COMPARATIVE EVALUATION OF HARD AND SOFT TISSUE CHANGES IN IMMEDIATE IMPLANT PLACEMENT USING FLAPLESS APPROACH WITH AND WITHOUT DEMINERALISED FREEZE DRIED BONE ALLOGRAFT CLINICALLY AND RADIOGRAPHICALLY USING CONE BEAM COMPUTED TOMOGRAPHY.

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ABBRREVIATIONS

1.	Alveolar ridge preservation	ARP
2.	Apical part bone width	APBW
3.	Biphasic calcium phosphate	BCP
4.	Bone to Implant Contact	BIC
5.	Bone Morphogenic Protein	BMP
6.	Bone substitute material	BSM
7.	Buccal Bone Thickness	BBT
8.	Clinical documentation	CD
9.	Cone Beam Computed Tomography	CBCT
10.	Connective Tissue	CT
11.	Crestal bone bone loss	CBL
12.	Crestal Bone width	CBH
13.	Crestal Bone Loss	CBL
14.	Crestal bone width	CBW
15.	Demineralized Freeze Dried Bone Allograft	DFDBA
16.	Deproteinized bovine bone mineral as well as a collagen matrix	DBBM/CM
17.	Direct Implant Bone Contact	DBC
18.	Equicrestally with bone grafts	ECTG
19.	Equicrestally without bone grafts	ECCG
20.	Facial gingival tissue thickness	FGTT
21.	Fixed partial dentures	FPD
22.	Full Mouth Bleeding Index	FMBS
23.	Gingival Index	GI
24.	Gingival Thickness	GT

25.	Hydroxyapatite	HA
26.	Implant Aesthetic Score	IAS
27.	Implant Stability Quotient	ISQ
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47.	Titanium plasma sprayed	TPS
48.	Testori Score	TS
49.	Testori esthetic score	TES
50.	University of North Carolina	UNC

51.	Vertical Distance	VD
52.	Vertical distance Distal	VDD
53.	Vertical distance mesial	VDM
54.	Visual Analog Scale	VAS

INTRODUCTION

Tooth loss is closely linked to a decline in oral hygiene, which then can impact overall health of a human being; that has always been detrimental to the quality of life in terms of oral health. Permanent tooth extraction is necessary for the variety of reasons, which includes dental cavities, periodontitis, facial trauma, prosthetic concerns, orthodontic therapy, endodontic failure, & tooth impaction. Despite the fact that there are several causes, dental caries as well as periodontal disease are the two leading causes of tooth loss globally[1].

The two most frequent treatments for missing teeth are fixed partial dentures (FPD) and resin-bonded bridges (RBB). FPD has a major disadvantage in that it necessitates a significant reduction of the adjacent teeth. In esthetic areas, subgingival margins are required, but they may increase the risk of gingival inflammation. Furthermore, because the average expected life expectancy of FPD is 10.3 years;

young people require multiple prostheses [2]. As an alternative to typical fixed partial dentures, resin-bonded bridges were introduced. They provide a more conservative tooth replacement option; however, RBB preparation is extremely technique-sensitive. The frequent debonding of the resin-bonded bridge is a major drawback. There has been a reported debonding rate of 25-31% [3, 4].

Over the previous 40 years, osseointegrated dental implants have evolved into a reliable therapeutic option. They were originally used in entirely edentulous jaws mostly in early 1980s, but because of their rate of success, they were later employed for edentulous patients, so solitary implants are a frequent treatment option. When the surrounding teeth don't have any restorations, the implant maintains a integrity of the remaining healthy teeth. Single tooth implant is without a doubt the therapy of choice for young individuals who are born with missing teeth. The finished restorations are not only esthetically beautiful and practical, but they also protect healthy tooth structure from undue harm. The main benefit of implants is that adjacent teeth need no tooth preparation, offering a favorable prognosis since they are preserved in their present state of health and are excluded from getting coupled as a part of the bigger prosthesis, and that they are not subjected to an increased risk of root canal treatment and caries as a result of abutment preparation. As a result, individuals must be fully informed about the merits as well as demerits of both types of single-tooth restoring treatment options so as to help them to make a decision [5].

Both the maxillary as well as mandibular arches are composed of a number of anatomical components, each with its own distinct composition, physiology, & function. The body of both jaws is made by basal bone which develops alongside the

skeleton; whereas the alveolar process forms after eruption of the tooth. Following tooth removal, the "bundle bone" will be initial bone to get resorbed. Bundle bone borders the alveolar socket, expands coronally to create the buccal bone crest, and eventually forms component of the periodontal system. As a result of the remodelling process caused by extraction, its ridge morphology is lower in vertical height as well as more palatal in regard to a original tooth location [6]. As a result of both the regeneration and repair, bone resorption happens in two stages. A first stage is distinguished by rapid bundle bone loss as well as substitution by woven bone. Because the crestal portion of buccal wall is entirely composed of bundle bone, its buccal region of the socket exhibits the greatest reduction in bone height. Buccal plates endure higher resorption because they are often thinner, measuring 0.8mm in front teeth & 1.1mm in premolar locations [7]. Although it is unknown why remodelling occurs during the second phase, it is thought that disuse wasting, diminished blood flow, as well as localised inflammatory changes all take an active part in demineralization. As reported by Schropp L. et al., 66% of tissue changes take place during the early 90 days following tooth removal [8]. Till that period both neighbouring osseous walls are maintained, bone formation within the alveolar socket happens naturally. During recovery, an alveolar bone experiences volume constriction, which might also jeopardise implant insertion. Several surgical procedures have been offered to keep alveolar bone loss to tolerable levels. These are as follows: 1) atraumatic extraction 2) Protocol with no flaps 3) Ridge Preservation Technique 4) Overdevelopment of the buccal bone 5) Implant Insertion Right Away 6) trying to bridge the gap, 7) innovative methods to tissue engineering (6).

Type of surgical and prosthetic methods used have a direct influence on the future success of implants prostheses."(1) Type 1 immediate implant insertion on the day of extraction; (2) Type 2 early insertion of implant between 4 to 8 weeks healing of soft tissue; and (3) Type 3 early insertion of implant between 12 to 16 weeks of provisional healing of bone." Implant loading procedures are classified as "(A) conventional loading, in which implants are installed after more than 2 months of healing without prosthetic restoration or (B) minimal loading, in which implants are positioned after under 2 months of healing without restoring it prosthetically. (B) Early loading: implants were connected to the prosthetic restoration between 7 to 60 days after insertion. (C) Immediate loading refers to implants that are connected to the prosthesis within one week of being inserted." When the immediate implant insertion technique is combined with conventional loading, overall rate of success ranges from 90% - 100%, and so this blend of surgical & prosthetic methods has been scientifically as well as clinically confirmed [9].

Schulte and Heimke established the procedure of rapid implant insertion in a recent extraction socket in 1976 [10]. Implants implanted promptly after tooth extraction provide various advantages for both the patient and the doctor, including the prevention of bone loss, the reduction in treatment time, and, lastly, good esthetics [11]. Accessing the jawbone is a critical element in implant surgery. A flap approach, which includes a mucosal incision then flap reflection, is still the conventional method for exposing the bones and making a surgery field more apparent. The flapless approach, which does not use any incisions for immediate as well as delayed implant insertion, is a revised approach to do implant surgeries. As a result, in a flapless technique that does not require any incisions causes the least

amount of tissue damage, reduces intraoperative bleeding, faster soft tissue healing as the blood supply to the flap is maintained which also aids in bone regeneration around the implant and aids in its integration, making it a less invasive approach. Lack of visibility and overheating of soft tissue during preparation are the drawbacks of flapless procedures [12].

According to Botticelli D. et al in 2003, when an immediate implant is inserted, a horizontal space exists between the implant's surface and the intact osseous shell. They refer this as "jumping gap (JG)"[13]. This disparity is primarily attributable to anatomical differences between implant and extraction space. As a result, bone resorption occurs, and the formation of osseous defects, most notably is on the buccal wall of a socket. The width of a buccal bone and an extent of a jumping space influence the option to fill or keep this jumping gap. Since thick buccal plate is impervious to resorption, no graft is often required at the jumping space; however, for thin buccal plate sites, graft aids in preventing buccal plate collapse and resorption. Osseous graft increases osteoconductive ability of osteoblasts by preserving gap as well as encouraging the growth of new bone. According to studies, natural bone renewal and osseointegration involving proper bone-implant contact can take place at insertion sites with a jumping space width less or 2mm. If the jumping distance is larger than 2 mm size, a placement of barrier membrane both with and without osseous graft material is necessary to ensure enough bone-implant contact and successful osseointegration. However, there still is controversy regarding whether this jumping gap should be filled, since some research demonstrates that just an intact bone skeletal wall is necessary [14].

Becker and associates were among the first to compare the osteoinductive properties of "Demineralized Freeze-Dried Bone Allograft (DFDBA)" to those of other bone-graft solutions [15]. DFDBA has been utilised since then in implant and periodontal treatment, either alone or in conjunction with other regeneration therapies. Though autogenous bone grafts are more efficient in bone regeneration than DFDBA due to the presence of both osteoconduction and osteoinduction activities, it is now well established that DFDBA stimulates both periodontal and osseous tissue regeneration. DFDBA includes the growth factor Bone Morphogenic Protein (BMP), which causes mesenchymal cells to migrate and differentiate into bone-forming osteoblasts. The osteoinductive efficacy of DFDBA was impacted by the donor's age, preparation procedure, and sterilisation.

Working separately, Arai & Mozzo et al. developed “Cone Beam Computed Tomography (CBCT)”, The three-dimensional (3D) Imaging technique for screening and therapeutic planning in dentistry [16]. The benefits of CBCT over 2D x rays are such that CBCT is indeed a 3D image and thus more efficiently recognises 3D dental structures than 2D radiographs. Use of CBCT had also lowered the number of failures in implant placement and moreover enables for the secure placement of implants without inflicting harm to vital structures. In the event of grafting, CBCT can be utilised after the surgery to evaluate the bone graft as well as implant placement.

Metal scatter artefacts, on the other hand, are significantly decreased when utilising CBCT as contrasted to computed tomography. In a clinical study, Naitoh et al 2010 evaluated incidence of bone-implant interaction as well as demonstrated

osseous architecture surrounding incisor implants, both with and without osseous graft, can now appropriately diagnosed utilizing CBCT [18].

Although immediate implant insertion with a flapless method then bridging the jumping gap using bone graft material is recommended for improved outcomes, there is a scarcity of literature and also in vivo research examining changes that occur within hard and soft tissues. The purpose of this controlled trial was to evaluate and compare hard and soft tissue changes clinically and radio graphically with CBCT, after extraction and immediate insertion of implant utilising a flapless approach in the anterior region with or without grafting jumping space with DFDBA.

AIM AND OBJECTIVES

The study was aimed to evaluate and compare the hard and soft tissue changes in immediate implant placement using flapless approach with and without DFDBA clinically and radio graphically using CBCT

1. Also, attached to this aim were certain objectives:

2. To evaluate and compare the hard tissue changes in immediate implant placement with flapless approach with and without DFDBA at baseline and 6 months post surgery using CBCT.

3. To evaluate and compare the soft tissue changes in immediate implant placement using flapless approach with and without DFDBA at baseline and 6 months post surgery is using CBCT.

4. To assess Peri-implant soft tissues with Testori Implant Esthetic Score.

5. To evaluate and compare probing depth around implants in immediate implant placement using flapless approach with and without DFDBA at baseline and 6 months post surgery.

6. To assess patient's satisfaction using VAS scale.

REVIEW OF LITERATURE

A) Immediate implant placement

Michele Paolantonio et al. (2001)[19] compared the bone healing and osteointegration around an implant inserted in the alveolar socket as well as healed bone histologically. One experimental insert was implanted in a new extraction socket (TI) and one contra lateral insert was implanted in fully grown bone in 48 healthy patients (CI). Immediately after the surgery then again at 6 months a periapical radiograph was taken. Loss of marginal bone was measured radiographically between times of implant insertion to the implant with bone section removal. TI as well as CI was then detached with a trephine to obtain histology specimens. The proportion of direct implant-bone contact was calculated using a computerised microscopic digitizer (DBC). There was a substantial difference between the two experimental groups on the basis of radiographic as well as clinical parameters. There was no significant disparity between test and control in bone to implant contact of both dental arches. TI

or CI neither showed any presence of connective tissue nor the fibrous tissue surrounding them. In any of the histological sections, there was no sign of bone resorption. Implants inserted into mature, healed bone have the same clinical outcome and degree of osteointegration as implants inserted into unhealed bone.

Daniele Botticelli et al. (2003) [13] studied the implant healing which were inserted in sites with the large dehiscence. Inside fourth quadrant of oral cavity, 4 osteotomies had been created for implant "[sandblasted-large-grit-acid-etched (SLA)]" placement. At control side Conventional implants were implanted in a single location. Four months after the implants were installed; histological sections were prepared from block tissue samples from all insertion site. Following 4 months of rehabilitation, newly produced bone was able to replace the marginal deficiencies. Extent of contact bone between a SLA surface and recently produced tissues were high at all test sites and comparable that which found at control. By selectively applying the protocols for both approaches, it was possible to combine immediate implantation and immediate non-occlusal loading in this case. The following factors all played an important role in clinical success. Implant placement after extraction, correct implant positioning, and instant loading Implants were inserted in newly extracted sockets in the anterior maxilla, preventing bone resorption. By selectively applying the protocols for both approaches, it was possible to combine immediate implantation and immediate non-occlusal loading in this case. The following factors all played an important role in clinical success. Implant placement after extraction, correct implant positioning, and instant loading Implants are placed in newly extracted sockets in maxillary anterior prevents bone resorption.

Ugo Covani et al. (2004) [20] investigated healing as well as remodelling at coronal bony sites in the vicinity of 35 implants, 20 of which were placed immediately after tooth extraction as well as 15 of which were placed 6 to 8 weeks afterward. After implant placement, an average distance between both the buccal and lingual bones was 1cm for immediate inserted implant and 0.886 cm for delayed inserted implants. There was no use of a neither membrane nor filler material. The primary flap was successfully closed at all sites. All defects around implants were repaired at the time of stage two surgery, average distance between both the labial and lingual bones was 0.81 cm for experimental group & 0.58cm for non experimental group. Although two groups had clinically equivalent narrowing of the buccolingual thickness, it should be noticed the control group had already reduced ridge width at stage two surgery. Early remodelling may begin instantly following tooth extraction. The differences in bone remodelling rates round the immediate and delayed inserted implants might well have significant impacts for implant insertion timing in maxillary anterior esthetic areas.

Ugo Covani et al. (2010) [21] assessed bone remodeling around 3.25 diameter implant immediately inserted in five beagle dogs with 1 year age. The gap between implant's shoulder and also the bony peak, as well as thickness on a buccolingual bone crest were assessed both buccal & lingual sites. Assessments were performed immediately following root excision, as well as 1/2, 1, and 3 months after implant insertion. Average buccolingual crestal bone width just at the moment of root extraction seemed to be 4.5 mm. After 3 months of recovery, a lingual bone crest displaced -0.3 millimeters from the implant neck and 0.8 mm from the buccal crest. The placement of implant along palatal/lingual wall having less diameter especially when compared

with size socket, immediate insertion of implant may play an essential part in decreasing the resorption of vertical bone at buccal site.

Giorgio Pagni et al.(2012)[6] in their review article, focused on minimizing the inevitable modelling and remodelling procedure after extraction, as well as the biological explanation for both the socket augmentation technique, as well as the therapeutic alternatives accessible to avoid degenerative changes at edentulous crest. Based on previous research, the above assessment helps to reveal the literature support for socket bone grafts in order to provide practitioners with useful tools for making informed decisions about when and why to recommend this therapy.

