingivitis. For each implant, the mBI value was calculated based on the average of the four obtained values:score 0,score 1 ,score 2 ,and score 3.out of 10 patients ,six patient had, no bleeding on running a periodontal probe along the gingival margin adjacent to the implant and 4 patients reported with isolated bleeding spots.(TABLE 6)

Post operative crestal bone loss at six month follow up (T1) revealed bone loss of, 0.52±0.13mm, 0.57±0.12mm for mesial and distal implant.(TABLE 8). Post operative crestal bone loss at 12 month follow up

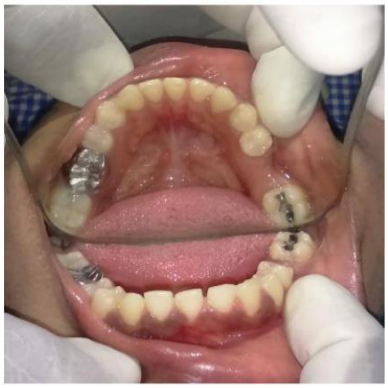
(T2) was 1.05± 0.20mm, 1.08±0.23mm for mesial and distal implant respectively(TABLE 9). Comparison of crestal bone loss at 6 months and 12 months done using paired t test was statistically significant(p value >0.05) for mesial and distal implant. Comparison of crestal bone loss between mesial and distal implants at 6 months and 12 months is not statistically significant (p value <0.05) (TABLE 10 AND 11).

CASE 2

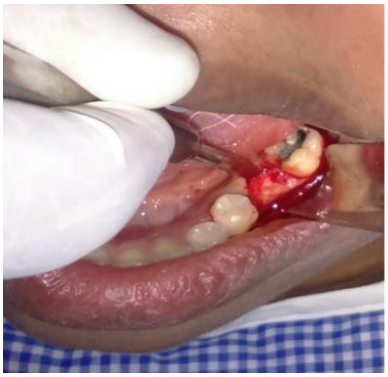
PROFILE PHOTO



INTRA ORAL VIEW



MUCOPERIOSTEAL REFLECTION



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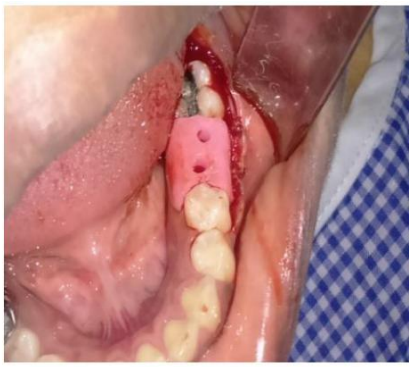
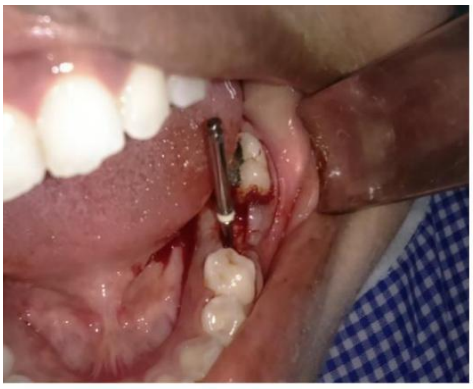
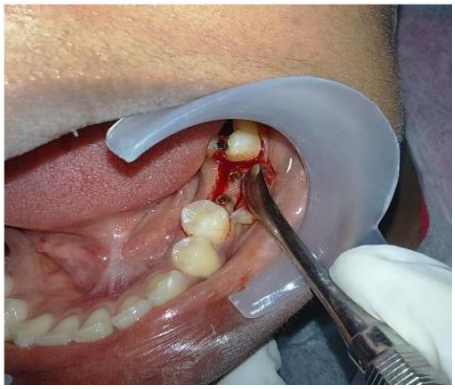


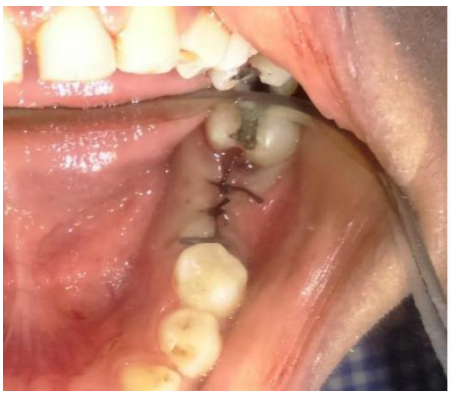
PARALLELING PIN PLACEMENT



MESIAL AND DISTAL IMPLANT PLACEMENT

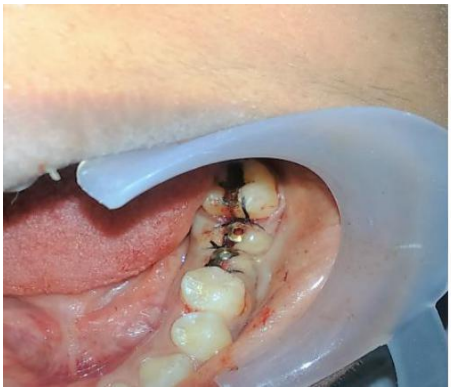


SUTURING DONE

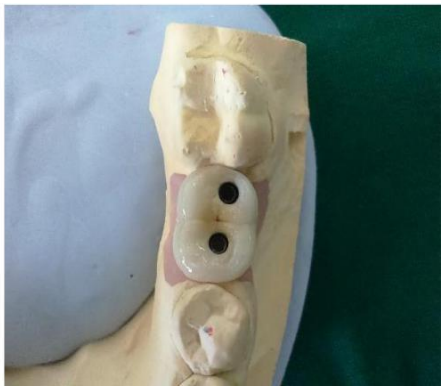


HEALING ABUTMENT PLACEMENT

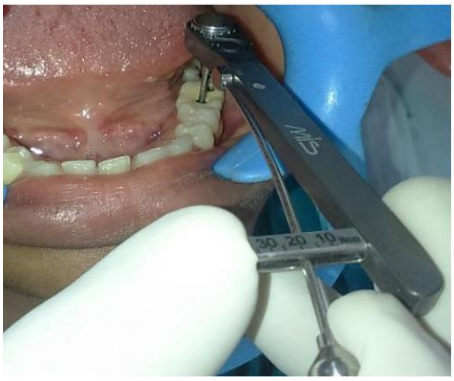
SUTURING DONE



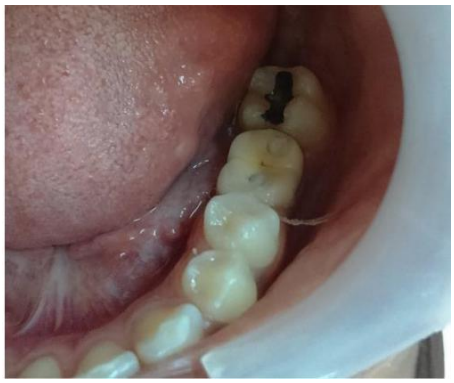
SCREW RETAINED METAL CERAMIC PROSTHESIS



SCREW TIGHTENED TO 20 N TORQUE



OCCLUSAL ENTRY CLOSED WITH COMPOSITE



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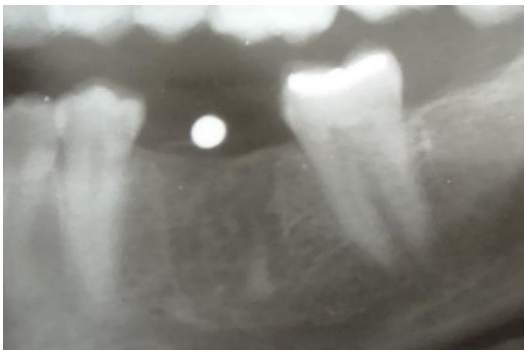

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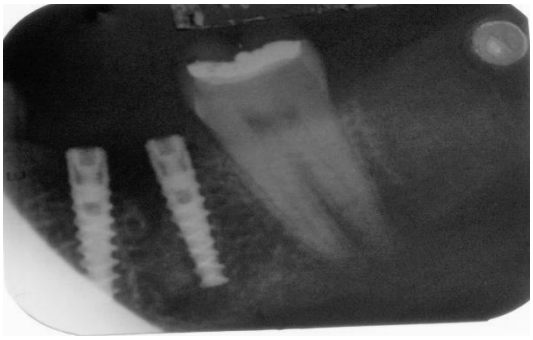