Novaes Jr. et al. (2012)[22] investigated the buccal bony plate healing when immediate implant inserted with a flapless method with or without use of xenogenic bone graft to fill a 2mm buccal space within the lower bicuspids of 8 dogs. Implant placed 2 mm subcrestal with bone grafts (SCTG), Implant placed 2 mm subcrestal without placing bone grafts (SCCG), Implant placed 2 mm equicrestal with bone grafts (ECTG), and Implant placed 2 mm equicrestal without bone grafts (ECCG)were allocated into four groups . To examine the remodeling of the buccal bone plate, radiological imaging was done resulting distance between bony slope and implant shoulder shows statistically significant difference in SCTG group especially in comparison to a ECTG and ECCG. There was little or no buccal bone loss around equicrestal implants, but when a xenogenic bone replacement was used around subcrestal implants, there was loss of bone at buccal site. The crest of buccal wall always above a shoulder of implant.

Gustavo Cabelo et al. (2013) [23] investigated soft tissue changes surrounding the implants in the esthetic area that were placed using a trimodal method (Placement of implant immediately after extraction, flapless, and immediate interim prosthesis) and their correlation with gingival/periodontal biotype in 14 patients. At baseline, the position of the papillae, gingival zenith, and gingival thickness was measured with a rigid tooth-supported stent and also a digital precision vernier scale, and after placing an implant with a trimodal approach, the same parameters were measured at 3, 6, and 12 months. At end of follow up, buccal margin recession of 0.45 millimetre was present. All patients had a sufficient level of papilla at completion, with average variations of 0.80 mm for distal papilla & 0.38 millimetres for the mesial papilla, respectively. The trimodal technique appears to validate as a simple and reliable protocol for inserting & restoring immediate implants within esthetic region, with few problems and good esthetic results. There was no significant relationship between the patient's soft tissue alterations and soft-tissue biotype.

Matteo Capelli et al (2013)[24] conducted analysis of 20 subjects and examined alteration in contours around implant placed immediately at newly formed extraction site.Group A (I-BP distance 4mm) received graft only in space around the implant (intrinsic grafting-IG), whereas group B (I-BP distance 4mm) received both intrinsic and extrinsic grafts (IEG). The contour changes at the implicated sites were computationally analysed by superimposing the digitised models. The mean buccal volume in Group A decreased slightly, while it increased in Group B. A difference of this magnitude was statistically significant (P=0.02). The Implant Esthetic Score (IAS) for group which received IEG was higher than group that received on IG. IEG was advised in clinical scenarios where there was under 4 mm of jumping

distance present to maintain the specific form & volume of a crest and obtain a favourable cosmetic result

Mohanad Al-Sabbagh et al (2014) [14] elaborated various methods for immediate implant insertion as well as how to prevent and manage the consequences. According to several previously reported studies, insertion of immediate implants at new extraction site leads to successful outcome. Immediate insertion has several advantages over late insertion of implants; It is not without dangers and consequences. Therapeutic procedures and counselling should be accompanied to avoid problems. Patient enrollment and implant-related parameter evaluation are critical to the development of immediate implant placement. To identify the patient's desires, the practitioner and the patient must have a lengthy talk. When selecting whether to install implants immediately, early, or late, practitioners must consider these desires.

Maurizio S. Tonetti et al. (2016) [25] compared the need for osseous augmentation, surgical consequences, and periodontal, radiological, cosmetic, and patient-related results in participants receiving implant insertion immediately after extraction (IMI) or 12 weeks. A total of 124 people were chosen to have solitary tooth extractions in inter premolar region. IMI was not feasible through 7.5 percent of cases. Bone augmentation was required in more IMI cases when compared to delayed cases, IMI also shows occurence of more wound complications. At one year, probing depths at IMI was more compared to delayed. There was a trend toward increased radiographic bone loss during the first three years at IMI (P0.01). Inadequate pink esthetic scores were found around IMI was more than twice that of delayed placed

implant. There were no variations in the outcomes reported by the patients. When esthetics are crucial, immediate implant insertion should be avoided,

Edward J et al (2017) [26] compared the soft as well as hard tissue healing occuring in a maxillary esthetic area when delayed and immediate implants were inserted. 100 dental implants have been inserted in 77 patients. Implants were allocated into immediately inserted group and delayed placed group. Postoperative follow ups were carried out six months. Both clinical as well as radiographic parameter were examined. The esthetic score of implant and grey scale assessment show significant results. In contrast, peri-implant crestal bone loss has non-significant values. Immediate implant provides better esthetic and functional results in terms tissue healing and bone resorption than delayed implant.

Managutti et al. (2017) [27] investigated marginal bone level radiographically, PPD, clinical outcomes and success of immediately and delayed inserted implants, after two years after placement. A total number 62 implants were inserted, 30 in the test & 32 in the control site. Depth as well as thickness of crestal bone deficiencies at peri-implant site was assessed clinically shortly upon insertion and again three months later during second stage surgery. Clinical criteria evaluated include local infection, changed sensation, pocket depth, soft tissue dehiscence, implant movement, purulent discharge and patient satisfaction. According to the results, there was insignificant difference in pocket depth and CBL between the two groups. The test side had smaller pocket depth than the delayed side after one year.

Mohindra K et al. (2017) [11] evaluated buccolingual and interproximal crestal bone modifications following delayed and immediate implant insertion, as well as platform

switched- acid-etched implant insertion without using grafts or barrier membranes. The study included 14 implants, and clinical parameters such as "Jemt papilla fill index score" (PFI), "Keratinized mucosa index score "(KMI), probing attachment levels, BLW, and CBH had been assessed at preoperative, 3 & 6 monthly with in immediate as well as delayed insertion groups. They observed that KMI scores for both groups remained constant throughout the research. In each metric, including crestal bone level, there's no significant difference among immediate & delayed implant placement

Panejad M. et al. (2017) [11] evaluated the effect of jumping distance filling onto crestal bone level of a buccal side after immediate implant insertion over a 4-6-month period. The randomised controlled experiment included 20 patients undergoing extractions in the maxillary front area. Atraumatic extraction tooth, carried out followed by immediate flapless implant insertion, and placing xenograft in test group while control group didn't receive any graft in jumping distance. Prior to implant placement (baseline), CBCT and clinical exams were carried out. After 4-6 months of implant insertion, second examination was done. Following 4 months of healing, there were insignificant variations in bone height measures of the control and the experimental. The study discovered that both groups showed reduced buccal bone level. Filling xenogenic bone graft in jumping distance failed to prevent buccal bone plate resorption in an immediately placed implant.

Vivianne Chappuis et al. (2017) [28] outlined the scope of tissue changes in the anterior maxillary solo tooth extraction site and recognised related modifying variables to aid in selecting the appropriate therapeutic strategies to enable fulfil

esthetic clinical outcomes. The changes in hard and soft tissue measurements which happen in the front maxilla after tooth extraction have an effect on the esthetic aspect of an implant-supported prosthesis. There is a sizable amount of osseous remodeling that happens during the first 2 weeks of recuperation. Although the interdental parts of the osseous wall are adequately preserved either by periodontal ligaments of neighboring teeth, the central part of the osseous wall is primarily molded at individual extraction sites. The amount of flapless post-extraction osseous remodeling determines the thickness of a facial bone wall. Thin bony wall phenotypes (1 mm) experience speedy bone resorption with complete vertical loss of an old socket facade, whereas broad osseous facade phenotypes (> 1 mm) have sluggish resorption rates.

Agrawal et al (2018) [29] Through their review, they presume there is an emerging basic necessity for immediately loaded methods of treatment in the preparing of completely or partially edentulism as well as strengthen their belief that immediate interconnecting implant to prosthesis was an outstanding, viable technique which helps solve both the esthetic and functional prerequisites of an immediate implant in very good condition.

German O Gallucci et al. (2018) [9] perform a comprehensive assessment of data on fixed implant prosthetic outcome metrics in partly edentulous individual treated with various implant inserting and loading procedures. For each location and loading method, the corrected average percentage survival rate ranges between 96.3- 100%. Clinical documentation (CD) was available for Types 1A, 1B, and 4A, but it was insufficient for Types 2-3A and 2-3B. It is crucial to integrate the insertion and

loading procedures for evaluating oral implant success. The loading procedure appears to have an effect on the result of rapid implant implantation.

Henny J. et al. (2019) [17] utilized CBCT to determine the presence of buccal bone after tooth extraction within esthetic of maxilla, as well as the average buccal plate thickness 1 month and 1 year following final prosthetic delivery in patients with major bony deficiencies. Patients with failing tooth and a large bone deficiency were included in test group [n = 20] significant bone deficiency, immediate implant implantation, and delayed loading procedure. The findings were compared to a control group having minor bone anomalies (n = 20). After 1 month and a 1 year, both groups had almost 1 mm of buccal bone thickness, with no noticeable difference. It was able to create a bone surface buccally of a failing tooth implant through patients with significant bony inadequacies, & this bone surface remained stable more than a 1-year follow-up there were insignificant differences all through buccal bone width between many patients with comprehensive buccal osseous inadequacies and also patients even without small bony inadequacies at 1 month and one year.

Vignoletti F. et al. (2019)[30] investigated immediate & delayed bone healing surrounding implants inserted immediately and without raising the flap (test) and delayed with elevating a flap (control). Both immediate & delayed implants were put in eight beagle dogs. Histological method was used at 2 and 8 weeks to determine horizontal and vertical bone remodeling, as well as bone-to-implant contact. The vertical resorption of a buccal bone crest was found to be equal in the both groups. Transverse buccal bone resorption, on the other hand, was considerable. The buccal bone crest of immediate implants was thinner than that of delayed implants or teeth.

De novo bone formation simply on the implant surface observed to be more apparent at two weeks following delayed sites, indicating that there was no change of bone - implant contact at 2 months. Both implant insertion procedures caused ridge changes, with considerable transverse bone loss and equivalent levels of total vertical buccal bone decrease. The two surgical procedures have different horizontal bone remodeling processes.

Marco Clementini et al (2020) [31] on 30 patients requiring tooth extraction with single root or premolar extraction, the impact of immediate implant insertion combined with "alveolar ridge preservation (ARP)" that used "deproteinized bovine bone mineral as well as a collagen matrix (IMPL/DBBM/CM)" versus ARP with DBBM/CM only. Sudden healing was evaluated radiographically on vertical as well as horizontal bone remodelling was evaluated radiographically. In terms of vertical bone turnover on the buccal and lingual sides, there were statistically insignificant differences between groups. ARP therapies employing DBBM & CM, rather than SH, minimize horizontal bone morphological changes that occur after tooth extraction, notably in the coronal portion of the buccal bone wall. Group II labial alveolar bone displayed the most alterations in horizontal dimensions, followed by Group I.

B) Flapless implant Placement

Vohra et al. (2015)[32] performed a comprehensive review on surgical method for implant insertion, including delayed implant insertion with flap elevation (flapped - control group) even without flap elevation (test group), and compared crestal bone bone loss (CBL) round the implant positioned in healed alveolar site with the focused question. Is CBL around dental implants inserted in healed locations affecting either

flapped or flapless approach? Implants were implanted flapless in the test group, while implants were placed after reflecting the flap in the control group. CBL was detected around dental implants placed in healed regions using flapped & flapless methods.

Bhavita Vadhwa et al. (2015)[33] studied and compared changes in CBH between implants installed flapless and after flap elevation (open flap). In the prospective trial, 16 people had 32 implants implanted in bilaterally lacking first molars in the lower arch. The flapless approach was used for one implant, while the open flap method was used for the other. CBH was measured utilizing standard radiographs at three, nine-, and fifteen-months following implant insertion. The flapless procedure results in CBL of 0.046 millimetre on mesial side & 0.043 millimetres on a distal side, whereas the open flap technique results in 1.48 millimetre on the mesial side & 1.42 mm on the distal side. Despite the fact that both treatments lowered CBH over time, a flapless approach decreased CBH less than the open flap technique. Flapless method is assumed to be a better therapeutic option if there is enough width as well as height of available bone

Fabio Mazzocco et al. (2016)[34] compared variations in bone volume after 6 months of rehab using a flapped (control) or flapless (test) technique and assessed the influence of bone measurements after immediate implant placement on bone remodelling. The implant was then installed, as well as the buccal space had been packed with "organic bovine bone graft". A second CBCT was conducted following 6 months of recovery. The differences of buccal & lingual plate height, & ridge width at two, four, and six mm between baseline & 6 months were evaluated. At half a year,

there were no substantial differences between the flap and flapless procedures. Despite the fact that flap group had greater reduction of ridge, no statistical differences were identified between the two treatment techniques.

Divya Kumar et al.(2018)[35] assessed and compared both hard & soft tissue remodelling surrounding endosseous implants implanted in the posterior region of mandibular jaw utilising flapped & flapless surgery in 20 patients over time. After 12 months, a flapless group shows statistically significant less PD compared to flap group. Both flapless and flap surgeries demonstrated statistically significant decreases in crestal bone height surrounding the implants, however, the flapless group exhibited a less statistically significant drop in CBH than the flap group. On day 0, the difference in mean VAS scores between the flapped and flapless groups were statistically significant. The amount of pain is lower in the flapless group than in the flapped group.

Felice Roberto Grassi et al (2019)[36] studied buccal alveolar ridge remodelling after immediate implant insertion by elevating the flap and grafting the bone, flapping and no grafting and flapless and also no grafting. A CBCT scan was performed immediately after the intervention as well as six months afterwards. The three procedures nearly completely filled the marginal region, with an average residual vertical space of 0.27 millimetres and a leaping distance of 0.5 mm. Patients reported decreased discomfort as a result of the flapless without graft treatment. Following a 6 month follow up, flapless without graft surgery resulted in comparable buccal bone alterations & gap filling at post-extraction implants in locations with adequate buccal bone support.

C) CBCT Analysis

Salimov F et al (2014) [37] It was determined if pre - surgical density values generated from CBCT give stable and accurate data on primary s well as a secondary stability for immediately prosthetically loaded implants under diverse clinical factors for 77 immediately prosthetically loaded dental implants. Resonance frequency parameters were measured after surgical therapy "(ISQ -Implant Stability Quotient)" and after one, three, and twelve months of loading (ISQ1, ISQ3, and ISQ12). There were significant differences between ISQ 0 and ISQ 1, and also ISQ 0 & ISQ 12 (P 0.001), but not between ISQ 0 and ISQ 3. In terms of how stability varies over time, statistically significant correlations were discovered among bone density readings using CBCT and ISQ follow-up measurements, and also ITV and ISQ follow-up data, at all test periods. There was a positive correlation and linear regression between TP and CBCT, TP and US, and CBCT and US. TCE and CBCT were used to compare GMBC-V as well as GMBC-I, with all teeth considered. The correlation and linear regression results for GMBC-V and GMBC-I in incisors, canines, and premolars were significant. A valuable diagnostic tool is the use of CBCT to visualise and way of measuring GT, GMBC-V, and GMBC-I.

Arora et al. (2016)[38] explored the correlation among buccal cortical thickness of buccal cortical bone as well as response of soft tissue around implant in 18 patients who required the replacement of a solitary maxillary front tooth after immediate placement but also rehabilitation of implants inside the maxillary esthetic region. A CBCT scan was performed to quantify buccal bone thickness at 1 and 2year follow-up, as well as a" pink esthetic score (PES)" was employed to assess soft tissue alteration around the implants. PES levels increased from a pre-operative to the end of

two years. The relationship between buccal bone thickness & soft tissue alterations following immediate implant insertion was negligible.

Ehsan Moudi et al. (2019) [39] pink base plate wax had been applied at various locations of the jaws on a dry human head that represent soft tissue in their investigation, as well as the probe had been used to measure widths of the 1, 2, 3, and 5 millimetres. These widths then were measured four times in a week by 1 person that used a digital calliper. Two CBCT scanners were used to scan the skull, and the varied wax thickness was evaluated 4 times a week intervals by two observers. As a baseline, the CBCT data will be compared to digitized calliper values. With thicknesses just under 2 mm, there was no statistical difference between CBCT & digital calliper readings ($P > 0.05$).

Kolte et al. (2020) [40] CBCT images were used to quantify buccal as well as lingual bone widths at four levels: Crestal bone width (CBW), mid root bone width, middle of the alveolar bone housing bone width, and most apical part bone width (APBW).

In the edentulous region, bone width was measured at three levels: CBW, 5 mm as from the crest (CBW-1), and 10 mm as from the crest (CBW-2) (CBW-2). From the buccal and also lingual levels of a crestal bone (CBW-B and also CBW-L) of 1.10 mm & 1.21 mm, correspondingly, to a buccal as well as lingual sides of a APBW of 2.82 mm & 3.43 mm, respectively. The bone width at the coronal level of buccal as well as lingual surfaces of dentate sites is limited in compared to a basal level, which has major implications for implant treatment.

Nimeshkumar Patel and Ekta Mistry (2021)[16] address the numerous characteristics using CBCT in their literature review, as well as frequent dental applications of

CBCT for management and therapy in several dental specialities. CBCT is now widely used in a range of dental treatments. CBCT can examine maxilla, mandible, skull, & associated structures in three dimensions. They concluded that three-dimensional imaging, or CBCT, may be utilised for comprehensive diagnostics by dentists and dental professionals. CBCT can also help identify features like as root canal system, bifurcation canals, additional tooth, & impacted teeth in different planes, making it a useful tool during treatment planning.

D) DFDBA as bone graft for regenration

Marlin E.et al. (1994)[41]investigated the bone development & osseointegration of "hydroxyapatite (HA) coated with titanium plasma sprayed (TPS)" implants put in sockets soon after extraction. 12-TPS &10-HA implants were grafted with DFDBA over which a barrier membrane placed, primary closure was achieved by coronal advancement of the flap in twenty patients. Except for the lack of DFDBA, all of the 11-TPS and 10- HA implants were implanted in the same manner (control). The test group had 5.68 mm of osseous fill just at base of the biggest osseous defect, while the control group had 3.18 mm (P 0.04). The width discrepancies between the two groups were statistically significant at three levels.

Wood A. et al. (2012) [42] compared the regeneration of extraction sockets transplanted using DFDBA against FDBA in terms of ridge preservation, as well as alterations in ridge height and width after grafting with any of these two materials inside the intra premolar region histologically. A histological examination was carried out to determine the percentage of viable bone, graft particles which stayed, connective tissue (CT), as well as other non-bone components. The alveolar ridge measurements

and CT percentages of the two groups are not significantly different. The percentage of CT was statistically insignificantly different across groups. The DFDBA group had a higher proportion of necessary bone than the FDBA group. Additionally, a DFDBA group had a substantially lower proportion of residual graft particles than the FDBA group.

Jeremiah Whetman et al. (2016)[43] compared bone regeneration eight to ten weeks upon extraction of intra premolar teeth and ridge preservation with a DFDBA and dimensional alteration such as ridge thickness and height at the two healing time points. 44 patients received DFDBA after tooth extraction for ridge preservation from a single donor. There were both short-term (8 to10 weeks) and long-term (18 to 20 weeks) healing groups selected. The sites were re-entered after the appropriate healing time, a biopsy was taken, and a dental implant was inserted. T he height and width of the ridges were measured. Histomorphometric analysis was used to calculate the proportion of new vital bone formation, residual graft, and connective tissue/other. The long-term healing group produced significantly more new vital bone (47.41 percent) than the short-term healing group (32.63 percent) (p=0.012). The percentage of remaining graft, connective tissue/other, and ridge size were not significantly different. According to this study, after tooth extraction, new vital bone growth is greatly increased. When sites healed 18-20 weeks, extraction and ridge preservation with DFDBA were possible compared to 8-10 weeks prior to dental implant installation.

Amir Moeintaghavi et al (2016)[44] investigated bone regeneration 8–10 weeks following intramolar tooth extraction for ridge preservation using both a DFDBA and dimensional alterations including ridge thickness and height at the two healing time

periods. After tooth extraction & ridge preservation, a single donor delivered DFDBA to 44 patients. Short-term (8–10) and long-term (18–20) treatment groups were selected. Long-term healing resulted in much more new viable bone than short term healing (p=0.012). The proportions of remaining graft, connective tissue/other, and ridge size were not significantly different. In compared to 8-10 weeks prior to dental implant installation, extraction and ridge preservation utilising DFDBA were feasible 18-20 weeks after sites healed.

Sunkavilli R. et al (2021)[45] used CBCT to examine the effectiveness of DFDBA with or without PRF in the treatment of 60 intrabony lesions. From baseline through 3, 6 and 9 months, PD, PI, and GI were examined. CBCT will be used to examine hard tissue changes at baseline as well as after 9 months to measure defect fill & resolution. A comparison of the two groups found that the DFDBA plus PRF group had a statistically significant larger decline in PD & attachment growth but insignificant decline in "PI, GI, FMBS, defect fill, and defect resolution". DFDBA alone outperforms DFDBA + PRF in terms of defect fill & defect resolution.

MATERIALS AND METHOD

Implant therapy is presently considered an efficient treatment modality for the rehabilitation of both function and aesthetic of missing teeth. Despite their proven effectiveness, osseointegrated implants are vulnerable to crestal bone level alterations caused by pathophysiological remodeling. Because of aesthetic concerns, there is an increased interest in preserving bone levels around the implant and soft tissue volume. Implants placed soon after tooth extraction have several benefits for both the clinician and the patient, including the prevention of bone loss, reduced treatment time, and, finally, better esthetics.

The flapless technique offers the advantage of least damage to the tissues through minimally invasive incisions, reduces bleeding, minimal interference on the blood supply morbidity, faster healing of soft tissue, absence of suture, reduced surgical time, and thereby increased patient compliance and satisfaction. The

morphological and vascular characteristics of the bone crest, according to Novaes Jr., may have a significant effect on the process of bone remodeling which occurs soon after implant insertion. Previous research has found that the flapless procedure's richly vascularized peri-implant mucosa is clearly relevant to an enhanced blood supply all around implant that could enhance the implant's tolerance to inflammatory response[22].

Several studies have been conducted to evaluate the effect of various materials in regenerative therapies combined with immediate implant insertion. Following implant insertion, the space between the implant and bone may be augmented to achieve predictable bone-implant contact and prevent soft tissue ingrowth associated with natural socket healing. In 2006, Nevins et al investigated immediate insertion in the aesthetic zone of the maxilla and bridged the space with deproteinized bovine bone mineral, demonstrating less buccal plate resorption than the non-grafted control group[46]. Despite the fact that many authors have advocated for the use of bone material with immediate implant insertion, there is a dearth of literature and in vivo studies assessing the hard and soft tissue alterations. As a result, this clinical trial was designed to evaluate both the hard and soft components. So, the purpose of this clinical trial was to assess clinically and radiographically the hard and soft tissue alteration in immediate implants using the flapless method in the anterior region with and without DFDBA using CBCT.

As per the study by Paknejad M. et al. (2017)[11], the authors investigated the effect of flapless implant placement in conjunction with graft material on level of buccal bone. They measured the alteration in bone height at the beginning and after

four to six months .Mean difference in the heights were obtained for both the treated and control group, which were -1.30 ± 2.38 mm and -1.66 ± 2.67 mm respectively.

The proposed study also aims at determining the bone height in samples of treatment and control groups. The effect size obtained using the aforementioned means for two groups was 0.1423. However, a larger effect size of about 1.25 was also accepted for investigation. Accordingly, to achieve this effect with 95% confidence and 80% power, the estimated number of Site per group are 12 (Total: 24).

The formula for estimating the sample size was:

$$n = 2\left(\frac{Z_{1-\alpha/2} + z_{1-\beta}}{\mu_A - \mu_B}\sigma\right)^2$$

Where $Z1_{-\alpha/2}$ and $Z_{1-\beta}$ are the standard normal values for 5% significance level and 80% power, while μ_A and μ_B are the mean differences in height and σ is the pooled standard deviation.

Sample size: Total sample size of 24 was considered. Which was divided into following groups:

Study Group

Group I (Control Group) : Immediate implant placement using flapless approach withoutDFDBA (n=12 Sites)

Group II (Test Group): Immediate implant placement using flapless approach with DFDBA(n=12sites)

Sampling Technique

Random sampling: At the time of surgery, all sites that meet the inclusion criteria will be selected and Using computer-generated random numbers, participants were randomly sorted into 2 groups.

INCLUSION CRITERIA-

1. Systemically healthy patients.
2. Patient having healthy and stable soft tissue morphology.
3. Co-operative, motivated and hygiene conscious patients
4. Tooth/teeth with Grade III mobility required to be extracted.
5. Root stumps
6. Tooth with endodontic failure or non restorable caries or vertical fracture.
7. Chronic periodontal disease with hopeless prognosis.
8. Sites at which minimum torque of 35 Ncm is obtained at the time of implant insertion.

EXCLUSION CRITERIA

1. General contraindications to implant surgical procedure.
2. Patients who have had head and neck irradiation within the last 6 months.
3. Been treated or is being treated with intravenous amino-bisphosphonates.
4. Smokers or patients with poor oral hygiene.
5. Patients who have para-functional habits.
6. Females who are pregnant or lactating

Withdrawal Criteria

Patient not willing to participate in study

Patient wants to leave the study at any point during the study

STUDY PROCEDURE

Pre-surgical Therapy

All the selected patients were subjected to pre-surgical hygiene therapy. Initial therapy consisted of detailed oral hygiene instructions, scaling and root planing procedure. Under loacal anesthesia with adrenaline 1: 200000 transgingival probing is done to check integrity of bony walls of tooth. Tooth with missing wall or dehiscence were excluded from the study, any occlusal adjustments if needed were corrected prior to surgery. Three weeks after the initial therapy the patients were re-evaluated to assess the plaque control and overall oral hygiene.Moreover, alginate impressions were made and poured with dental stone to obtain diagnostic cast that further helped in treatment planning. A radiographic stent was prepared using self cure acrylic resin which incorporates metallic wire in the centre of the tooth running in the mesial to distal in straight path was prepared. Routine blood investigations were carried out, and after explaining the purpose and design of the study, signed informed consent was taken from every patient. On the day of the surgical procedure, prior to surgery, recording of clinical data was carried out by the same examiner in all the patients. For evaluation of oral hygiene and gingival health, Plaque Index (PI) and Gingival Index (GI) were obtained at baseline, 6 months and 12 months.

Appropriate methods of Measurement

A) Clinical Parameter

All the clinical parameters was measured pre operatively at baseline and post operatively at 6 and 12 months follow up.

PARAMETERS ASSESSED

1) Plaque index

Preoperatively on the day of the surgical procedure, a same examiner recorded clinical data in all of the patients. Oral hygiene and Plaque Index (PI) were assessed at baseline, and post operatively at three and six months.

PI: (Silness and Loe, 1964)[47]

PI was evaluated in the following tooth scoring units: distofacial, facial, mesiofacial, and lingual surfaces. Plaque index was determined using a mouth mirror and a dental explorer.The selected index teeth are-

16 - Right Maxillary First Molar

12 - Right Maxillary Lateral Incisor

24 - Left Maxillary First Premolar

36 - Left Mandibular First Molar

32 - Left Mandibular Lateral Incisor

44 – Right Mandibular First Premolar

If any of the index teeth were missing, full mouth examination was done.

The criteria for scoring were as follows:

SCORE	CRITERIA
0	There is no plaque in the gingival area.
1	A recognisable film of plaque that adheres to the free gingival margin and adjacent area of the tooth and can be identified by walking a probe all over the tooth surface
2	A moderate amount of soft deposits can be seen with the naked eye within the gingival pocket, on the gingival margin, and/or on the adjacent tooth surface
3	There is an abundance of soft matter in the gingival pocket and/or on the gingival margin and adjacent tooth surface.

To begin, the scores from four different areas of the tooth were totaled and then divided by four. The index scores for each tooth are then added together and divided by the total number of teeth examined.

$$\text{PI} = \frac{\textbf{Total plaque score}}{\textbf{No of teeth examined}}$$

The following suggested nominal scale was used for patient evaluation.

Score	Rating
0	Excellent
0.1-0.9	Good
1- 1.9	Fair
2- 3	Poor

2 Probing pocket depth will be measured using UNC 15 (HuFriedy) periodontal probe

3) Soft Tissue Assessment using Testori esthetic score

B) Soft tissue around the implant was evaluated using implant aesthetic scoring. Tissue coloration and gingival contours were evaluated and scored using the Testori et al. standards (2005)[24]

(a) The presence of mesial and distal papillae and their stability

0 = papilla is not present.

1 = esthetically appropriate in harmony with neighboring teeth but it could not fill the space completely

2 = papilla completely fills the space.

The vertical measurement between the apexes of the mesial and distal papillae and the fictitious line connecting the cementoenamel joints of two neighboring teeth would be used to assess the structural stability of the papilla. This line was used to measure the height of the mesial and distal papillae on a regular basis.

(b) The texture of soft tissue around the implant

0 = Texture completely lost,

1 = Some tissue texture still remains but it does not appear healthy.

2 = Appearance of healthy gingival tissue across tooth structure.

(c) Colour of soft tissue around the implant,

0 = entirely different from colour of normal tissue,

1 = esthetically acceptable but do not appears like healthy tissue,

2 = appears the same as colour of healthy gingival tissue around tooth

structure.

(d) Contour of gingival tissue

0 = obvious asymmetrical from acknowledged scalloped parameters,

1 = though it is esthetically acceptable but show asymmetry from normal,

2 = gingival contour seems to be harmonious.

4) Measuring the ridge width-A Bone Gauge would be used to measure the width of the ridge at two mm and four mm from the alveolar crest.

C) RADIOGRAPHIC PARAMETERS

Following radiographic parameters was evaluated using CBCT at baseline and 12 months

Hard Tissue Assessment

1. Crestal bone height- Distance between tooth CEJ/implant shoulder to the most coronal point of inter proximal crest al bone height was assessed using CBCT atbaseline and 12 months postoperatively.
2. Buccal bone thickness at the crest, 5mm from crest and 10 mm from crest was assessed using CBCT at baseline and 12 months post operatively.
3. Ridge width – Bucco-lingual dimension of osseous ridge was assessed using CBCT at baseline and 12 months and clinically using bone gauge at base line, 6 and12 months post operatively
4. Vertical Distance (VD)

5. Jumping gap meaurement- Horizontal distance calculated between coronal point of mesial, distal, buccal, lingual bone crest to implant platform at right angle.

6. Measuring the radiolucent area- Area between shoulder of implant and bone crest.

Soft tissue Measurement

Buccal and Palatal/Lingual gingival thickness measurement

APPROPRIATE STUDY TOOLS

1. Implant and prosthetic components.
2. Dental implant surgical and prosthetic kit.
3. Physio-dispenser.
4. Basic surgical instrument kit.
5. Periotome and extraction forceps
6. Periodontal plastic probe
7. UNC-15 Periodontal probe
8. Bone gauge
9) CBCT unit
10) Bone graft material

Data Management and Stastical Analysis

The descriptive statistics for the bone heights were summarized using mean, standard deviation, and median. The comparison of height between baseline and 3 and 6 months was carried out in each group using paired t-test. Also, the comparison of the change in Crestal Bone height between two groups was carried out using an unpaired t-test for independent samples.

All analyses were carried out using SPSS ver 20.0 (IBM Corp.), and statistical significance will be determined at 5 percent of the overall level.

SURGICAL ARMAMENTARIUM

Instruments were arranged in a definite order on a sterilized drape placed on a surgical trolley. All the equipments were autoclaved. The surgical armamentarium consisted of -

- Mouth mirrors.
- UNC-15 periodontal probe (Hu-Friedy, USA).
- Straight probe.
- Explorer number 23 and number 17.
- Tweezer.
- Disposable surgical gloves.
- Head cap
- Disposable face masks.
- Cheek Retractor
- Photographic mirror

- Disposable syringe – 5ml and 2ml.
- Local anesthetic (2% Xylocaine HCl with adrenaline 1:200000).
- Gracey curettes.
- Bone Curette.
- Scissors – straight and curved.
- Tissue forceps.
- Needle holder.
- Periosteal elevater
- Mersilk suture material.
- Cotton swabs.
- Gauze.
- Surgical suction tip.
- Kidney tray with saline and irrigation syringe.
- Dappen dish.
- Normal saline.
- Denatured spirit.
- 0.2 % Chlorhexidine gluconate.
- Ridge Mapping Gauge.
- Straight handpiece.
- Implants (Adin Touareg™ S and Adin One ™).
- Implant Kit.
- Physio Dispenser.
- Healing Abutment.
- DFDBA

ARMAMENTARIUM FOR PROSTHETIC REHABILITATION

- Abutment.
- Implant analogue.