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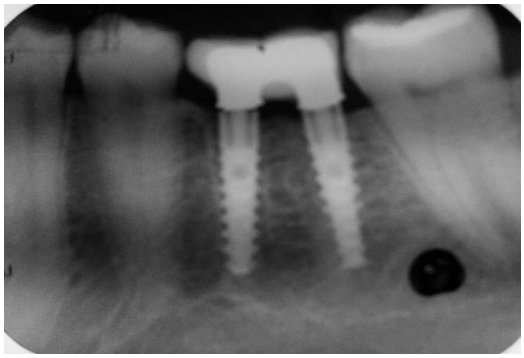

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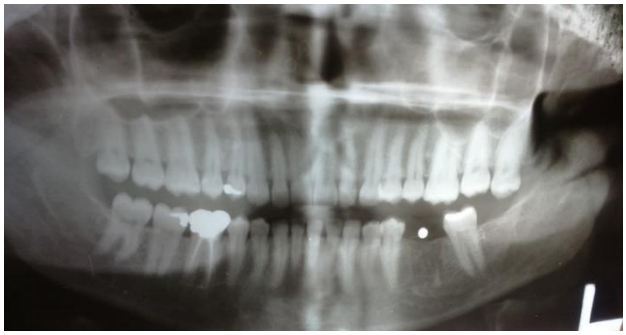

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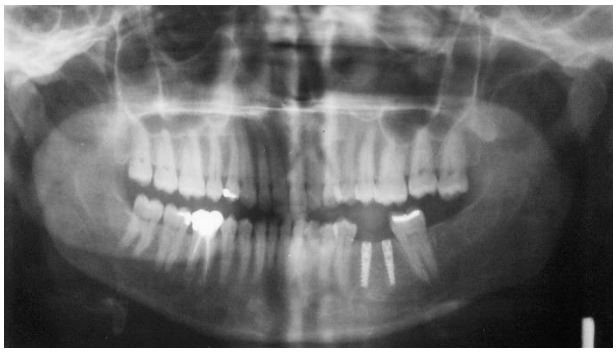

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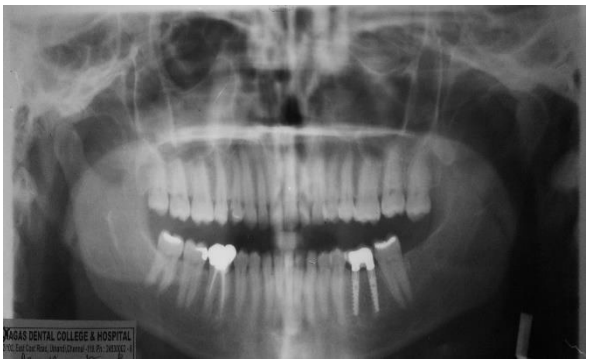
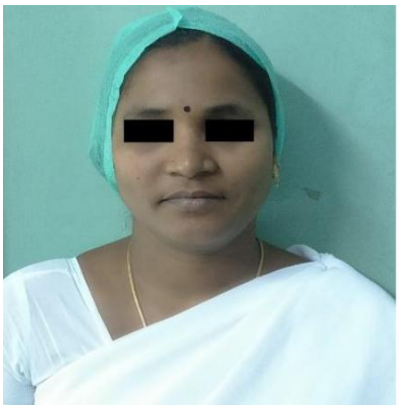
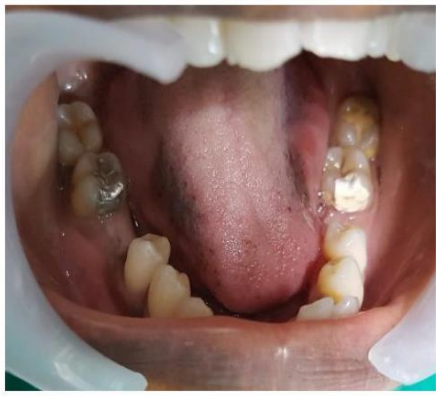


CASE 3

PROFILE PHOTO

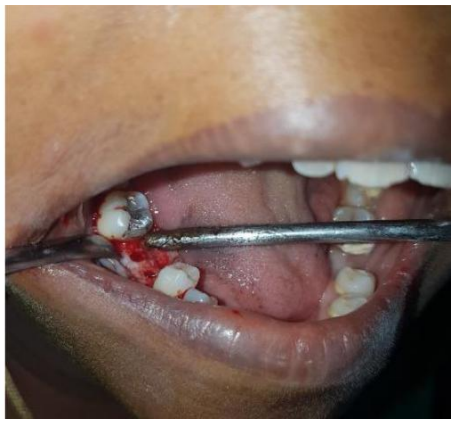


INTRA ORAL VIEW

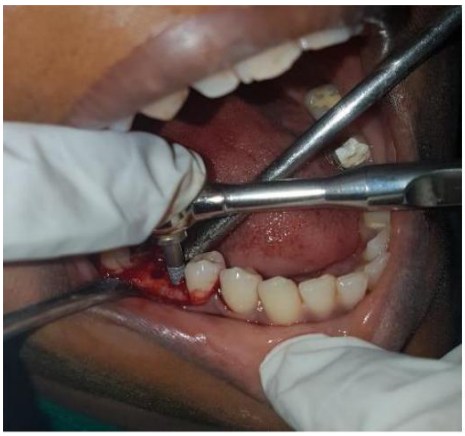


MUCOPERIOSTEAL REFLECTION

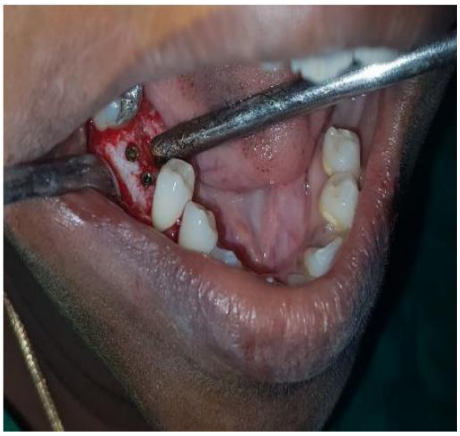
IMPLANT SITE PREPARATION



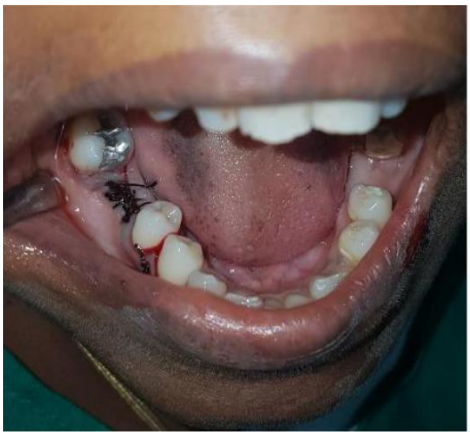
IMPLANT PLACEMENT



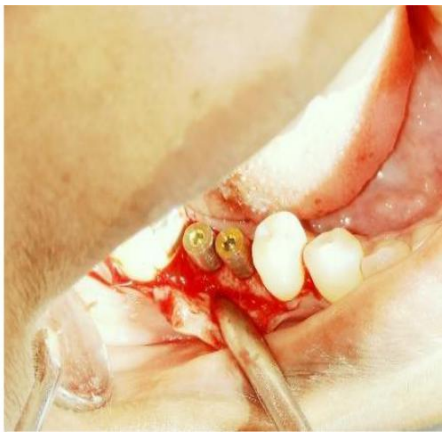
MESIAL AND DISTAL IMPLANT PLACEMENT



SUTURING DONE



HEALING ABUTMENT PLACEMENT



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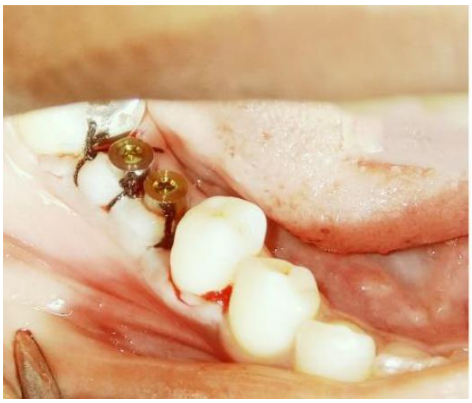
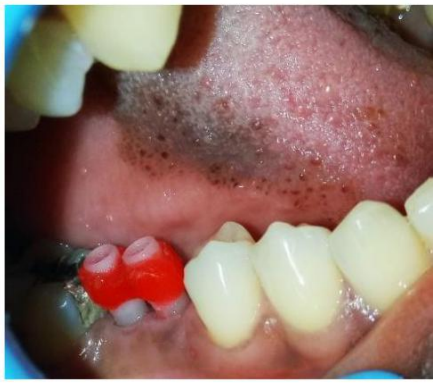
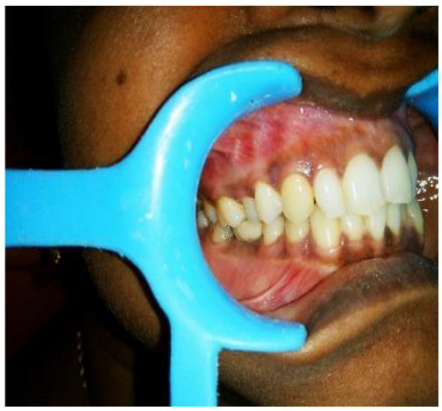