- Impression coping.
- Prosthetic implant drivers.
- Elastomeric impression material.
- Impression tray.
- Bite registration wax.
- Shade guide.
- GIC luting cement.

ARMAMENTARIUM FOR CBCT

- CBCT Unit
- Disposable plastic sleeves
- Lead apron and Thyroid shield
- Compact disk
- Radiographic stent

SURGICAL PROCEDURE

The patients entered the surgical phase of the implant therapy after accomplishing preliminary therapy and baseline examinations. The respective sites to be treated were anesthetized with local anaesthesia containing 2% Xylocaine HCl with adrenaline (1:200000). After adequate anaesthesia the surgical procedure was initiated.

Atrumatic flapless extraction

Atraumatic flapless extraction was done to preserve bone, gingival architecture which allows for immediate flapless implant placement. Periotome,

forceps, and endodontic files had been utilized for atrumatic extraction. Periotome was gently inserted in the periodontal ligament space which causes breakdown of periodontal fibers as well as luxation of teeth, then extraction was done gently using forceps with rotational motion. In cases where sub crestal root piece remain endodontic file was used for engagement and removal of the root tip. Complete debridment of granulation tissue was done using curette and irrigating with povidone iodine solution followed by normal saline and examination of intergrity of socket walls were carried out.

Placement of Implant

An implant with the required sizes determined by pre-surgical radiovisiography(RVG) and clinical examination of an implantation site. After thorough debridement, the extraction site t was then drilled with the implant surgical drills from the Adin Implant kit. Adin Touareg™ S implants were inserted till the level of alveolar crest in accordance to the guidelines. Following that, participants were assigned to one of two treatment groups at random.

In Group I (Control Group) no bone graft is placed to fill the jumping gap while DFDBA is used to fill jumping gap in the GroupII (Test Group). The implant site was then sutured using 3-0 mersilk sutures.

POST-SURGICAL CARE

All the patients were given appropriate oral hygiene and post-surgery instructions. Antibiotics (Capsule of Amoxicillin trihydrate 500mg) three times a day for five days. Analgesics (Tablet of Aceclofenac 100mg and Paracetamol 325 mg) were prescribed to control postsurgical discomfort. Sutures were placed and patients were called after 7 days for suture removal. Patients were advised to just use a

Chlorhexidine mouthwash (10 mL twice daily) for fifteen days, abstain from chewing tough or sticky foods and brush the implant area forcefully before their next appointment at three months. At follow-up visits, adverse effects were noted, and supragingival accumulations were eliminated. Patient advised to do CBCT within 24 hrs of implant placement. While taking CBCT patient advised to wear radiographic stent at implant site.

SECOND STAGE SURGERY

After 4 months of implant placement second stage surgery was performed in both groups in same manner. The respective sites to be treated were anesthetized with local anaesthesia containing 2% Xylocaine HCl with adrenaline (1:200000). After adequate anaesthesia the surgical procedure was initiated. After careful examination of implant site X incision was place such that its center coincides with center of the implant, elevation all papilla done with periosteal elevator[48]. Cover screw was removed and healing abutment of appropriate dimension was placed after copious irrigation.

PROSTHETIC PHASE

Healing abutments were removed in both groups, and implant level impressions were taken at the implant platform with a customized tray and standardized prosthetic elements, such as impression coping and implant analogue. Healing abutments were then removed three more times: during metal framework and bisque trying, and also at the time of final delivery of prosthesis, as they were replaced by prosthetic abutments. All of the final prostheses were delivered three months after the implant was inserted.

FOLLOW-UP EVALUATION

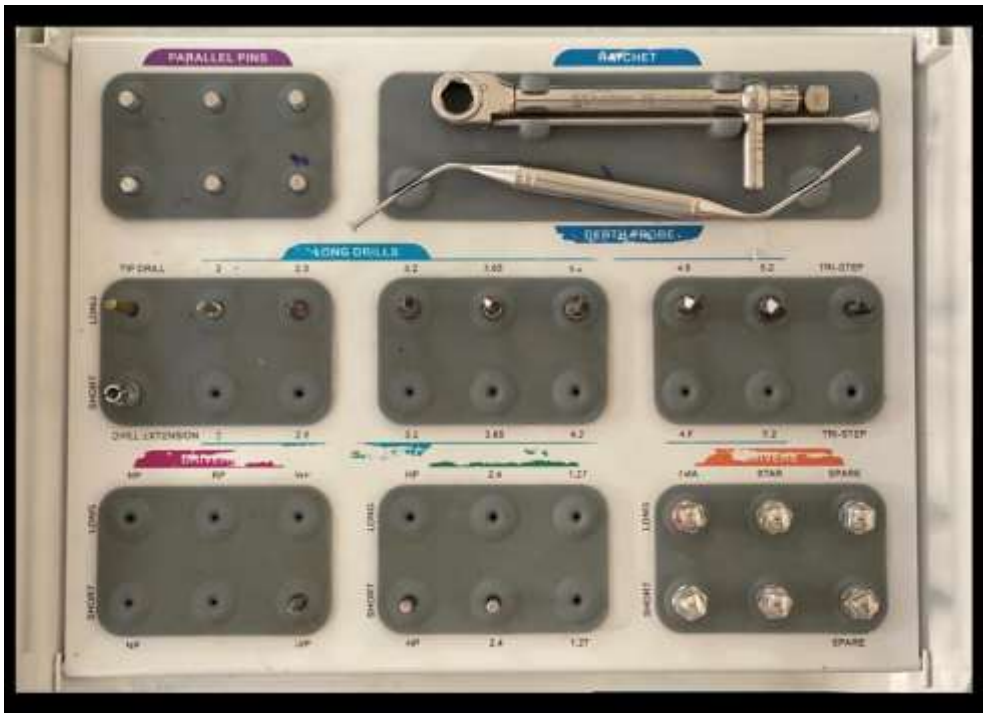
The patients were clinically evaluated at six and tweleve months, as well as by CBCT soon after implant placement and at 12 months intervals. UNC 15 graduated periodontal probe used to measure the peri-implant probing depth and bleeding on probing. Clinically soft tissue examinations were done by applying Testori's criteria. Radiographic measurements were done using CBCT software; the patient satisfaction was assessed by VAS

Colour Plate I

Surgical Armamentarium

Physio-dispenser

Colour Plate II

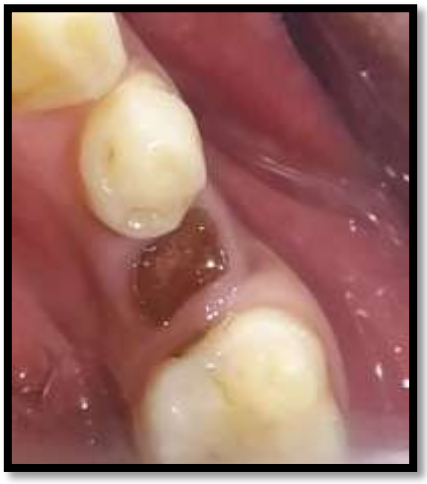


Adin Implant Drilling Kit

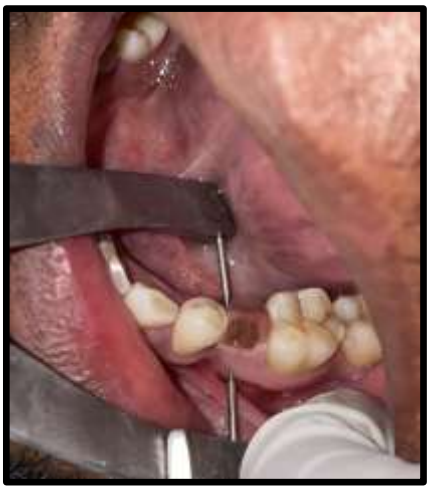
Prosthetic Armamentarium

Colour Plate III

Control Group : Base line Clinical Photograph

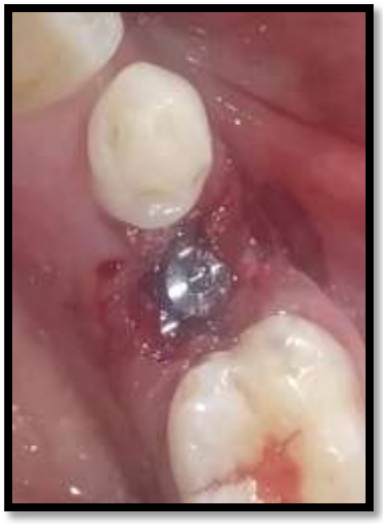


Pre Operative Surgical site



Pre operative ridge width

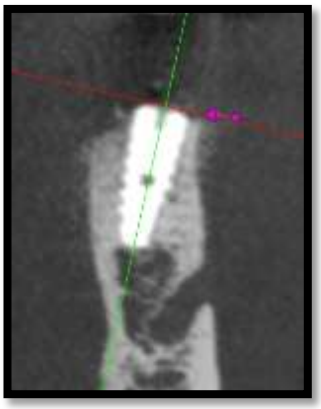
Extraction



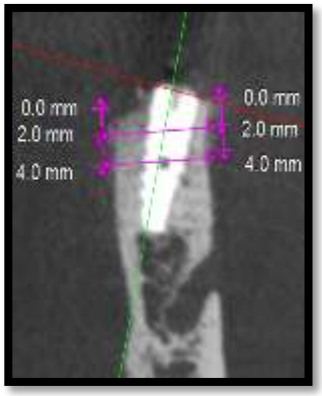
Implant Placement

Colour Plate IV

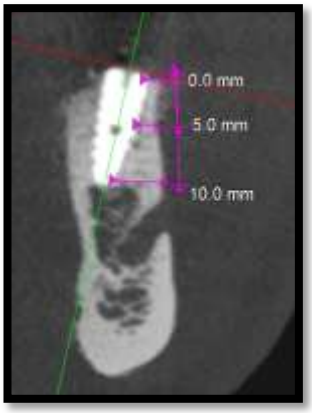
CONTROL GROUP : Baseline CBCT Measurements



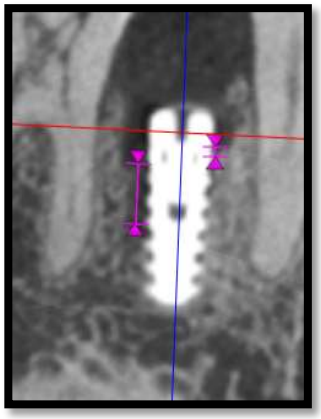
CBH



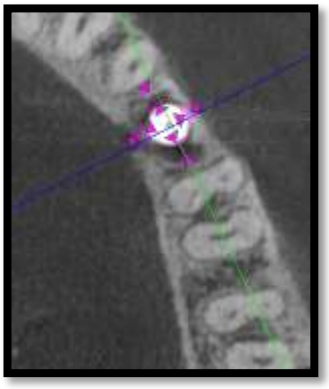
RW



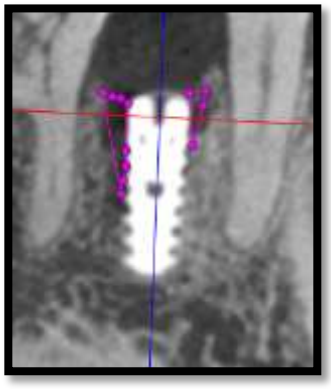
BBT



VD



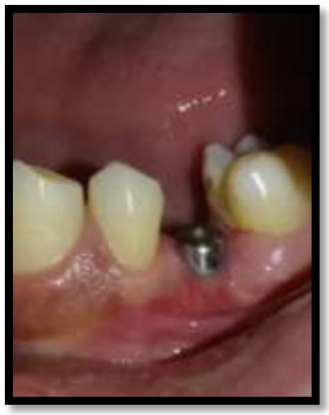
JG



RA

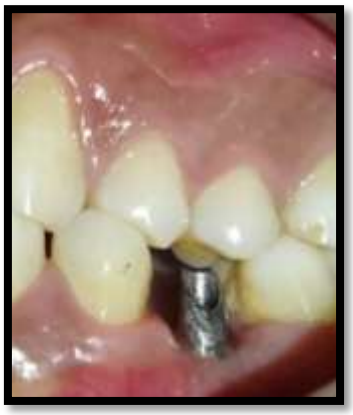
Colour Plate V

Control Group: 6 months Prosthesis

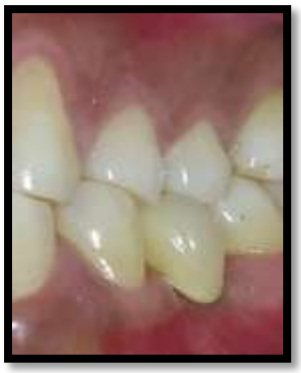


Healing Abutement

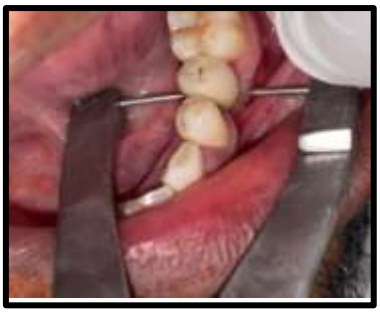
Emergence Profile



Prosthetic Abutement



Final Prosthesis

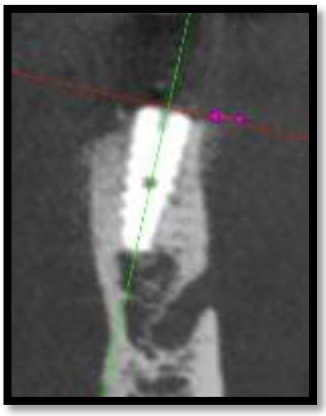


6 months RW

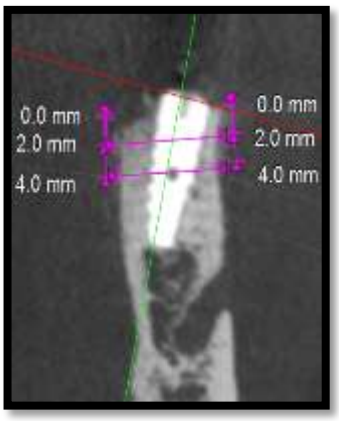
12 months RW

Colour Plate VI

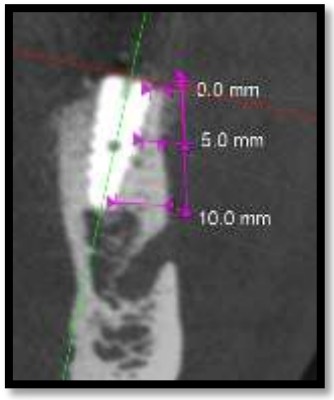
CONTROL GROUP : 12 Months CBCT



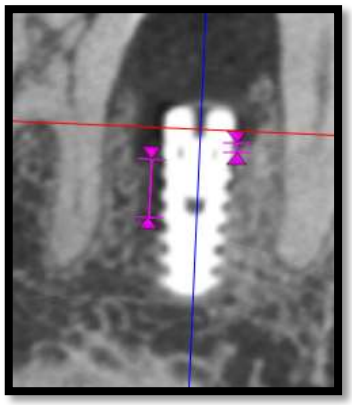
CBH



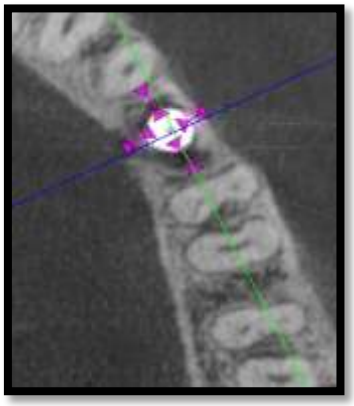
RW



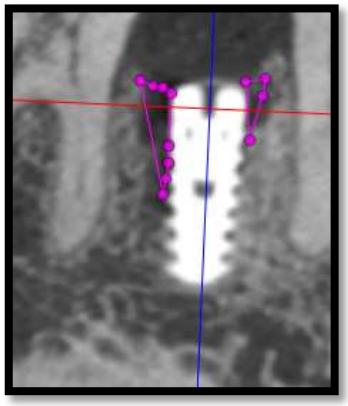
BBT



BD



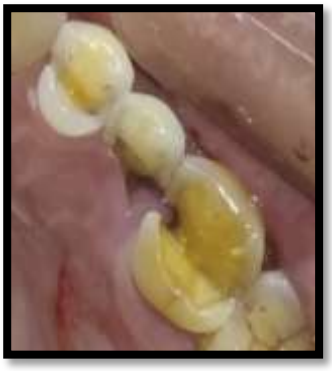
JG



RA

Colour Plate VII

Test Group : Clinical Images

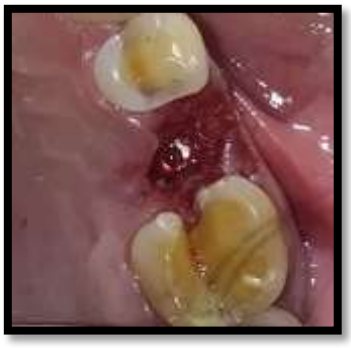


Pre Operative Site

Pre operative ridge width

Extraction.