ZIG TRIAL VERIFICATION

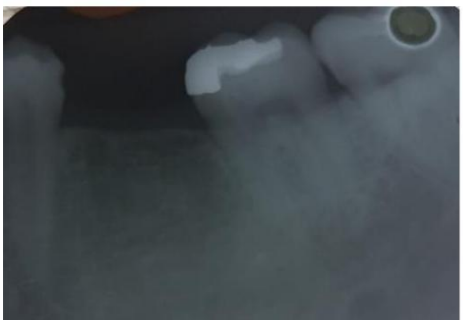


SCREW RETAINED METAL CERAMIC PROSTHESIS

OCCLUSION



PREOPERATIVE IOPA



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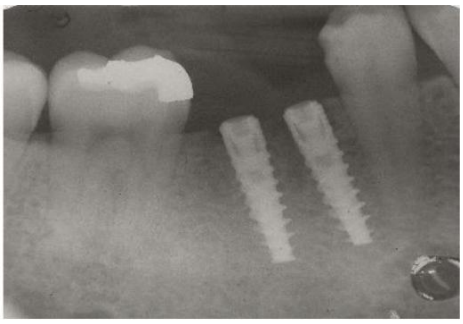

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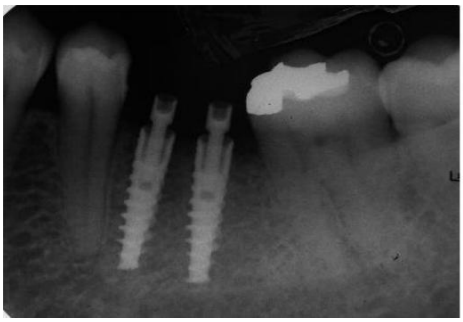

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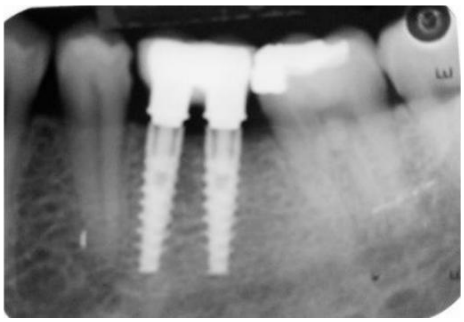

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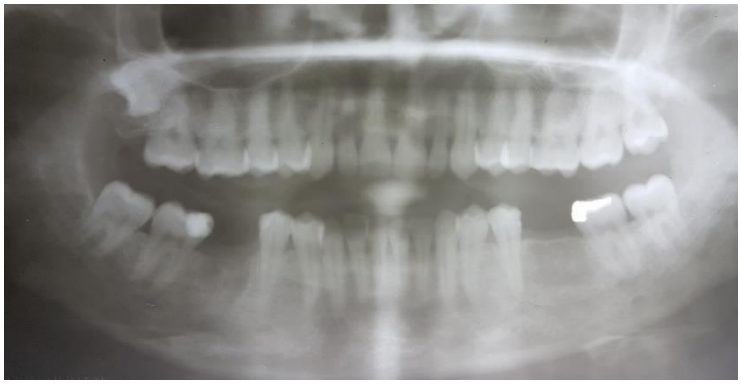
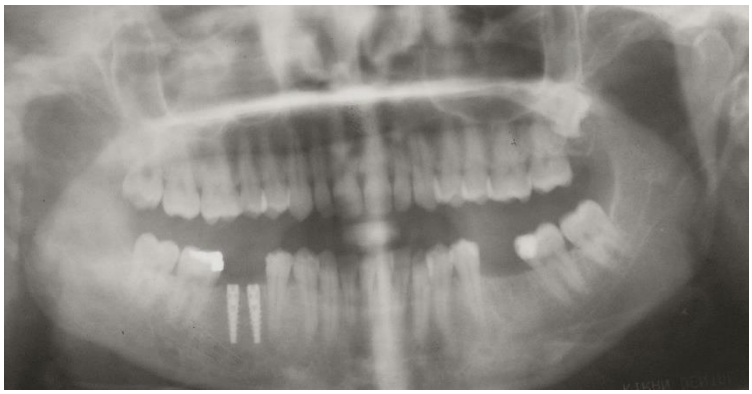


OPG AFTER IMPLANT PLACEMENT



OPG AFTER PROSTHESIS PLACEMENT

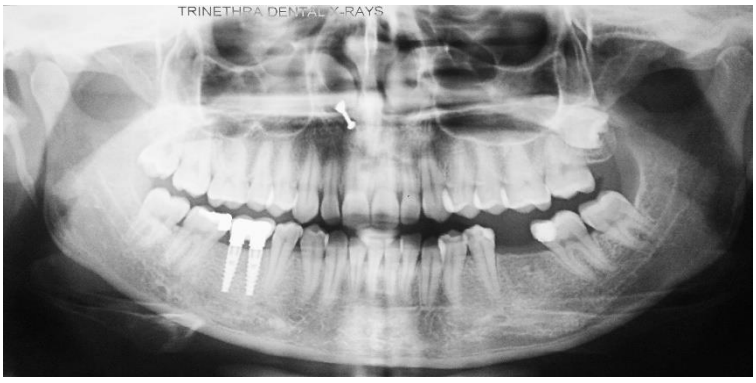


TABLE 1: GENDER DISTRIBUTION

Gender	Frequency	Percentage
MALE	4	40%
FEMALE	6	60%

TABLE 2: AGE DISTRIBUTION

Age (years)	Number of patients	Percentage
18-25	1	10%
26-33	7	70%
34-41	1	10%
42-49	0	0
50-57	1	10%
58-65	0	0

TABLE 3: IMPLANT SITE AND IMPLANT DIMENSIONS

Cases	Implant Site	Available Space (Mesio -Distal) X (Bucco-Lingual Width)	Mesial Implant Diameter And Length	Distal Implant Diameter And Length
CASE 1	36	12.5mm x6mm	3x 13mm	3x13mm
CASE 2	36	12.0mmx7mm	3x13mm	3x13mm
CASE 3	36	11.5mmx5.5mm	3x10mm	3x10mm
CASE 4	37	10.5mmx6.5mm	3x10mm	3x10mm
CASE 5	36	12.0mmx7mm	3x11.5mm	3x11.5mm
CASE 6	46	11.0mmx6mm	3x10mm	3x10mm
CASE 7	37	11.5mmx6.5mm	3x11.5mm	3x11.5mm
CASE 8	36	12.0mmx7.0mm	3x10mm	3x10mm
CASE 9	46	10.5mmx6.0mm	3x13mm	3x13mm
CASE 10	37	11.5mmx5.5mm	3x11.5mm	3x11.5mm

TABLE 4: 1. INTERNATIONAL CONGRESS OF ORAL IMPLANTOLOGIST (ICOI) PISA IMPLANT QUALITY OF HEALTH SCALE

CASES	IMPLANT SITE	GRADE 1	GRADE 2	GRADE 3	GRADE 4
CASE 1	36	✓			
CASE 2	36	✓			
CASE 3	36	✓			
CASE 4	37	✓			
CASE 5	36	✓			
CASE 6	46	✓			
CASE 7	37	✓			
CASE 8	36	✓			
CASE 9	46	✓			
CASE 10	37	✓			

TABLE 5: VAS SCALE PAIN GRADING

CASES	IMPLANT SITE	ABSENT (0)	MILD (1-3)	MODERATE (4-7)	SEVERE (8-10)
CASE 1	36		✓		
CASE 2	36		✓		
CASE 3	36		✓		
CASE 4	37	✓			
CASE 5	36			✓	
CASE 6	46		✓		
CASE 7	37		✓		
CASE 8	36	✓			
CASE 9	46		✓		
CASE 10	37		✓		

TABLE 6:

CASES	IMPLANT SITE	WOUND HEALING INDEX	IMPLANT MOBILITY INDEX	MODIFIED BLEEDING INDEX	MODIFIED PLAQUE INDEX
CASE1	36	SCORE 1	SCORE 0	SCORE 0	SCORE 1
CASE 2	36	SCORE 1	SCORE 0	SCORE 0	SCORE 0
CASE 3	36	SCORE 1	SCORE 0	SCORE 1	SCORE 0
CASE 4	37	SCORE 2	SCORE 0	SCORE 1	SCORE 1
CASE 5	36	SCORE 1	SCORE 0	SCORE 0	SCORE 0
CASE 6	46	SCORE 1	SCORE 0	SCORE 0	SCORE 0
CASE 7	37	SCORE 2	SCORE 0	SCORE 1	SCORE 1
CASE 8	36	SCORE 1	SCORE 0	SCORE 0	SCORE 0
CASE 9	46	SCORE 1	SCORE 0	SCORE 0	SCORE 0
CASE 10	37	SCORE 1	SCORE 0	SCORE 1	SCORE 1

TABLE 7: PATIENT SATISFACTION INDEX

Cases	Implant site	Average score	Grading
CASE 1	36	5	Moderately satisfied
CASE 2	36	7	Very satisfied
CASE 3	36	4	Slightly satisfied
CASE 4	37	3	Slightly satisfied
CASE 5	36	6	Moderately satisfid
CASE 6	46	5	Moderately satisfied
CASE 7	37	4	Slightly satisfied
CASE 8	36	7	Very satisfied
CASE 9	46	7	Very satisfied
CASE 10	37	6	Moderately satisfied

Table 8: POST OPERATIVE CRESTAL BONE LOSS AT 6 MONTH FOLLOW UP (T1)

Cases	Implant location	Crestal bone loss in mesial side of mesial implant	Crestal bone loss in distal side mesial implant	Mean crestal boneloss for mesial implant	Crestal bone loss in mesial side of distal implant	Crestal bone loss in distal side of the distal implant	Mean crestal bone loss for distal implant
CASE 1	36	0.5mm	0.4mm	0.45mm	0.6mm	0.5mm	0.55mm
CASE 2	36	0.4mm	0.5mm	0.45mm	0.6mm	0.4mm	0.50mm
CASE 3	36	0.5mm	0.8mm	0.65mm	0.70mm	0.3mm	0.50mm
CASE 4	37	0.4mm	0.4mm	0.40mm	0.6mm	0.7mm	0.65mm
CASE 5	36	0.5mm	0.4mm	0.45mm	0.4mm	0.5mm	0.45mm
CASE 6	46	0.5mm	0.6mm	0.55mm	0.6mm	0.7mm	0.65mm
CASE 7	37	0.4mm	0.6mm	0.50mm	0.5mm	0.5mm	0.5mm
CASE 8	36	0.7mm	0.4mm	0.55mm	0.7mm	0.5mm	0.6mm
CASE 9	46	0.5mm	0.7mm	0.60mm	0.6mm	0.7mm	0.65mm
CASE 10	37	0.7mm	0.5mm	0.60mm	0.8mm	0.6mm	0.7mm

TABLE 9: POST OPERATIVE CRESTAL BONE LOSS IN 12MONTHS (T2)

CASES	Implant location	Crestal bone loss in mesial side of mesial implant	Crestal bone loss in distal side mesial implant	Mean crestal bone loss for mesial implant	Crestal bone loss in mesial side of distal implant	Crestal bone loss in distal side of distal implant	Mean crestal bone loss for distal implant
CASE 1	36	1.2mm	1.3mm	1.25mm	0.9mm	1.2mm	1.05mm
CASE 2	36	0.9mm	1.2mm	1.05mm	1.1mm	1.2mm	1.15mm
CASE 3	36	1.1mm	1.0mm	1.05mm	1.0mm	1.0mm	1.0mm
CASE 4	37	1.3mm	1.2mm	1.25mm	1.0mm	1.1mm	1.05mm
CASE 5	36	1.1mm	1.0mm	1.05mm	1.2mm	1.3mm	1.25mm
CASE 6	46	0.9mm	0.9mm	0.9mm	0.9mm	0.9mm	0.9mm
CASE 7	37	1.1mm	0.9mm	1.0mm	1.1mm	1.4mm	1.25mm
CASE 8	36	0.9mm	1.0mm	0.95mm	0.9mm	1.0mm	0.95mm
CASE 9	46	1.0mm	1.2mm	1.1mm	1.1mm	1.1mm	1.1mm
CASE 10	37	0.9mm	1.0mm	0.95mm	1.1mm	1.2mm	1.15mm

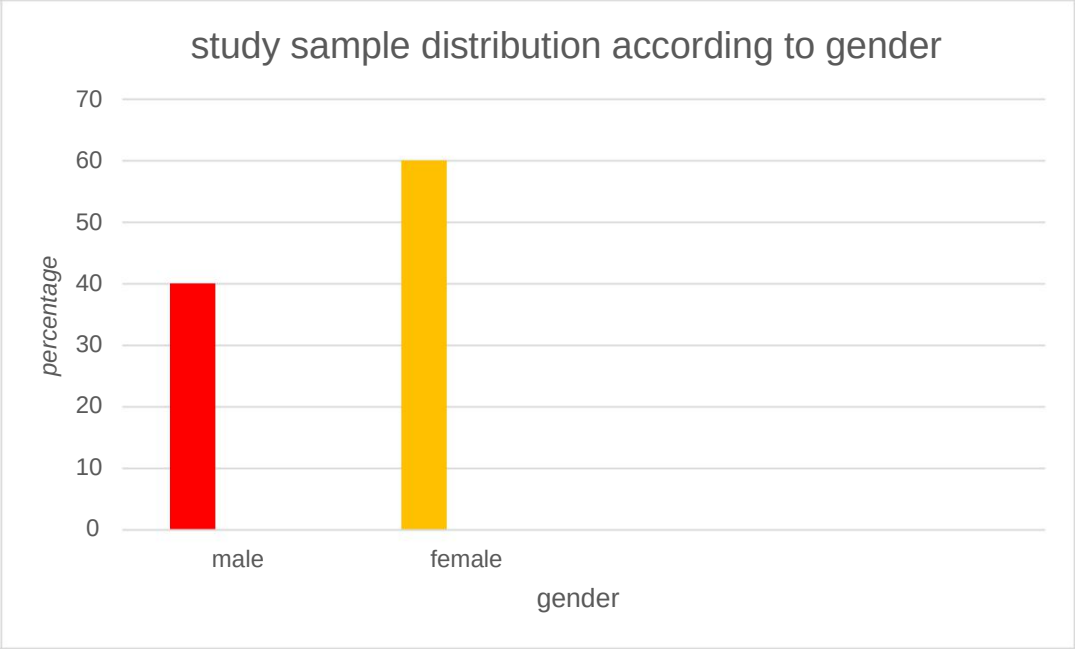
TABLE 10: COMPARISON OF CRESTAL BONE LOSS OF MESIAL AND DISTAL IMPLANTS AT 6 MONTH

CASES	IMPLANT LOCATION	MEAN CRESTAL BONE LOSS OF MESIAL IMPLANT AT 6 MONTH	MEAN CRESTAL BONE LOSS OF DISTAL IMPLANT AT 6 MONTH
CASE 1	36	0.4mm	0.55mm
CASE 2	36	0.5mm	0.50mm
CASE 3	36	0.8mm	0.50mm
CASE 4	37	0.4mm	0.65mm
CASE 5	36	0.4mm	0.45mm
CASE 6	46	0.6mm	0.65mm
CASE 7	37	0.6mm	0.5mm
CASE 8	36	0.4mm	0.6mm
CASE 9	46	0.7mm	0.65mm
CASE 10	37	0.5mm	0.7mm