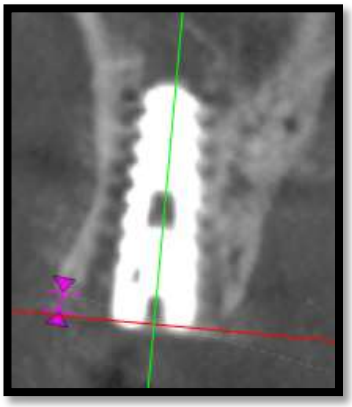
Implant Placement



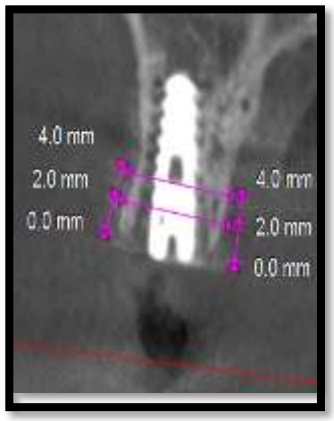
JG filled with DFDBA

Colour Plate VIII

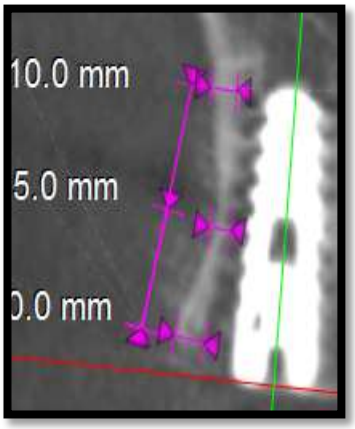
Baseline CBCT



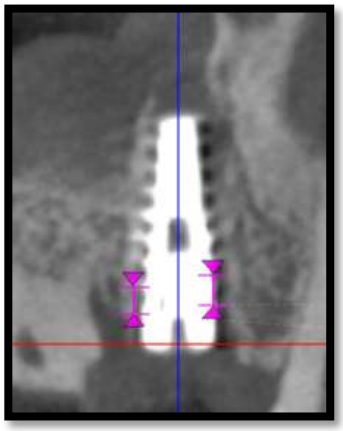
CBH



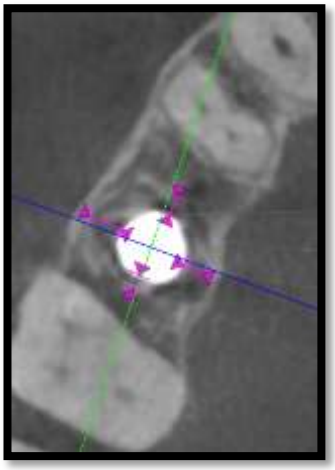
RW



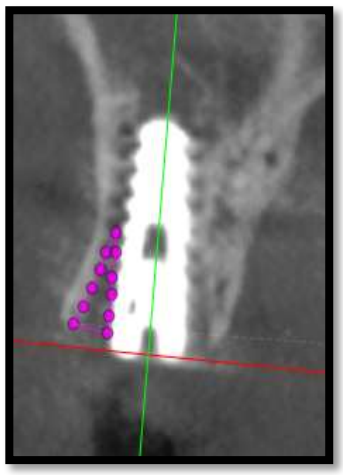
BBT



BD



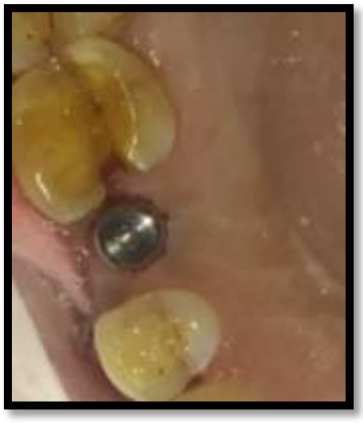
JG



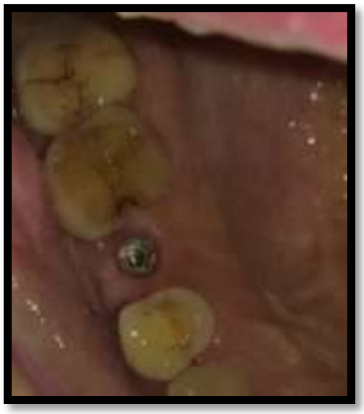
RA

Colour Plate IX

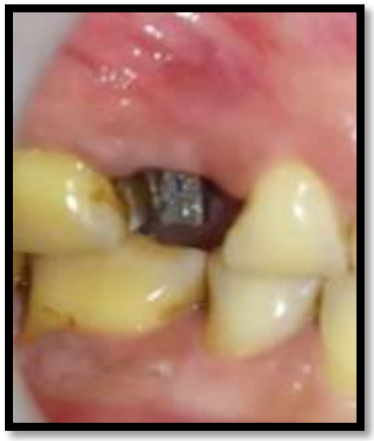
Prosthesis



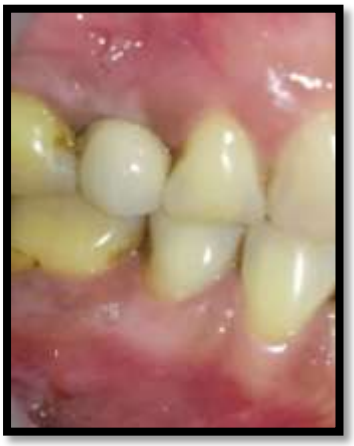
Healing Abutement



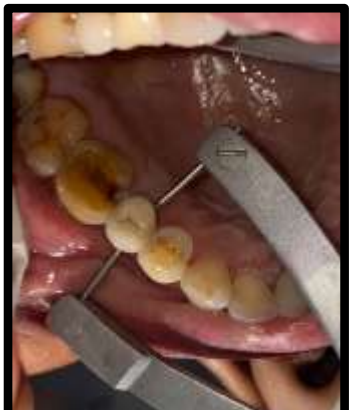
Emergence Profile



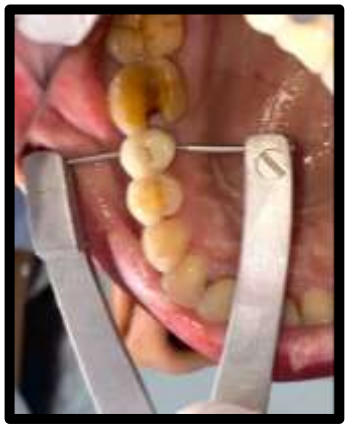
Prosthetic Abutement



Final Prosthesis.



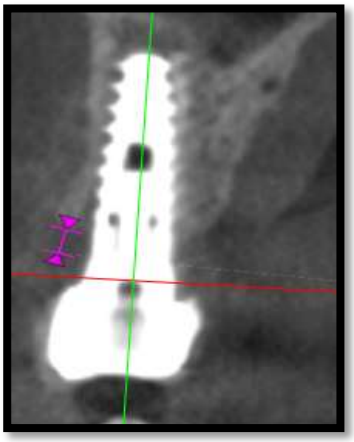
6 months RW



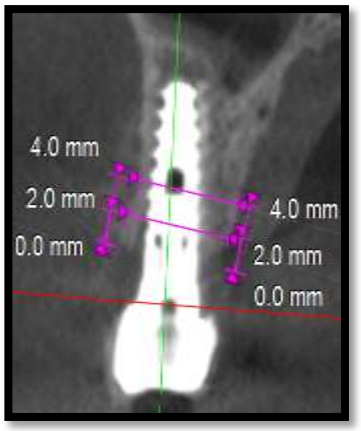
12 months RW

Colour Plate X

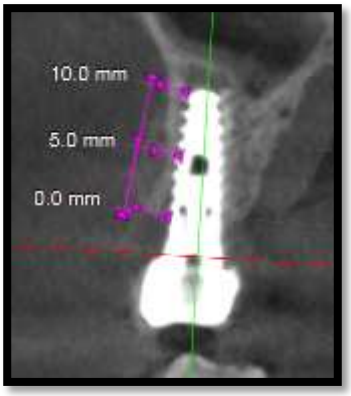
Baseline CBCT



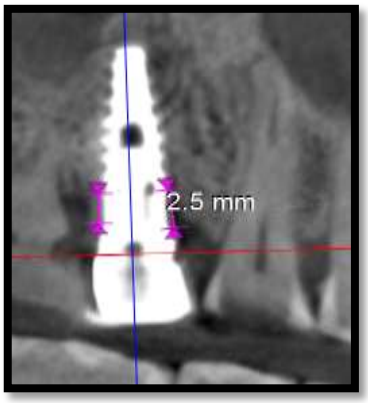
CBH



RW



BBT



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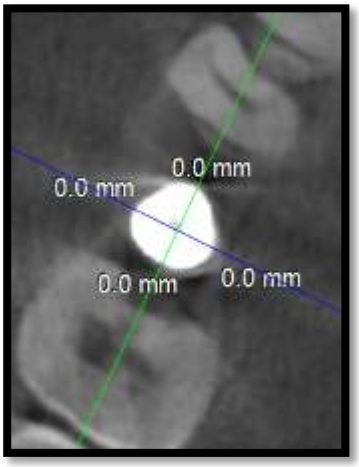
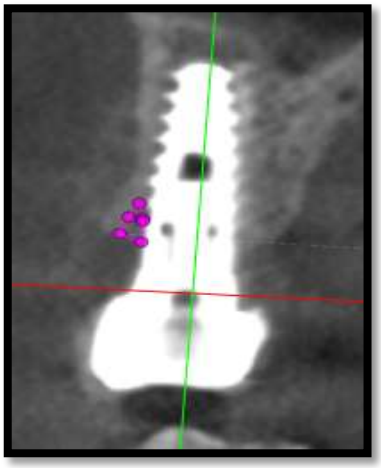


JG



RA

RESULT

The study population consisted of systemically healthy 15 male and 9 female patients aged between 28 to 65 years. 32 sites were taken into consideration from 24 patients. Out of 32 sites, in the 16 sites immediate flapless implant were placed and jumping gap filled with DFDBA and at in other 16 sites immediate flapless implant were placed without filling jumping gap. Of these 32 implants, 14 were adjacent implants and 18 were nonadjacent implants. All the implants were placed in maxillary and mandibular esthetic zone (from second premolar of right side to second premolar of left side). Out of 24 patients 22 returned for clinical and radiographic examination at defined intervals post-surgery as there were 1 dropout from test group till the completion of the study. The postoperative healing was uneventful in 31 treated sites and the implants were successfully osseointegrated. Due to the failure of osseointegration, one implant from control group was removed and that patient omitted from study. Fortunately, after strict oral hygiene for 1 month, the wound

healed without any clinical signs of infection, and osseointegration was achieved. The prosthodontic treatment was finished 6 months after the implant placement. No clinically detectable or subjectively reported side effects were noted in any treated patient. This study achieved a 97% implant and 100% prosthetic success rate at the 12-month follow-up examination for both the test and control group.

STATISTICAL METHODS

The demographic characteristics like age and sex were summarized according to scale of measurement. The comparison of mean age between two treatment groups was performed using t-test for independent samples, while sex distribution was compared using chi-square test. The parameters crestal bone height, buccal bone thickness, ridge width, vertical distance, radiolucent area was summarized in terms of mean and standard deviation. The comparison of mean difference of each parameter in each group and in each jumping score category between two times (baseline and 12 months) was performed using paired t-test. The difference of mean for each parameter at each time point, between two categories was tested for significance using t-test for independent samples. Further, the comparison of each parameter between two groups, irrespective of the criteria, was performed for each parameter using t-test for independent samples. Further, the parameters plaque index, gingival index, pocket probing depth, ridge width and gingival thickness were expressed in terms of mean, standard deviation. The indexes, pocket probing depth and testori criteria were compared between time points using Friedman ANOVA, while between category comparison was done using Mann-Whitney U test. The ridge width and gingival thickness were compared between time points using paired t-test, while between

category comparison was done using t-test for independent samples. The VAS score was compared using Mann-Whitney U test.

All the analyses were performed in SPSS ver 26.0 (IBM Corp, USA) software and statistical significance was tested at 5% level.

The description of tests used is as below:

1. **Measures of central tendency**

If x_1, x_2,…x_n are the observations on a random variable X, then following measures of central tendency can be obtained:

- **Mean** for a set of observations is given by

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

- **Median**: It is the middle value of a set of values when arranged in the increasing order of magnitude.

2. **Measures of dispersion**

- **Standard deviation** for a set of observations in given by

$$s = \sqrt{\frac{1}{(n-1)}\sum_{i=1}^{n}(x_i - \bar{x})^2}$$

where x_i = observation on each object

n = number of objects

- **Student's t-test for independent samples**

The test is used for comparing the statistical significance of difference in the means of two samples. It compares the sample difference between two means in

relation to the variation in the data (expressed as the standard deviation of the difference between the means).

It is given by the formula:

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{S\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

where $\bar{x}_1$ and $\bar{x}_2$ are the means of sample observations of two different groups, μ_1 and μ_2 are the means of the respective populations from which the samples are derived, and S is the pooled sample standard deviation, which is given by:

$$s^2_{pooled} = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$$

here s_1^2 and s_2^2 are the variance of two samples and n_1 and n_2 are the sample sizes in two groups. If the test statistic results in a P-value > 0.05 (level of significance), then the null hypothesis H_0: There is insignificant difference in the means of two groups is accepted and the alternative hypothesis H_1: There is significant difference in the means is rejected. On the other hand, if P-value < 0.05, then the H_1 is accepted and H_0 is rejected.

- **Paired t-test**

The method is typically used for assessing the effectiveness of an experimental procedure that makes used of related observations resulting from dependent samples. The hypothesis test based on this type of data is known as paired comparison test. Its formulation is given by:

For n sample differences computed from n pairs of measurements, which are distributed normally, the test statistic for testing hypothesis about population mean difference μ_d is given by:

$$t = \frac{\bar{d} - \mu_d}{s_d / \sqrt{n}}$$

Where $\bar{d}$ the sample mean, μd is is the hypothesized population mean difference, s_d is the star

Wilcoxon rank sum test

The test is a non-parametric equivalent of Student's t-test for independent samples, when the assumption of normality is violated. It evaluates the null hypothesis that the two populations are the same against alternative that particular population has larger values than the other. It involves computation of a test statistics based on ranked series. The observations are ranked according to magnitude irrespective of the two groups. The steps involved are as under:

i) Add the ranks for observations from group 1.

ii) Since sum of all ranks equal N (N+1)/2, the sum of ranks in group 2 is total sum minus the sum of group 1.

iii) A statistic U is defined as:

$$U_1 = R_1 - \frac{n_1(n_1+1)}{2}$$

where n_1 is the size of sample 1 and R_1 is the sum of ranks of sample 1. Equally valid formula for U is

$$U_2 = R_2 - \frac{n_2(n_2+1)}{2}$$

The smaller of U_1 and U_2 is for significance testing.