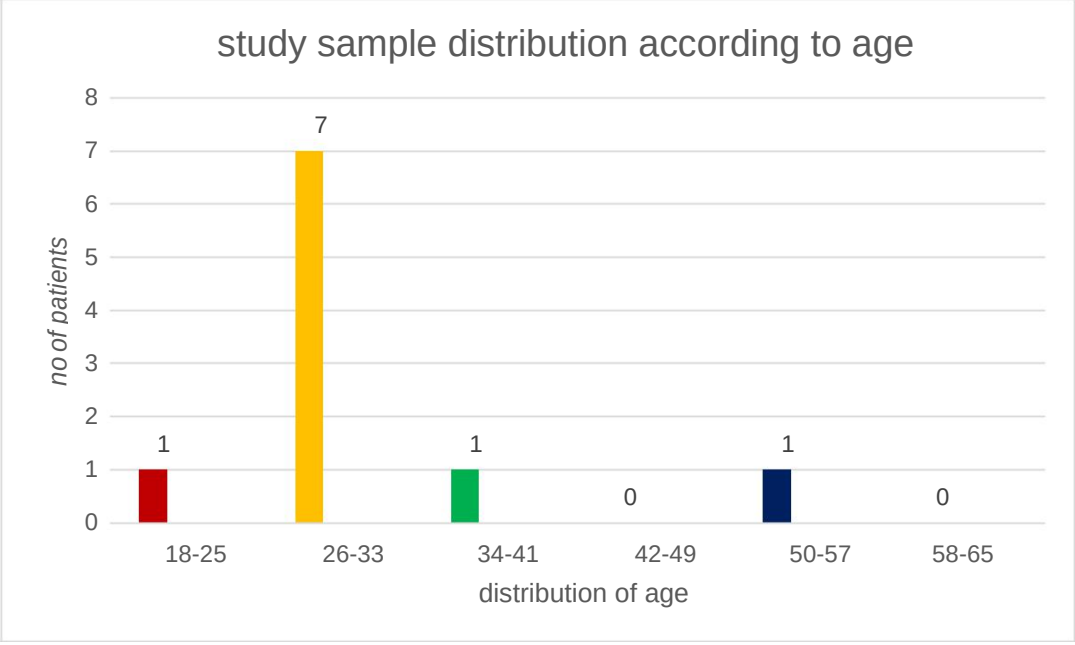
TABLE 11: COMPARISON OF CRESTAL BONE LOSS OF MESIAL AND DISTAL IMPLANT AT 12 MONTH

CASES	IMPLANT LOCATION	MEAN CRESTAL BONE LOSS OF MESIAL IMPLANT AT 12 MONTH	MEAN CRESTAL BONE LOSS OF DISTAL IMPLANT AT 12 MONTH
CASE 1	36	1.25mm	1.05mm
CASE 2	36	1.05mm	1.15mm
CASE 3	36	1.05mm	1.0mm
CASE 4	37	1.25mm	1.05mm
CASE 5	36	1.05mm	1.25mm
CASE 6	46	0.9mm	0.9mm
CASE 7	37	1.0mm	1.25mm
CASE 8	36	0.95mm	0.95mm
CASE 9	46	1.1mm	1.1mm
CASE 10	37	0.95mm	1.15mm