For large sample sizes (N > 30), U is approximately normally distributed, and the standardized value is given by

$$z = \frac{U - m_U}{\sigma_U}$$

where

m_U and σ_U are the mean and standard deviation of U. The significance of z can be obtained from normal probability tables. Here m_U and σ_U are given by:

$$m_U = \frac{n_1 n_2}{2} \qquad \sigma_U = \sqrt{\frac{n_1 n_2 (n_1 + n_2 + 1)}{12}}$$

- **Friedman's test**

The test is a non-parametric equivalent of parametric repeated measures ANOVA and typically used to detect the differences in observations across multiple test attempts. The procedure mainly involves ranking each row and then considering the values of ranks by columns.

Given data $\{x_{ij}\}_{nxk}$ as a matrix of n rows (repeated measurements) and k columns (treatments), calculate the ranks within each row. If there are tied ranks, then assign an average rank that would have been assigned without ties. Replace the data with the new matrix of ranks $\{r_{ij}\}_{nxk}$ where r_{ij} is the rank of entry x_{ij} within i^{th} row.

Find values:

$$\bar{r}_{.j} = \frac{1}{n}\sum_{i=1}^{n} r_{ij} \qquad \bar{r} = \frac{1}{nk}\sum_{i=1}^{n}\sum_{j=1}^{k} r_{ij}$$

$$SS_t = n\sum_{j=1}^{k} (\bar{r}_{.j} - \bar{r})^2$$

$$SS_e = \frac{1}{n(k-1)} \sum_{i=1}^{n} \sum_{j=1}^{k} (r_{ij} - \bar{r})^2$$

The test statistic Q is given by

$$Q = \frac{SS_t}{SS_e}$$

When n or k is large (n>15; k>4), the probability distribution of Q can be approximated by chi- squared distribution. In this case, p-value is given by $P\left(\chi^2_{k-1} \geq Q\right)$, else p-values can be obtained from Q tables.

- **Pearson's Chi-square test**

Let X and Y be two variables under study with r and s levels respectively; and the data on r × s levels be in the form of counts. Let the null hypothesis be that the two variables are independent. That is, knowing the levels of X does not help in predicting the levels of Y; against the alternative hypothesis that the two factors are not independent. That is, knowing the level of X can help in predicting levels of Y. To decide about the acceptance of hypothesis, the Chi-square test statistic is used which is defined as:

$$\chi^2 = \sum_{i=1}^{r} \sum_{j=1}^{s} \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

where O_{ij} is the observed frequency count for i^{th} level of variable X and j^{th} level of variable Y. E_{ij} is the expected frequency count for same cell. The expected count is given by:

$$E_{ij} = \frac{n_i \times n_j}{n}$$

where n_i and n_j are the total counts for i^{th} level of variable X and j^{th} level of variable Y; and n is the total count. The calculated Chi-square value is compared with the tabulated one for (r-1)×(s-1) degrees of freedom. If the corresponding p-value is smaller than the pre-decided significance level, say 0.05, then we reject the null hypothesis and accept the alternative one. If the p-value is more than 0.05, then we accept null hypothesis.

Results

Demographic Data

Table 1 provides the descriptive statistics for demographic characteristics of patients treated with DFDBA and without DFDBA. The mean age of patients treated with DFDBA was 42.33 (SD: 11.6) years, while that of without DFDBA was 44 (SD: 12.22) years. The difference in the means was statistically insignificant (p=0.704). Further, the sex distribution of patients in two groups also differed insignificantly (p=0.245). **(Graph 1A and 1B)**

Plaque Index(PI)

In general, patients showed good oral hygiene through-out the complete duration of the study. Baseline PI score for control group was 0.957(SD: 0.191), while at 6 months, it decreased to 0.816 (SD: 0.206), while at 12 months, the mean PI score was 0.867 (SD: 0.300). In test group the mean at baseline, 6 months and 12 months was 0.973 (SD: 206), 0.807 (SD: 0. 233) and 0.917 (SD: 0.281). At all-time points baseline, 6 and 12 months the mean PI score between two groups was statistically insignificant ($p > 0.05$). The comparison of PI score across time point in test group showed statistically insignificant difference ($p > 0.05$). **(Table2 & 3) (Graph 2)**

Gingival Index (GI)

Baseline GI score for control group was 0.649(SD: 0.189), at 6 month, it decreased to 0.551 (SD: 0.121), while at 12 months, the mean GI score was 0.672 (SD: 0.231). In test group the mean GI score at baseline, 6 months and 12 months was 0.731 (SD: 200) , 0.593 (SD:211) and 0.732 (SD:250). At all-time points

baseline, 6 and 12 months the mean GI score between two groups was statistically insignificant ($p > 0.05$). The comparison of GI score across time point in test group showed statistically insignificant difference ($p > 0.05$).

.(Table 4 & 5) (Graph 3)

Probing Pocket Depth (PPD)

PPD increase in control and Test group from base line value of 1.517 (SD: 383) mm and 1.583 (SD: 0.309) mm to 12 month value 1.650 (SD: 489) and 1.667 (SD: 0.408) respectively but it failed to reach the level of statistical significance. The mean PPD around implant at base line, 6, 12 months between control and test group was statistically insignificant **(Table 6 & 7) (Graph 4)**

Gingival Thickness (GT)

Comparison of GT between baseline and 12 months in two groups. In DFDBA group, the mean difference of GT for labial and lingual/palatal were statistically significant with p-values (< 0.0001) each. In without DFDBA group, the mean difference were significant with ($p < 0.0001$) each**.(Table 8 & 9) (Graph 5)**

Ridge Width (RW) measurement clinically

In both groups the mean RW reduced significantly from base line to 6 and 12 month but more pronounced in control group compare to test group.

Comparison of RW between baseline, 6 months and 12 months in two groups. In DFDBA group, the mean difference of RW at 2 mm and 4mm were statistically significant ($p < 0.0001$). In without DFDBA group also, the mean difference at 2 mm and 4 mm were significant ($p < 0.0001$.Comparison of RW between two groups at

three different time points. At 2 mm, and at 6 months, the difference of mean RW between two groups was statistically significant (p=0.001). Further, at 12 months, the difference of means was statistically significant (p < 0.0001). At 4mm, at all the three times points, the difference of means was statistically significant with p=0.045, p=0.001 and p < 0.0001 respectively. **.(Table 10 & 11) (Graph 6,7)**

Testori Score (TS)

Comparison of TS between baseline and 12 months in two groups. In both the groups, the mean difference was statistically significant with p-values (0.001) each.The comparison of TS between two groups at different time points. At baseline, the difference of means between two groups was statistically significant at baseline (p=0.001), and at 12 months, the difference showed statistical significance (p < 0.0001). At Base line value for control group 7.333 (SD: 0.487) was more compared to test group 6.400 (SD: 0.828) but value for control group decreases to 6.267(SD: 0.457) and for Test group it increases to 7.133 (SD: 0.516). The comparison of TS between two groups at different time points.At baseline, the difference of means between two groups was statistically significant at baseline (p=0.001), and at 12 months, the difference showed statistical significance (p < 0.0001). **(Table 12 & 13) (Graph 8,9)**

VAS Score

It measures patient's satisfaction in terms of pain experienced by patient during treatment. Baseline VAS scores for control and Test was 0.667 (SD: 0.976). VAS score demonstrated insignificant difference (p > 0.05) between both the test and control group with mean value less than 1, which indicate minimal pain. **(Table 14) (Graph 10)**

Hard Tissue Parameters

Crestal Bone Height (CBH)

Mid facial bone height was reduced in both groups significantly from base line to 12 months and reduction was more in control group compared to test group.

(Table 15) gives the comparison of crestal bone height between two groups at different sides and at two time points i.e. baseline and 12 months. At midfacial side, and 12 months, the difference of mean crestal bone height was statistically significant ($p < 0.0001$), while for other sides and time points, the difference was statistically insignificant between two treatment groups

(Table 16) shows the comparison of crestal bone height between baseline and 12 months in two groups. In DFDBA group, the mean difference for CBH midfacial was statistically significant ($p < 0.0001$). In without DFDBA group, the mean difference for midfacial and distal were significant with p-values < 0.0001 and 0.044. **(Graph 11)**

Buccal Bone Thickness (BBT)

BBT was increased in both groups significantly in test group from base line to 12 at the crest and 5 mm from the crest while in control group it increased significantly at crest only. The mean increase in BBT was more in test group compare to control group but results were fail to achieve significant value.

(Table 17) shows the comparison of buccal bone thickness between baseline and 12 months in two groups. In DFDBA group, the mean difference for BBT at crest and 5 mm from crest were statistically significant with p-values 0.002 each. In

without DFDBA group, the mean difference at crest was significant (p=0.004). **(Graph 12)**

(Table 18) shows the comparison of buccal bone thickness between two groups at baseline and 12 months. The difference of means was statistically insignificant between two groups at all the levels for each time point. **(Graph 13)**

Ridge width (CBCT)

(Table 19) shows the comparison of ridge width between baseline and 12 months in two groups. In DFDBA group, the mean difference of ridge width at 2 mm from crest and 4 mm from crest were statistically significant with p-values < 0.0001 and 0.001 respectively. In without DFDBA group, the mean difference at 2 mm from crest and 4 mm from crest were significant with p < 0.0001 each. **(Graph 14)**

(Table 20) provides the comparison of ridge width between two groups at difference time points. At 2 mm level from crest, the difference of means between two groups at baseline was insignificant, while at 12 months was statistically significant with p=0.03. Further at 4 mm, the difference of means at baseline and 12 months was statistically insignificant. **(Graph 15)**

Vertical Distance (VD)

From base line to 12 month the bone to implant contact point shifted more coronally at mesial and distal sites in both group .The differences were significant in test group only. Hence there was more bone fill and less vertical bone resorption seen in test group compared to control group

(Table 21) shows the comparison of VD between baseline and 12 months in two groups. In DFDBA group, the mean difference of vertical distance at mesial and distal sides showed statistically significant with p-values < 0.0001 each. **(Graph 16)**

(Table 22) provides the comparison of VD between two groups at baseline and 12 months for mesial and distal sides. The mean VD between two groups for both sides at 12 months was statistically insignificant; however, the difference was only significant at baseline for distal side (p=0.003). **(Graph 17)**

Jumping Gap (JG)

JG reduction were significant at all sites in test group ,in control group significant results were seen at buccal and distal sites only from base line to 12 month. The buccal JG reduction was significantly more in test group at the 12 month follow up.

(Table 23) shows the comparison of jumping gap measurement between baseline and 12 months in two groups. In DFDBA group, the mean difference of buccal, lingual, mesial and distal were statistically significant with p-values < 0.0001, 0.003, 0.001 and < 0.0001 respectively. In without DFDBA group, the mean difference were significant at buccal and distal sides with p-values 0.011 and 0.041 respectively**(Graph 18)**

(Table 24) gives the comparison of jumping gap measurement for each side between two groups at baseline and 12 months. The difference between mesial and distal sides at baseline was statistically significant with p-values 0.045 and 0.002 respectively. For buccal side, at 12 months, the difference of mean jumping gap was significant with p=0.013. **(Graph 19)**

Radiolucent area (RA) Measurement

RA reduction were significant at all sites in test group ,in control group significant results were seen at buccal site only from base line to 12 month. The buccal RA reduction was significantly more in test group at the 12 month follow up.

(Table 25) shows the comparison of radiolucent area between baseline and 12 months in two groups. In DFDBA group, the mean difference of radiolucent area at mesial, distal, buccal and palatal sides were statistically significant with p-values < 0.0001, 0.005, < 0.0001 and 0.002 respectively. In without DFDBA group, the mean difference at buccal was significant with $p < 0.0001$. **(Graph 20)**

(Table 26) shows the comparison of radiolucent area between two treatment groups at different time points. At distal side, the difference of mean area was statistically significant at baseline (p=0.022), while at buccal side, the difference of mean area was statistically significant at 12 months (p=0.002). The differences at other sides were statistically insignificant **(Graph 21)**

DISCUSSION

This clinical-radiographic study was initiated with the objective to evaluate and compare the hard, as well as soft tissue, changes around immediately inserted implants using the flapless approach with and without filling the jumping distance using DFDBA. Radiographic assessment was carried out with CBCT. The study also assessed peri-implant soft tissues with Testori implant esthetic score, PPD, and patient pain with the VAS scale. Baseline CBCT was taken on the same day of implant insertion and follow up CBCT was done after 12 months of implant insertion

When a tooth fails, its replacement after extraction may be managed using a variety of different modalities. Dental implants have shown to be a dependable mechanism for replacing lost or dying teeth with various forms of fixed dental restorations, with over 30 years of clinical data on the clinical usage of endosseous implants revealing good long-term outcomes[49].

Innumerable improvements have been presented ever since initial dental implant installation procedures in order to restore faster, less invasive and more cosmetic approaches to repair lost teeth. One of these game changing innovations was the advancement of a technique that involves implant placement immediately after dental extraction, eliminating the need to wait for the ridge to heal, and so was the standard procedure underneath the traditional technique. Immediate implant installation has several advantages, including a reduction in the number of surgical interventions required and a shorter treatment period, enhanced implant orientation during insertion, maintenance of the socket area, as well as improved esthetics of the neighboring soft tissues. Following immediate implant insertion in the extraction socket, high success rates have been observed. It not only serves to keep them soft as well as hard tissue architecture, but it also helps to preserve the alveolar architecture and the bony crestal height. The current study, which used an immediate implant insertion and a delayed loading protocol, had a success rate of 97 percent, which was similar to a systematic review carried out by Gallucci et al. (2018) with the evidence for clinical outcome of fixed implant prostheses treated with different combination of implant placement and loading ,it was discovered that immediate insertion followed by delayed loading (Type 1C), were scientifically as well as clinically validated, and demonstrated a 96.0 percent survival rate with a 91-100 percent success rate[9]. In the esthetic zone of the maxilla, Edward J et al (2017) analyzed and compared the soft tissues around the implant, crestal bone resorption, as well as bone healing in 100 implants placed immediate and delayed, and it was found that immediate implants seemed to have better esthetic and functional outcomes in terms of peri-implant soft tissue and peri-implant bone healing. They also discovered no statistically significant

difference in peri-implant crestal bone loss between the immediate & delayed implant groups[26].

One of most important conditions for implant success is the preservation of tissues around the implant such that osseointegration and esthetic elements are not jeoparadized. Several previous studies from the 1960s demonstrated alveolar process resorption after tooth removal, which is substantially more prominent in the buccal area[22]. Blood flow is provided by three primary sources when teeth are present: the vessels of the periodontal ligament, the periosteum of bone, and bone tissue. When a tooth is removed, the periodontal ligament is destroyed, leaving only two feeding sources. Furthermore, the cortical bone is less vascularized than the medullary bone; hence, when a flap is produced for implant insertion, the supraperiosteal blood supply is cut off, leaving just the weakly perfused bone without such a medullary component, resulting in bone resorption in the initial stages[50]. Such bone remodelling in response to insufficient blood flow becomes more crucial in the buccal area due to traits inherent in the architecture and anatomy of this region, which may result in major compromises for both osseointegration and esthetics. In view of these findings, not elevating a flap before implant placement may be a viable option for reducing buccal bone plate resorption as it preserves supraperiosteal vascularization. Furthermore, flapless operations retain soft tissue integrity and decrease gingival recession, both of which are crucial aspects in cosmetic surgery. Other benefits include less surgical time and bleeding, more postpartum comfort for the patient, as well as evidence that implants put through flapless operations give better predictable results, as long as the right method is used and the patients are carefully selected[33].