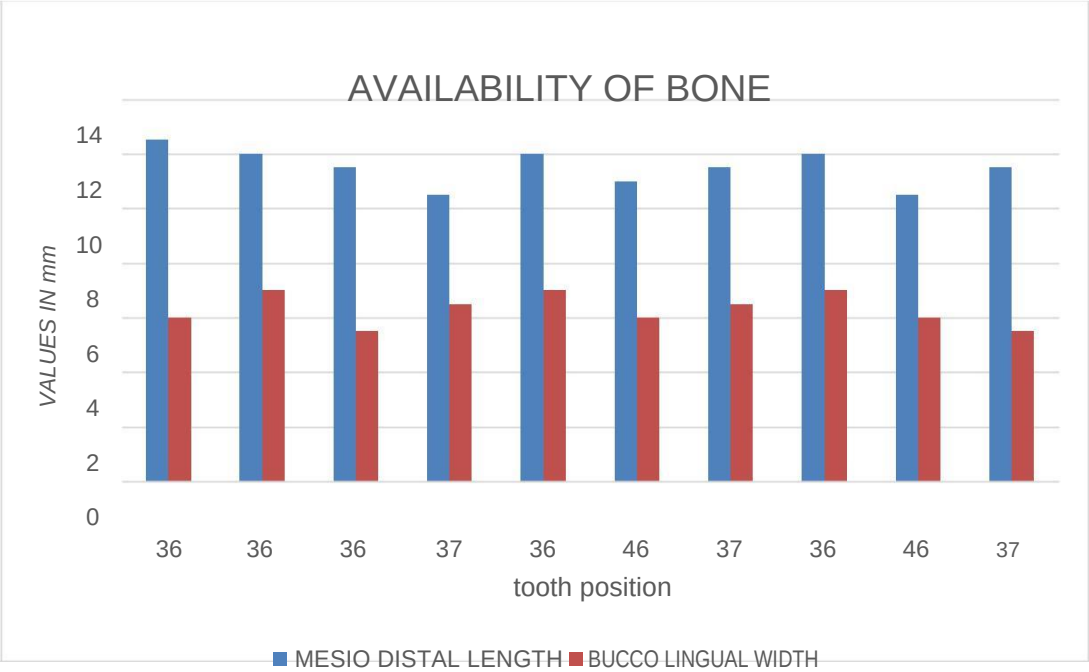
GRAPH 1



GRAPH 2

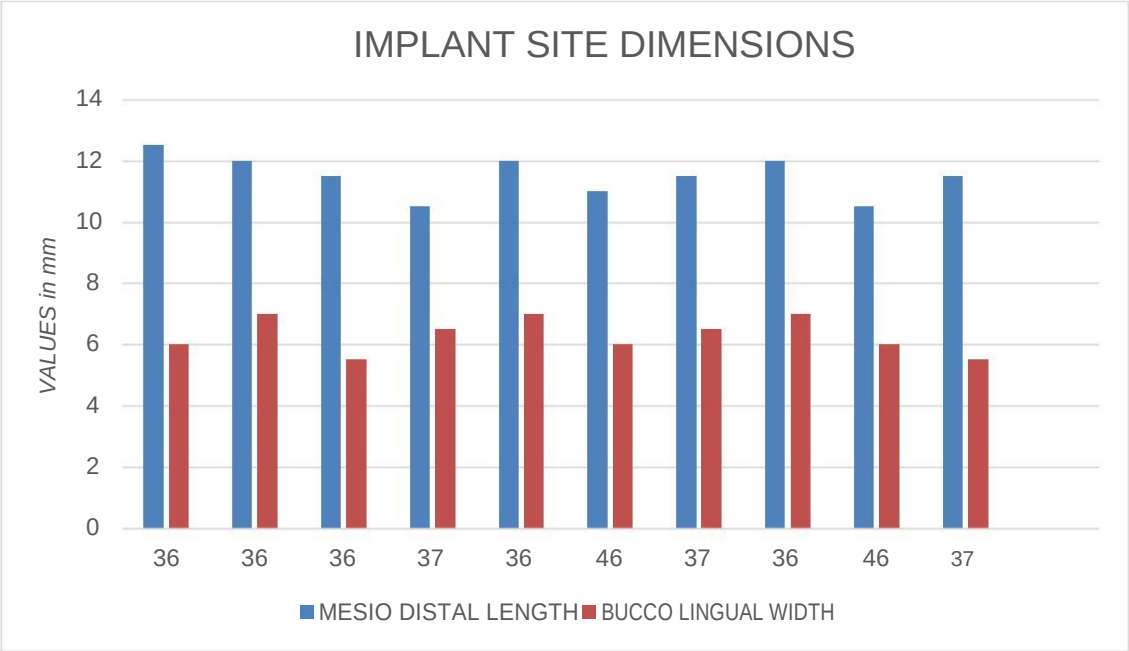


GRAPH 3

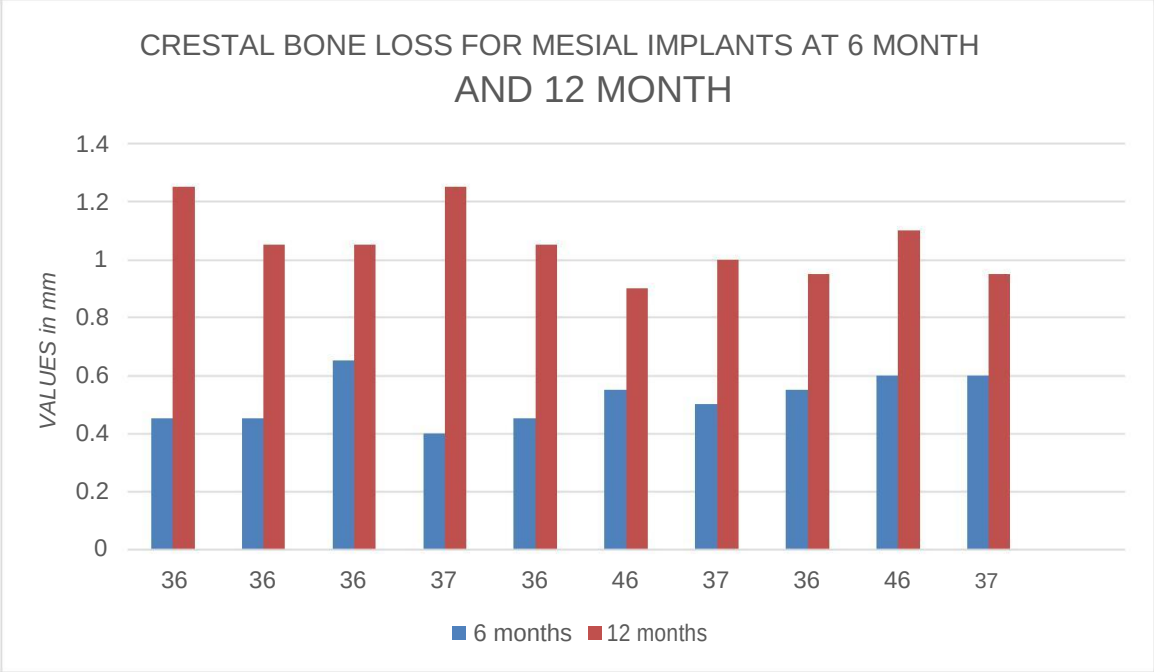


GRAPH 4

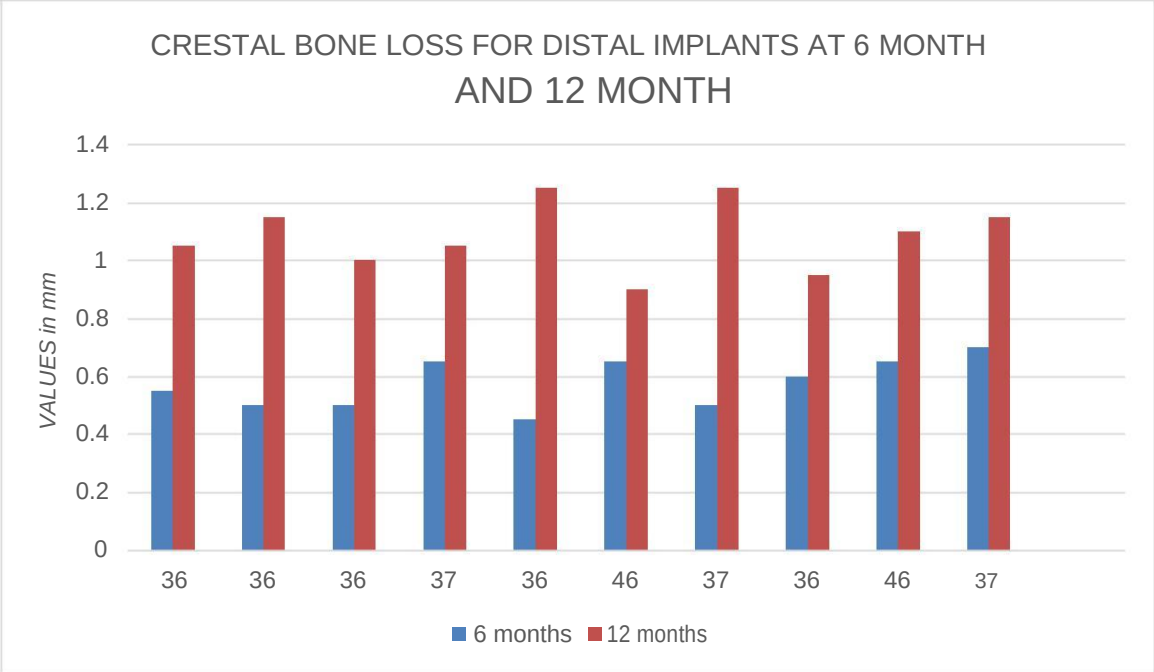
GRAPH 5



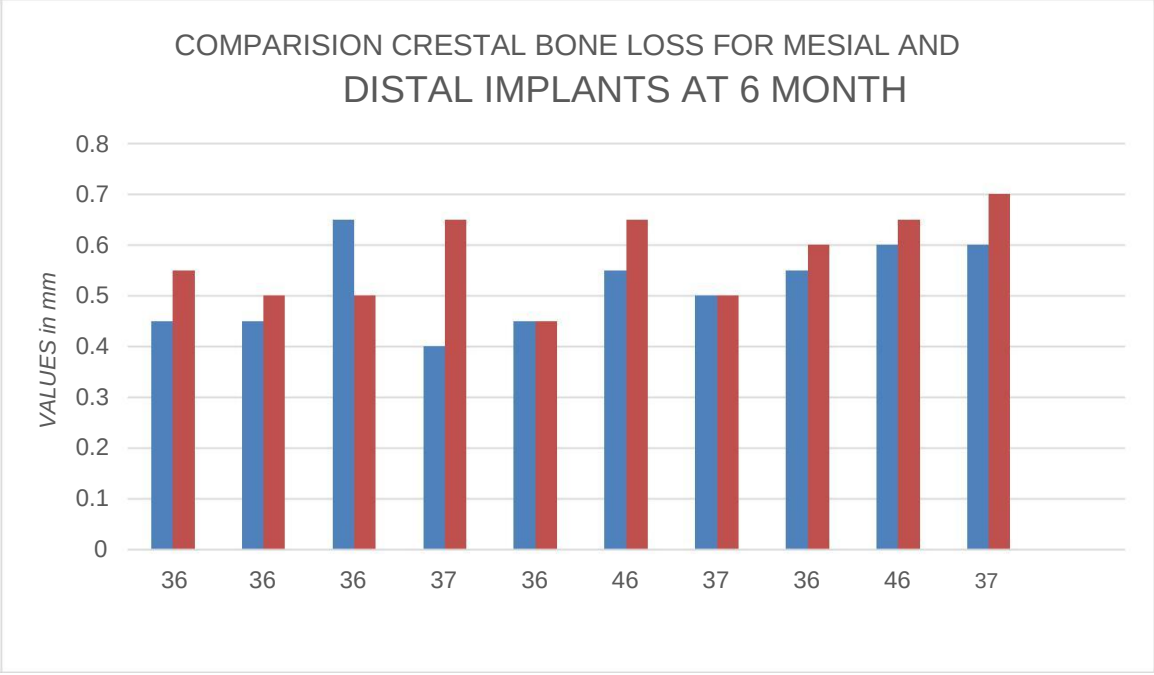
GRAPH 6



GRAPH 7



GRAPH 8



DISCUSSION

The use of dental implants for single posterior tooth replacement has become a predictable treatment modality.[33]The quantity of available bone for implant placement in the posterior is limited by the lingual concavity and the inferior alveolar nerve in the mandible, and by the sinuses in the maxilla. These conditions create a need for carefully selected treatment plans for posterior single-tooth replacement using osseointegrated dental implants. Wide-diameter implants are conventionally being used to replace the missing molar tooth. Wide-diameter implants are not always a treatment option especially when the buccolingual dimension is deficient.[44] Studies on bite-force measurement indicate that there is considerably greater force generated in the posterior compared with the anterior part of the same jaw.[14] Occlusal forces can be 3 to 4 times as great in the molar region compared with the incisor region. Single regular-diameter implants might be incapable of predictably withstanding molar masticatory function and occlusal loading

forces.[15]

Suggested guidelines for loading implants within physiologic limits include: ensuring optimal passive fit of the prosthesis, developing ideal preload in the abutment screw, reducing prosthesis cantilevers, narrowing the buccal-lingual width of the crowns, flattening the cuspal inclines, centering occlusal contacts over the implant body, and selecting adequate width, length,

and number of implants.[20] Several authors recommended reducing the width of the occlusal table to favor axial load on the implant in non-aesthetic regions .Reducing the buccolingual width of a restoration is not a new concept in dentistry. In 1935, Schuyler advocated reducing the contacting surfaces as a means of adjusting occlusal dysharmony, which could result in occlusal trauma. Dykema advocated narrowing the buccolingual dimensions of pontics up to 40% as a means of reducing load on the abutments. Weinberg, suggested narrowing the occlusal table and/or moving the occlusal contact area more in line with the implant location as one means to reduce the shearing stress on the retaining screws.[20]

Since a molar is not equally wide as it is long, it is difficult to provide optimal root-form support with 1 cylindrical implant. The placement of a crown that extends beyond the diameter of the implant both mesio-distally and buccolingually are potential biomechanical problems. Restoration of missing molars with 1 wide-diameter implant has a greater incidence of screw loosening and prosthesis mobility and a higher failure rate. The complication rate is even higher when single narrow diameter implants are used for single molar tooth replacement due to the combination of high masticatory forces, buccal-lingual mandibular movement, and cusp-groove orientation.[15]

However, the use of 2 implants has been successfully demonstrated to be a functional and more biomechanically sound method of molar replacement. The use of 2 implants might also provide better prosthetic stability and prevent rotational forces on the prosthetic components.

All of the prosthetic screws tested were tightened to 10 N-cm according to the manufacturers' instructions. The untightening torque of the screws in the different groups tested was about 2 N to 3 N less than the tightening torque. These observations correspond to the findings of Shigely and Mischke22 of a 2% to 10% reduction in preload within the first few seconds or minutes after tightening as a result of the settling effect (embedment relaxation). To reduce the settling effect, the screws were retightened after 10 minutes following the protocol suggested by Dixon et al33 and Breeding et al.34 The finding that the crowns supported by 2 implants exhibited untightening torque of prosthetic screws comparable with the untightening torque before loading supports the assumption that doubling the implants reduces the chances of rotational forces developing, which consequently reduces the likelihood of screw loosening.[20]

It has been suggested that 2 implant offer the advantage of eliminating mesio-distal bending and is strongest, yet not as efficient, in eliminating lateral bending forces. Lateral bending forces are often due to excursive contacts. In our case series, we used to two narrow diameter supported single molar mandibular tooth replacement. We didn't encounter any prosthetic complications in our patients.

Implant failure rate varies with the type of prosthesis, and is reported to range between 3% and 22% (Goodacre et al. 2003). Application of excessive forces is thought to be a cause for failure, and understanding of peri-implant physiology is critical. To address these issues and provide greater

implant surface, in particular in areas of the mouth where bone quantity and density are compromised, wide-diameter implants were introduced. Yet, there has been limited histological evidence that increased surface provided by wider implants has an impact on surrounding bone. Ivanoff et al. (1997), using a rabbit model, suggested that greater bone support is provided with wider implants. However, they also reported in a subsequent retrospective clinical study that wider implants had demonstrated a lower success rate (Ivanoff et al. 1999).[13] This study revealed significant differences in ABD in standard vs. wide implants: bone density was not affected by the presence of wide implants, whereas it was increased with standard implants. This is in agreement with FEA studies. Using two-dimensional FEA, Holmgren et al. (1998) found that implant diameter was critical to stress distribution. These studies also reported that stress mostly occurred at the marginal area.

Wide-diameter (WD) implants tolerate higher occlusal forces [7] and offer greater surface area for osseointegration compared with other types of implants, allowing them to provide a high degree of stability and controlled loading conditions even in immediate loading protocols.[24] Indeed, the few studies that investigated bone level changes around implants of a diameter of 6mm or wider show that no implants had a dramatic bone loss extending past the first implant thread [8–10] or report a remodeling range of −0.24mm to −0.04mm . Formerly, an alternative way to provide sufficient support for high occlusal forces was to replace a single molar with two implants to mimic the tooth's natural anatomy.[18]However, that option was very difficult in regions

with low bone density, limited accessibility for surgical and prosthetic procedures, or insufficient space between adjacent teeth.[16] Additionally, that option limited cleaning access. Therefore, the application of WD implants in smaller molar spaces (8– 11 mm) with a crestal width ≥8mm is of particular interest .[17] Indeed, Degidi et al. reported that WD implants created

a wider base for proper prosthesis, were a successful alternative to using two regular-diameter implants for restoration, and were beneficial in the long-term maintenance of various implant-supported prostheses.[37] In our study, all our cases had the mesiodistal span of more than 12mm.

Another factor to consider when restoring first and second molars is the time of loading. Immediate implant loading in such situations has attracted increasing interest among clinicians.[34] WD implants can offer high initial stability and therefore might be an effective therapeutic choice in immediate loading protocols. But in all our cases, we followed two stage technique. We allowed the implants to heal for a period of three months before loading the implants.

There were no technical or biological complications in our study. That result contrasts with those of other published studies in which a single implant was used to replace a single molar. Balshi et al. reported a 48% incidence of prosthesis mobility or screw loosening , and W. Becker and B. E. Becker reported a 38% incidence of screw loosening .[34] Another study reported a high rate of biological complications associated with cement retention .[36] We

attribute the difference between our results and the previous results in part to our use of screw retained prosthesis supported by two implants.

Bone grafting is a well-documented procedure to restore lost bone volume, but it is associated with increased morbidity and a prolonged treatment time, with the necessary graft-healing period when dentures cannot be worn . While many additive techniques for the reconstruction of missing morphology are employed on a routine basis today, surgical intervention may not always lead to the desired outcome. Physiologically, some patients may be poor candidates for extensive grafting, or they may simply decline such treatment on emotional or financial grounds. Narrow-diameter implants (NDIs) would be beneficial to decrease the rate of augmentations necessary for implant insertion.[26]

NDI is an implant with a diameter less than 3.75 mm and is clinically indicated in specific conditions of rehabilitation such as a reduced inter radicular bone, thin alveolar crest, or replacing teeth with a small cervical diameter.[37] The availability of residual bone width less than 5 mm is also indicative for the use of NDIs. Several studies have reported the use of narrow diameter implants in different clinical situations and using different surgical techniques . In most cases, satisfactory results have been obtained, achieving medium- and long-term cumulative survival rates equivalent to those obtained in restorations using larger diameter implants (between 94 and 100% survival rates).[37] In all our cases we used two narrow diameter implants to replace a

single molar. In some cases though they had a better width we chose a narrow diameter implant to provide adequate spacing in between the implants which otherwise complicates the prosthetic procedure.

Thomas j balshi et al has done study on a comparative study on one implant versus two implants replacing a single molar,had marginal bone loss between 1 and 3 years of function was 0.10mm for the group with one implant and 0.24mm for the group with two implant. That was comparatively less compared to our study which has 1.05mm and 1.08mm for mesial and distal implant respectively. Thomas j balshi et al,reported Prosthesis mobility related to screw loosening was the most frequent complications with 7 of 21 in group 1(one implant) and 2 of 25 in group 2(two implant). In our study of 20 implants in ten patients with the follow up period of 1 year, no patients reported with prosthesis mobility and screw loosening. However, in few our cases, we had difficulty in accommodating the healing abutment and placing impression coping during the prosthetic phase.

Ziv mazor et al has done study on replacement of molar with two narrow diameter implant,33 patients receiving 66 implants in first molar ,with age ranged from 26 to 76 years, the mean distance between adjacent teeth was 12.1±1mm and all implants survived the follow up period of 18 months, with one implant reported with 1mm of marginal bone loss. In our study average mesio-distal width was 11.5±1mm with mean bone loss of 1.05 mm to 1.08

mm ,all the implants survived the follow up period of 12 months with no implant loss.

Brian J Jackson et al done study on small diameter implant specific indication and consideration in posterior mandible, he used single piece endosseous implant, the main advantages of this type of endosseous implant are its size, 1-piece design, and precontoured abutment, as well as the ease of the restorative phase. He claims that 1-piece design of small diameter implants (1.8–3.0 mm diameter) provides strength to the implant while allowing biological width development to occur at fixture placement. Predictability in strength of the implant is largely due to the lack of an abutment-fixture connection (micro-gap) and retention screw commonly found in the 2-stage design. Small diameter 2-piece implants demonstrated higher failure rates caused by small diameter screws, screw loosening, and fracture. As a result, this implant design elicited low success rates and its fabrication and use were diminished by most implant manufacturers and conscientious clinicians. Moreover, research has demonstrated that the 2-piece implant design with its abutment fixture connection (micro-gap) harbors pathogenic microorganisms that can cause peri-implantitis. Microbial pathogens have been indicated as a causative factor of crestal bone loss around dental implants.15 finally, studies have demonstrated that limiting prosthetic component part disconnections from the implant body minimizes the amount of gingival recession and dental papilla shrinkage that occurs. In contrast to this study we have used 2 piece

implant design and prosthesis design done by two stage technique. None of the cases reported with abutment fracture, screw loosening or implant fracture. After the four months of healing period, cover screw removed and healing cap placed in second stage and screw retained porcelain fused metal ceramic prosthesis were made. None of the patient experienced more than 1.5mm bone loss in 1 year follow up period.

Adjacent implants can be splinted together only when fixtures are placed in parallel. It is critical that the surgeon is cognizant of this principle when placing 1-stage implants, thereby allowing the restorative dentist to design the final restoration as a single-unit crown supported by 2 endosseous implants.