Several surgical procedures have been proposed to reduce alveolar bone loss to manageable levels. Reducing extraction stress and controlling flap raising are essential for success in all of these surgeries. When comparing the variations in ridge remodelling between flapped and non-flapped extraction sockets, animal studies yield inconsistent findings[6]. Although it has been speculated that by interrupting a thin layer of cells that compose the adult periosteum's osteogenic layer, the raising of a flap may reduce the capacity of the cells of the periosteum to rebuild bone, an undisturbed periosteum retains its osteogenic capability. It is probable that flap elevation has just a short-term effect on alveolar dimension changes. A systematic review by Vohra F et al (2014) compared the crestal bone loss (CBL) around the implant in a healed site using "flapped & flapless surgical techniques" showed that the CBL around the dental implants inserted in healed locations utilising flapped as well as flapless surgical techniques was comparable[32].Many studies have concluded that flapless implant placement results in limited bone remodelling around the implant and helps to reduce crestal bone loss around the implant [22, 23, 30]. Bhavita Vadhwa et al. (2015) carried out radiographic assessment of CBH over a period of 15 months after implant placement. Both the flapped and the flapless procedures exhibited a decrease in CBH over time, although the flapless approach showed a smaller decrease. There's no significant decline in CBH for the first 9 months, but there was a substantial reduction during the next 9–15 months for "flapless" technique. The mean CBL was 0.046 ± 0.008 mm on the mesial aspect, 0.043 ± 0.012 mm on the distal aspect with the "flapless" approach, and 1.48 ± 0.085 mm on the mesial aspect, 1.42±0.077 mm on the distal side with the "open flap" technique. The flapless procedure may be a preferable therapeutic option for implant placement, particularly when an appropriate

breadth and height of accessible bone are present[33]. Kumar D et al. (2018) demonstrated that the flapless technique of endosseous implant placement resulted in significantly less PD, decreased bone, and pain than the flap technique in 20 patients in the mandibular posterior region with a one-year follow-up. The decrease of CBH around the implants inserted by flapless as well as flap technique was statistically significant. When compared to the flap group, the flapless group demonstrated a significant decrease in crestal bone height[35].

Immediate implant insertion has some restrictions, tissue alteration, high technique sensitivity, and the presence of a jumping distance between the implant and the socket wall in the coronal region caused by a mismatch in implant size and the large tooth socket discovered immediately after tooth removal. The decision to fill or maintain this jumping gap is determined by the thickness of the buccal bone and the length of the jumping space. The therapeutic benefits of bone fillers in preserving alveolar ridge volume, maintaining buccolingual breadth, and forecasting the future of a buccal plate have been well recognized, and as a result, numerous literature favors the use of bone grafts [6].Despite the fact that tooth extraction causes obvious changes in the oral mucosal dimension of the ridge, multiple authors demonstrated that implant placement soon after extraction is a useful procedure in terms of results and cosmetic consequences. Approximately 50% of crestal width was lost over a 12-month period (equivalent to 6.1 mm; ranging from 2.7 to 12.2 mm), with two-thirds of it (3.8 mm; 30%) occurring in the first three months [6].

PI, GI, and PPD

The clinical parameters such as PI and GI following extensive oral hygiene recommendations and performing oral prophylaxis at all locations demonstrate significant improvement. Plaque management is vital for clinical results to remain stable over time. Bacterial plaque is a major and important factor in the aetiology of soft tissue destruction, which ultimately leads to the loss of hard tissue. Thus, successful therapy depends upon its removal subsequent to treatment. Each patient participating in the study showed a healthy clinical gingival condition and good oral hygiene level throughout the duration of the study. **Oh TJ et al. (2002)[51]** stated that the presence of plaque on the implant may lead to gingival inflammation and progressive bone loss around implants. In the present study, there was a decrease in PI and GI at the end of 6 months and 12 months compared to baseline. The mean plaque score at the end of 12 months was 0.867± 0.30 for the non-experimental side and 0.917± 0.281 for the experimental side, while the mean GI scores were 0.672± 0.231 and 0.732± 0.250 for the control and test group, respectively. **Schou et al. (1992)[52] stated** in their review that well maintained implants generally have a mean plaque score below 1.0. They also added that the prevalence and severity of inflammation around successful implants is indicated by a mean gingival index below 1. ± 0.63. The participants of both the groups in our study underwent strict maintenance protocols along with oral hygiene maintenance instructions and motivation. The influence of maintenance therapy after implant placement was supported by various clinical studies. **Molina A et al. (2016)[53]** suggest that the patient's biofilm management as well as the resulting mucosal inflammatory changes have a prominent effect on the preservation of soft tissues around the implant. . Pathak AK[54] et al. (2016) found that strict routine follow-up and strong patient drive had a significant impact on biofilm

management in their trial. Similarly, **Albrektsson et al. (1988)**[55] concluded that the long-term achievement of implants depends on adequate supportive periodontal treatment visits. The improved plaque index scores suggested that there was an increased level of oral health awareness and good maintenance of oral hygiene by patients in both groups in our study. Soft tissue stability early in the healing process is critical for soft tissue maturity. Probing is an effective tool for evaluating possible alterations in the soft tissues around the implant. Increased PPD has been identified as a critical signal, indicating a high likelihood of infection emerging in the implant mucosa. Adell et al. (1981)[56] and Buser et al. (1990)[58] found that peri-implant probing depths of up to 3 mm surrounding implants were regarded as "healthy." At the end of 6 months, the mean PPD in the control group (1.633 ± 0.499 millimetres) was lower than that of the test group (1.717 ± 0.432 mm).

This study found that PPD computed at base line was more in test group compared to control group. The PPD increased from base line to 6 months in both test as well as control group, from 6 to 12 month follow up PPD showed reduction in test group while PPD in control group increased further. The reduction in PPD in the experimental group may be seen because the bone graft inserted in the defect acts as a barrier. As a result, reduction of gingival growth into defects which decreases the possibility of long junctional epithelium formation, and instead supports in the establishment of new attachment, thereby minimising PPD. However, because the defect in the control group lacks a barrier, the gingiva develops into the defect, resulting in the creation of a long junctional epithelium, which would be responsible for the increased PPD. This was consistent with the findings of Hassan et al., who

discovered that immediate implants that received bone grafts had a lower PPD when compared to their original value.

Testori score (TS)

Given the esthetic value of an implant-supported prosthesis in the anterior region, clinician should examine not only implant longevity as a success measure, but also the many features of the esthetic outcome and long-term soft tissue stability. The esthetic result of present study showedthe acceptable outcome (score 4 to 8) at baseline to 6 and 12 months. The test group showed the significant increase in soft tissue parameters from baseline to 6 and 12 months, while the control group showed a significant decrease in score from baseline to 6 and 12 months, the intergroup comparison showing a significant increase in the test compared to the control group. This may be due to less alveolar bone remodelling in the test compared to the control group and also due to loading of the prosthesis in both groups. The result of the present study is similar to the result reported by Testori T (2005)[24]. Where the authors combined immediate implant insertion with immediate loading .The two implants placed into extraction sockets and delayed loading strategy, while the two implants placed into healed bone were inserted using an instantaneous loading protocol. They also discovered a satisfactory result (score 4 to 8) and claimed that post-extraction implant insertion, implant location, and loading all contribute to clinical success.

VAS

In the present study, VAS was used to measure patient's satisfaction in terms of the amount of pain that a patient feels and it ranging across a continuum from no pain (1-3), moderate pain (4–7), and worst pain (8–10). Both tests, as well as the

control group, show exactly the same results with an insignificant difference. The results obtained in the current study were similar to those reported by Dong Wu & Collegue (2019)[58], where in both groups showed pain below the level of 3, which indicates no pain. In the present study, results were below 1 in both groups, which were superior to the previous study; this may be due to the fact that in the present study, a flapless approach was used, as opposed to a flapped approach in the previous study. Similar results were found by Kumar D et al. (2018)[35]. In comparison to the flap group, the flapless group had much less discomfort. And showed mean score of 0 on the day of surgery, the mean VAS score in the flaped versus flapless groups was significant.

Gingival Thickness

In the present study, there was an increase in gingival thickness from base line to 12 month follow up seen in both grafted as well as non-grafted sites on the labial site, with a significant increase in labial gingival thickness at the grafted site. The increase in thickness in both groups may be due to more palatal placement of implants, which creates space, and bone grafts that reduce remodelling of the buccal plate. The current study's findings were in accordance to Kitichai Rungcharassaeng et al. (2012)[59], investigated the change in facial gingival tissue thickness (FGTT) following immediate implant implantation and temporization, with and without a connective tissue graft. They discovered a considerable rise in FGTT in both group. However, the test groups mean FGTT was substantially higher than the control groups. Six months following intervention, gingival tissue thickness around the implant was stable and maintainable. Opposite outcome to that of present investigation demonstrated by Ronaldo Antonio et al. (2017)[60] concluded that over the

research period, the soft tissues around the immediate implant inserted in an aesthetic area demonstrated alteration in height but not in thickness.

CBH

The current radiographic investigation appears to indicate that, in the presence of dimensional changes in the alveolar ridge, the influence of these changes can be minimised mostly on the buccal aspect of the implant. Several parameters were evaluated in this study, one of which was CBH. CBH alterations were assessed by CBCT after flapless immediate implant insertion in the esthetic zone of both the maxilla and mandible, and the impact of buccal space filling using DFDBA on buccal bone height was also assessed. According to the findings of the current study, following 12 months of recuperation, the height of the buccal bone wall decreased by 0.3 mm and 0.8 mm in the test and control groups respectively, and the intergroup as well as intragroup results were statistically significant, indicating that the test group exhibited less CBH reduction than the control group. These values were in consistent with the findings of a previous meta-analysis by Lee et al. (2014)[61], which examined bone dimensional changes during the first year following immediate implant insertion and found a mean vertical decrease of 0.5–1 mm. The use of bone regeneration principles and a flapless process minimises the degree of bone loss following extraction, when compared to the use of regenerative elements and a flapped procedure.

After inserting immediate implants and filling the leftover space with anorganic bovine bone, a height decrease of roughly 0.5 mm can be predicted. They observed this finding when they assessed bone aspects after immediate implant

insertion with concurrent grafting of the buccal disparity to evaluate if initial buccal bone thickness had an impact on bone remodelling and also to correlate bone variation using a flap or even a flapless method upon 6 months of healing. After a year of follow-up, the current study found the same result: a 0.3 mm decrease in CBH in the test and a 0.8 mm reduction in the non-grafted group[34]. Interestingly, ridge preservation treatments were originally meant to retain bone volume following tooth extraction. Novaes Jr. et al. (2012) found marked bone loss of the buccal bone sheet upon immediate implant insertion in their study of 8 dogs and proposed the use of flapless surgical approaches prior to the insertion of immediate implants and the use of bone grafts in the space as viable alternatives to restrict bone loss. In the mean value comparison of the resultant jumping distance between the implant surface and the buccal plate, significant differences were found between the test group compared to control group[22]. The present study found a statistically significant difference between the two groups at 12 months, however it found higher bone reduction compared to Novaes et al. This might be because their study had a smaller sample size and a shorter follow-up period. Jung et al. (2013) used CBCTs to reveal a mean vertical decrease of 0.0 to 1.2 mm at the tooth removal site filled with anorganic bovine bone without flap elevation[6].Although quick implant insertion may result in a similar width reduction as ridge conservation, it lowers the number of surgical repeations and chair time, boosting patient satisfaction.

Immediate insertion of the implant in the extraction socket with xenograft failed to prevent bone resorption, a conflicting finding to the present study by Paknejad M et al. (2017) investigated the efficacy of jumping space filling on buccal crestal bone level after a 4-to 6-month observation period. The therapeutic

approach was atraumatic flapless tooth removal, immediate implant placement, and insertion of a graft between the implant and the socket wall in the test group or no material in the control group. 4-6 month follow-up illustrated that immediate implantation contributed to 1.30 and 1.66 mm reductions in buccal bone plate in the test and control groups, respectively[11]. There results were not statistically significant, which might be attributed to the short follow-up time of 4-6 months and the usage less sample size. Research using various surgical procedures reveals a different mean decrease in the coronal section of the buccal side wall 29.3% decrease when utilising a xenograft, while other revealed a mean resorption of 1.9 mm, equating to a 56% decrease after 4 months, and observed value of 1.1 mm, equal to a 36% decrease[13,62].

Buccal Bone thickness (BBT) and ridge width

In the present study, the BBT of the buccal plate was measured in accordance with Kolte et al. (2020)[40] at the crest, 5mm from the crest, and 10mm from the crest. Most other studies measured BBT from either the centre of the implant or the buccal surface of the implant. At a follow-up period of 12 months, the present study showed that there was an increase in mean BBT between both groups. After 12 month follow up, both groups showed an increase at crest, 5 mm and 10 mm in BBT, but diierence did not achieve statistical significance in the test group at crest and at 5 mm. Intragroup comparison shows a stastically significant result for the test group at the crest and 5 mm from the crest. The gain in BBT was mostly due to the filling of the jumping gap.

In the present study RW was measured by 2methods 1) Using CBCT which measures only buccolingual dimension of bone 2) Clinically by bone gauge, by this

complete RW was measured. The present study demonstrated that placing DFDBA in the space between both the implant and the walls of a socket helped to compensate for the usual shrinkage of the facial hard tissue plate during healing. The reduction in the total buccal–palatal ridge dimension was found to be less pronounced in the grafted 0.6–1.3 mm (6–10%) locations than in the non-grafted 0.9 to 2 mm (9–20%) sites. In agreement with the findings of Sanz et al. (2017)[63], investigated the additional utility of employing a bone graft substitute graft in conjunction with immediate implants in decreasing bone dimensional alterations in the alveolar ridge. The mean reduction in the alveolar crest width for the 16 weeks after the implant installation was 1.3 for the test and 1.7 mm for control. This represented about 11% and 16%, respectively. But the present study demonstrated less horizontal ridge width resorption over 12 months of follow-up compared to a 4 month follow-up by Sanz et al (2017). The possible reason could be because of the present study used a flapless approach while Sanz et al used a flapped approach.

John Zaki et al. (2020)[64] assessed the efficacy of using a "bone substitute material (BSM)" inside the insert–socket disparity in patients receiving tooth extraction as well as immediate implant placement was investigated, and it was discovered that the use of BSM throughout immediate implant placement decreases lateral buccal bone resorption and enhances periimplant soft-tissue esthetics. A systematic review was conducted by Clementini et al.[31]. Whenever an implant was put in concurrently with an alveolar ridge preservation surgery following flapped tooth removal, horizontal mean changes at 1 mm under the crest were 1.29 ± 0.38 mm (14.9 ± 4.9 percent) with buccal aspect changes of 0.99 ± 0.21 mm (26.80 ± 7.07 percent).

Following tooth removal, there is a significant decline in ridge size, which is particularly visible at the buccal compared to palatal or lingual sides, and hence an implant inserted in the newly extracted region may not assist to counterbalance such change[13]. The degree of buccal ridge size reduction seen in the current study's non-grafted locations (0.9–2 mm; 9–20 percent) is largely consistent with previous findings. Buccal ridge size of the marginal region of the residual ridge in "immediate implant" locations decreased to 56% after 4 months , but the decline indicated in the present study was restricted to 20%. The difference may be because with the present study an atrumatic flapless approach was used. DBBM-C slowed or prevented ridge reduction at most sites, preserving the width and cross-sectional surface of the remaining ridge[62].