RS Bedi et al done a study to radiographically compare the two standard diameter implant with one diameter implant in replacing one mandibular molar. Standardized periapical radiographs were used in this study, using the long-cone paralleling technique for periapical radiograph. These serial radiographs were used in this work to measure the peri-implant bone level changes by using special software where bone length was used as reference for calculations. This agrees with Sewerin and Lekholm, who used the same technique and advocated that radiographic interpretation of alveolar bone level has proven to be one of the most valuable parameter to clarify implant success. This study results recorded at the end of the 9th month a

mean of 1.078 ± 0.122 in group I and 1.004 ± 0.093 in group II. Our results are comparable to this study in MBL of 1.05mm to 1.08mm.

Michael moscovitch et al studied molar restoration supported by two implants, an alternative to wide implants. It is the opinion of this author that the concept of using 2 implants requires the availability of a strong and stable implant having a minimum diameter of 3.5 mm. Additionally, the associated prosthetic components should ideally not exceed this dimension.

But in our study we have used 3mm diameter implant which showed good dimensional stability, without any screw loosening, implant fracture or abutment fracture. Therefore, the use of 2 implants to replace a single molar is a logical treatment solution to avoid prosthodontic complications. The use of 2 implants to restore a molar tooth more closely mimics the anatomy of the roots being replaced and doubles the surface anchorage area. The implant positions may be parallel, offset buccolingually or overlapped mesio distally and may exhibit various angles in relation to one another.

The advantages of using 2 implants to support a molar restoration instead of a wide-diameter implant are several. There is wider support of the restoration in both the mesial-distal and the buccolingual dimensions. The dentist has greater flexibility to maximize placement in compromised bone receptor sites without perforation of the cortical plates, and thus there is better subsequent retention of crestal bone levels. The use of 2 implants diminishes the potential of the restoration to loosen under normal or parafunctional forces. The double implant may lessen the possibility of occlusal overload. It allows

for greater flexibility in restorative style: cement or screw retained. The possibility of increased cost may be outweighed by the reduced likelihood of failure of the implant or the restoration based on the reported complications described earlier. Finally, the double implant requires no special components or procedures that are not normally used in other restorative applications.

Therefore, the use of 2 implants to replace a single molar is a logical treatment solution to avoid prosthodontic complications. One significant barrier to the widespread use of this concept is the limitation of the size of implants and their associated prosthetic components. Nevertheless, when using narrow implants, 2 implants could be used even when the distance between the adjacent teeth is rather limited. This case series provided an evidence for the usefulness of 2 narrow diameter implants to replace a single molar. There is, however, a need for further long-term comparison studies to confirm and reaffirm the result presented here.

SUMMARY AND CONCLUSION

The study was conducted in the Department of Oral and maxillofacial surgery, Ragas dental college. Patients requiring mandibular molar tooth replacement with mesio distal span of 12mm t0 14 mm were included in our study. All the patients were treated with two narrow diameter implant supported single molar prosthesis with screw retained metal ceramic crown. They were evaluated post operatively for a period of one year. From our study, we conclude that

- The implant success rate was 100%
- Bone loss around the mesial implant was 1.05 $\pm$ 0.2 mm and for the distal implant was 1.08 $\pm$ 0.23 mm
- 80% of our cases had uneventful soft tissue and hard tissue healing and 20% of cases had mild gingival hyperplasia during healing abutment placement which resolved after treatment.
- The oral hygiene was good and 100 % of our patients had either score 0 or score 1 as evaluated by modified plaque index and modified bleeding index.
- 70% of our patients expressed moderately to very much satisfaction with the implant procedure.
- None of our patients had any prosthetic or functional complications following the implant procedure.

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Annexures I

RAGAS DENTAL COLLEGE & HOSPITAL
(Unit of Ragas Educational Society)
Recognized by the Dental Council of India, New Delhi
Affiliated to The Tamilnadu Dr. M.G.R. Medical University, Chennai
2/102, East Coast Road, Uthandi, Chennai - 600 119. INDIA
Tele : (044) 24530002, 24530003 - 06. Principal (Dir) 24530001 Fax : (044) 24530009

TO WHOMSOEVER IT MAY CONCERN

Date: 19.01.2018
Place: Chennai

From,
The Institutional Review Board,
Ragas Dental College and Hospital,
Uthandi,
Chennai – 600 119.

The dissertation topic titled **"EVALUATION OF OUTCOME OF SINGLE MANDIBULAR MOLAR TOOTH REPLACEMENT BY TWO NARROW DIAMETER DENTAL IMPLANTS"** submitted by **Dr. J. SENTHIL KUMAR.**, has been approved by the Institutional Review Board of Ragas Dental College and Hospital.

Dr. N.S. Azhagarasan M.D.S,
Member secretary,
Institution Ethics Board,
Ragas Dental College & Hospital
Uthandi,
Chennai – 600 119.

RAGAS DENTAL COLLEGE Chennai

ANNEXURE II

URKUND

Urkund Analysis Result

Analysed Document: EVALUATION OF OUTCOME OF SINGLE MANDIBULAR MOLAR TOOTH REPLACEMENT BY TWO NARROW DIAMETER DENTAL IMPLANTS.docx (D35006713)
Submitted: 1/25/2018 9:17:00 AM
Submitted By: drsentil27@gmail.com
Significance: 5 %

Sources included in the report:

Lagström & Persson.docx (D27386835)
https://www.duo.uio.no/handle/10852/59205
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4993844/
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https://www.researchgate.net/publication/7600677_Impact_of_smoking_on_marginal_bone_loss

Instances where selected sources appear:

34

ANNEXURE III

RAGAS DENTAL COLLEGE AND HOSPITAL

CASE HISTORY FOR DENTAL IMPLANT

Serial no :

Register No :

Name :

Age / Sex :

Address :

Contact Numbers:

Res :

Off :

Mob :

Email :

Chief complain :

History of presenting illness:

Medical history :

Diabetes Mellitus :

Hypertension :

Blood Dyscrasias :

Cardiac Problems :

H/O Jaw fractures or Jaw lesions :

Neural disorders :

Exposure to Radiation :

chemotherapy :

Any drug intake : Other disorder/Disability :

Habits :

Smoking :

Alcohol :

Duration……

Betel nut chewing :

Brushing :

General Examination :

Vitals:

CLINICAL EXAMINATION

State of Edentulousness :

Partially Edentulous :

Missing tooth/teeth :

Pre-treatment evaluation:

No of tooth present:

Missing:

Fillings:

Existing denture or FPD

Mouth opening:

Oral hygiene:

Nature soft tissue :

Condition of adjacent teeth :

Oral hygiene :

Alveolar ridge conditions :

Other observation :

B.Study Model :

Mesio – distal length :

Bucco lingual width:

Inter occlusal gap :

C.Radiographic examination:

IOPA : OPG :

Available Bone Height :

Relation of anatomical structures :

Pre-treatment procedure :

(A) Bone Mapping:

Available bone width :

Other Observation :

(B) Bone Augmentation procedure:

Required : Horizontal Vertical

Not Required :

Treatment plan:

Implant characteristics:

Total no of implants :

Implant length

Primary stability

Implant diameter

Angulation

Laboratory

Blood Sugar :

HB :

Others :

Surgical Stent:

Blow down stent :

Modified partial denture :

Digital splint :

Surgical procedure :

IMPLANT PATIENT FOLLOW UP FORM:

Follow up date:

Patient name:

Age/sex:

Address:

Contact no.:

Implant placement date:

Provisional prosthesis placement

date: Final prosthesis placement date:

Clinical mobility: Yes (less than 0.5mm / more than 0.5mm) No

Depressibility with finger: Yes / No

Intra oral photograph taken:

Condition of the gingiva at the implant site:

Normal

Hyperplastic

Suppuration

Inflamed

Intra oral radiograph taken:

Bone Resorption:

Bone loss	Grading
less than 1mm	0
1- 2mm	1
2-3mm	2
more than 3mm	3

Prosthesis:

Mobility

Occlusion

Plaque

Requires adjustment:

Treatment needs:

Soft tissue procedure

Hard tissue graft

Prosthesis replacement

Patient satisfaction: Not satisfied / slight / Moderate / Very satisfied

Implant evaluation (ICOI criteria): Success / Satisfactory survival / Compromised survival / Failure

Pain: Absent / Mild / Moderate / Severe

ANNEXURE IV

CONSENT FORM FOR TWO IMPLANT SUPPORTED SINGLE MOLAR PROSTHESIS

I am willing to undergo for two implant supported single molar replacement prosthetic rehabilitation. I am fully aware of the pros and cons of the procedure and possible complications involved in this procedure and the consequences thereof. This undertaking is given upon by my own accord and no one shall be responsible for any untoward happenings.

Name of the patient:

Sign of patient :