VD

Early bone remodelling occurs soon after the healed abutment is connected in both single-stage as well as two-stage implant insertion operations and can last up to a year. Postoperative trauma, occlusal overloading, peri-implantitis, a microgap between both the implant and abutment, biological width re-formation, and implant crest module design are all possible reasons for this problem. Crestal bone remodels to the first implant string, or 1.5 to 2.0 millimetres from apex to the implant-abutment interface, to provide room for the biological soft tissue seal. This early peri-implant bone remodelling has been widely addressed, and it has been referred to as a physiologic process, a foreign-body reaction, or implant adaption[65]. Hence, In the present study, vertical distance (VD) was measured between the first thread of the implant and the first implant to bone contact on the mesial (VDM) and distal (VDD) sides, The bone loss was calculated and position of the contact point was also

assessed based on the findings. If the initial implant-to-bone contact was indeed apical to the first thread of the implant, the VD is regarded negative; if the contact is coronal to the first thread of the implant, the VD is deemed positive. In the current study, the baseline values of VDM and VDD for the DFDBA grafted group were -0.493mm and 1.000mm, respectively, and 0.480mm and 1.220mm for the non-grafted group. After healing for 12 months, the values are 2.353mm and 1.940mm for the grafted and 1.533mm and 1.933mm for the non-grafted groups on VDM and VDD, respectively. The result indicates less bone loss and more coronal bone to implant contact point in the grafted group as compared to the non-grafted group. At base line, 12 month follow-up, the results were significant for the grafted group on the mesial and distal sides. The current study's findings were consistent with a histologic investigation done by Ralf F. Schuler (2010)[66], found that the insrtion of an implant with a bone graft resulted in a considerably higher proportion of "bone-to-implant contact" (BIC) as compared to non-grafted implants. Similar findings assessed by of a BSM in the implant–socket gap in patients receiving tooth removal and immediate implant insertion and discovered that BSM use during immediate implant insertion reduces lateral buccal bone resorption as well as improves periimplant soft-tissue esthetics. Although the usage of BSM raises the risk of mostly mild problems, authors also found a decline in reduction of vertical interproximal bone resorption in the BSM group compared to the non-BSM group[63].

Jumping Gap (JG)

The present study measured JG on all 4 sides of the implant. The maximum JG was present on the buccal side of both the test and the control group, with 1.427mm and 1.12mm, respectively. Minimum of mean 0.667 mm & 0.24 mm for test

and control group on lingual/palatal at base line, the more JG on buccal side was may be due to more lingual/palatal placement of implant. At follow-up period, lingual/palatal JG demonstrated complete filling. At the end of a 12-month follow-up, only the filled buccal JG in the test group showed a statistically significant difference. This was in accordance with the discussion of Novaes Jr. et al. (2012)[22] Animal investigations indicated that the horizontal space that remains between the bone and the implant immediately after installation may be filled with new bone growth and osseointegration. The percentage of direct bone-to-implant connection diminishes as the gap width surpasses 1.0 mm. The 2.0 mm JG between the implant surface and the alveolar buccal wall is regarded as a key size defect that no implant device has been capable of filling without the assistance of directed bone regeneration. The amount of bone-to-implant contact identified within defects grafted either with bovine bone mineral or autograft was larger than that found in lesions with no graft[67]. The findings of studies have demonstrated that following tooth removal, a marked decline in the ridge size occurs, and that this alteration is more noticeable at the buccal compared to palatal or lingual aspects, and that an implant inserted in the recently extracted site may not help counter such alteration (13). The degree of buccal ridge size reduction seen in the current study at non-grafted locations (0.9–2 mm; 9–20 percent) is largely consistent with previous findings. Buccal ridge size of the marginal region of the residual ridge in "immediate implant" locations was decreased to 56% after 4 months, but the decline indicated in the current study was restricted to 20%. Bone grafting enables excellent tissue volume preservation[62]. Combining an implant with a bone graft results in a considerably higher proportion of bone-to-implant contact (BIC)[68]. However placing a bone replacement graft in the space between both the

implant and the socket walls did not increase hard tissue fill. On the contrary, a thin zone of soft tissue was nearly always present in immediate contact to the implant in the marginal region of the majority of the grafted sites and demonstrated that the gap size was reduced by 1.6 mm in the experimental group versus 2.2 mm in the control group throughout healing[62]. These differences between the two groups were statistically significant (P 0.018) and accounted for approximately 61 and 71% of the buccal gap fill, respectively.

Radiolucent Area Measurement

A horizontal space exists between the implant's surface and the intact osseous shell, which refer to this as a "jumping gap"[13]. This disparity is primarily attributable to anatomical differences between implant and extraction spaces. Due to this anatomical difference between implant and socket wall, the horizontal and vertical defects were created, which was seen radiographically as a trigular radiolucent area. Radiographic comparison of the radiolucent triangular area between both the implant and the bony crest reveals no new bone development, and in their research of eight dogs, they employed a flapless technique and TCP to fill the JG. The region without the appearance of new tissue was reduced in the groups that employed synthetic bone grafting, particularly in the equicrestally positioned implant group, with values of 0.06 and 0.25 mm^{2}[(22)]. The current study measured the radiolucent area throughout all four sites: buccal, palatal, mesial, and distal, and discovered that there was a statistically significant difference at all four sites during intragroup analysis of the grafted group. While the non-grafted group only shows a significant difference at the buccal location from the baseline. Intergroup comparison revealed that the test group had a larger radiolucent region in the buccal aspect, which is statistically significant. The effective

radiolucent region without new bone growth was 0.19 mm^2 in the test group and 0.55 mm^2 in the control group. The acquired results were statistically significant. The discrepancy between the two studies might be attributed to the lesser smaller sample size in Noavs Jr et al. study. Application of DFDBA results in a significantly greater percentage of BIC and percentage of bone height filling in an intrabony gap surrounding titanium plasma-sprayed implants when compared with bioactive glass material[68]Polyzois & colleagues discovered increased BIC and more bone within the threads relative to nongrafted areas with voids of the same diameter. Limited osseointegration was observed in the defect region in locations where no grafting was used. The grafted wider defects, on the other hand, managed to illustrate BIC more coronally than locations with gaps of similar magnitude that did not contain grafts[69]. The current study's results are consistent with both Hall E et al & Polyzois & colleagues because present study analysed minimal radiolucent area across implants in the grafted group, denoting more BIC and more Jumping area fill.

SUMMARY

This clinico-radiographic study was initiated with objective to evaluate and compare the hard and soft tissue changes around immediately placed implant with flapless approach with and without filling the jumping distance using DFDBA. Clinical parameters were assessed as. PI, GI, PPD, GT, RW, Testori Score and VAS, while CBCT assessed parameters were CBH, BBT, RW, VD,JG RA were the parameters measured at baseline (after placement of implant) and after follow up period 12 months. All the soft tissue parameters except VAS measured at base line, 6 and 12 month period. VAS for pain estimation was measured at base line only. 22 patients with 30 implant sites completed 12 months follow up. 15 immediate flapless implant were placed and jumping gap filled with DFDBA other 15 immediate flapless implant were placed without filling jumping gap. All the implants were placed in maxillary and mandibular esthetic zone (from second premolar right side to second premolar of left side). The prosthesis was finished 6 months after the implant

placement. No clinically detectable or subjectively reported side effects were noted in any treated patient. This study achieved a 97% overall success rate at the 12-month follow-up examination for both the test and control group.

There was a significant improvement in clinical parameters such as PI and GI following extensive oral hygiene recommendations, performing oral prophylaxis at all locations. PPD revealed a normal range (≤5.0 mm), TS and increased significantly in the test group, and VAS score demonstrated the least discomfort for both groups. Radiographic measures showed a reduction in CBH and RW from baseline to 12 months; however the reductions were more evident in the control group, where as increases in BBT, reduction of mesial and distal bone loss, JG, and RA were greater in the test group at 12 months. Immediate flapless implant implantation and jumping gap filling aid to reduce post-extraction ridge alterations and the time necessary to replace failing teeth.

CONCLUSION

From the analysis of results, following conclusions were drawn:

1. There was a significant improvement in clinical parameters such as PI and GI following extensive oral hygiene recommendations. Immediate implant placed using flapless approach and JG filled with DFDBA demonstrated greater reduction of PPD between 6 to 12 month follow up.

2. Immediate implant placed using flapless approach and JG filled with DFDBA demonstrated significant lesser reduction of CBH, RW, increase in JG fill, BIC and BBT from base line to 12 month follow up period.

3. Immediate implant placed using flapless approach and JG filled with DFDBA demonstrated significant increase in labial GT and less reduction in RW reported in JG grafted with DFDBA base line to 12 month follow up period.

4. Immediate implant placed using flapless approach and JG filled with DFDBA demonstrated significant esthetic outcome as TS significantly increased base line to 12 month follow up period.

5. Immediate implant placed using flapless approach with and without DFDBA demonstrated high patient satisfaction in terms of pain experienced during surgical protocol

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Table and Graphs

Table 1: Demographic characteristics of patients in study groups

	Parameter	With DFDBA	Without DFDBA	P-value
Age in years	N	15	15	0.704
	Mean	42.33	44	
	SD	11.6	12.22	
	Median	42	42	
	Minimum	28	28	
	Maximum	65	65	
Sex	Male [No. (%)]	12 (80%)	8 (53.3%)	0.245
	Female [No. (%)]	3 (20%)	7 (46.7%)	

Table 2: Comparison of PI baseline and 12 months in each group

Parameter	With DFDBA				Without DFDBA			
	N	Mean	SD	P-value*	N	Mean	SD	P-value*
Plaque index - Baseline	15	0.973	0.206	0.449	15	0.957	0.191	0.115
Plaque index - 12M	15	0.917	0.281		15	0.649	0.189	

*Obtained using Wilcoxon signed rank test

Table 3: Comparison of plaque index between two groups at different time points

Parameter	DFDBA	N	Mean	SD	Median	P-value*
Plaque index - Baseline	Without	15	0.957	0.191	1.000	0.838
	With	15	0.973	0.206	1.000	
Plaque index - 6M	Without	15	0.815	0.213	0.870	0.902
	With	15	0.807	0.233	0.890	
Plaque index - 12M	Without	15	0.867	0.300	0.750	0.567
	With	15	0.917	0.281	1.000	

* Using Mann-Whitney U test

Table 4: Comparison of GI baseline and 12 months in each group

Parameter	With DFDBA				Without DFDBA			
	N	Mean	SD	P-value*	N	Mean	SD	P-value*
Gingival index - Baseline	15	0.731	0.200	0.73	15	1.517	0.383	0.7
Gingival index - 12M	15	0.732	0.250		15	0.867	0.300	

*Obtained using Wilcoxon signed rank test

Table 5: Comparison of gingival index between two groups at different time points

Parameter	DFDBA	N	Mean	SD	Median	P-value*
Gingival index - Baseline	Without	15	0.649	0.189	0.690	0.325
	With	15	0.731	0.200	0.750	
Gingival index - 6M	Without	15	0.551	0.121	0.600	0.806
	With	15	0.593	0.211	0.600	
Gingival index - 12M	Without	15	0.672	0.231	0.600	0.486
	With	15	0.732	0.250	0.890	

* Using Mann-Whitney U test

Table 6: Comparison of PPD baseline and 12 months in each group

Parameter	With DFDBA				Without DFDBA			
	N	Mean	SD	P-value*	N	Mean	SD	P-value*
Pocket probing depth - Baseline	15	1.583	0.309	0.374	15	0.672	0.231	0.32
Pocket probing depth - 12 M	15	1.667	0.408		15	1.650	0.489	

*Obtained using Wilcoxon signed rank test

Table 7: Comparison of pocket probing depth between two groups at different time points

Parameter	DFDBA	N	Mean	SD	Median	P-value*
Pocket probing depth - Baseline	Without	15	1.517	0.383	1.500	0.713
	With	15	1.583	0.309	1.750	
Pocket probing depth - 6M	Without	15	1.633	0.499	1.500	0.567
	With	15	1.717	0.432	1.500	
Pocket probing depth - 12 M	Without	15	1.650	0.489	1.500	0.838
	With	15	1.667	0.408	1.500	

* Using Mann-Whitney U test

Table 8: Comparison of gingival thickness between baseline and 12 months in each group

Parameter	With DFDBA				Without DFDBA			
	N	Mean	SD	P-value*	N	Mean	SD	P-value*
Gingival thickness - Labial - Baseline	15	0.973	0.128	< **0.0001**	15	0.867	0.129	< **0.0001**
Gingival thickness - Labial - 12M	15	1.013	0.155		15	1.993	0.187	
Gingival thickness - Lingual/Palatal - Baseline	15	2.040	0.188	< **0.0001**	15	0.880	0.115	< **0.0001**
Gingival thickness - Lingual/Palatal - 12M	15	2.047	0.188		15	1.993	0.187	

*Obtained using paired t-test; Bold p-values indicate statistical significance

Table 9: Comparison of gingival thickness between two groups at different time points

DFDBA	DFDBA	N	Mean	SD	Median	P-value*
Gingival thickness - Labial - Baseline	Without	15	0.867	0.129	0.810	0.031
	With	15	0.973	0.128	0.931	
Gingival thickness - Labial - 12M	Without	15	0.880	0.115	0.820	0.012
	With	15	1.013	0.155	0.985	
Gingival thickness - Lingual/Palatal - Baseline	Without	15	1.993	0.187	1.904	0.501
	With	15	2.040	0.188	2.000	
Gingival thickness - Lingual/Palatal - 12M	Without	15	1.993	0.187	2.001	0.443
	With	15	2.047	0.188	1.992	

*Using t-test for independent samples

Table 10: Comparison of ridge width between baseline and 12 months in each group

Parameter	DFDBA							
	With				Without			
	N	Mean	SD	P-value*	N	Mean	SD	P-value*
Ridge width 2mm - Baseline	15	10.440	0.634	< 0.0001	15	10.000	0.546	< 0.0001
Ridge width 2mm - 6M	15	9.460	0.643		15	8.580	0.614	
Ridge width 2mm - 12M	15	9.173	0.608		15	7.993	0.554	
Ridge width 4mm - Baseline	15	10.593	0.637	< 0.0001	15	10.153	0.504	< 0.0001
Ridge width 4mm - 6M	15	9.613	0.647		15	8.733	0.577	
Ridge width 4mm - 12M	15	9.367	0.628		15	8.240	0.515	

*Obtained using repeated measure ANOVA; Bold p-values indicate statistical significance

Table 11: Comparison of ridge width between two groups at different time points

DFDBA		N	Mean	SD	P-value
Ridge width 2mm - Baseline	Without	15	10.000	0.546	0.051
	With	15	10.440	0.634	
Ridge width 2mm - 6M	Without	15	8.580	0.614	**0.001**
	With	15	9.460	0.643	
Ridge width 2mm - 12M	Without	15	7.993	0.554	**< 0.0001**
	With	15	9.173	0.608	
Ridge width 4mm - Baseline	Without	15	10.153	0.504	**0.045**
	With	15	10.593	0.637	
Ridge width 4mm - 6M	Without	15	8.733	0.577	**0.001**
	With	15	9.613	0.647	
Ridge width 4mm - 12M	Without	15	8.240	0.515	**< 0.0001**
	With	15	9.367	0.628	

*Using t-test for independent samples; Bold p-values indicate statistical significance

Table 12: Comparison of Testori criteria between baseline and 12 months in each group

Parameter	With DFDBA				Without DFDBA			
	N	Mean	SD	P-value*	N	Mean	SD	P-value*
Testori - Baseline	15	6.400	0.828	**0.001**	15	7.333	0.487	**0.001**
Testori - 12M	15	7.133	0.516		15	6.266	0.457	

*Obtained using Wilcoxon signed rank test; Bold p-values indicate statistical significance

Table 13: Comparison of testori criteria between two groups at different times

Parameter	DFDBA	N	Mean	Std. Deviation	P-value*
Testori - Baseline	Without	15	7.333	0.488	**0.001**
	With	15	6.400	0.828	
Testori - 6M	Without	15	6.333	0.617	0.085
	With	15	6.000	0.378	
Testori - 12M	Without	15	6.267	0.458	< **0.0001**
	With	15	7.133	0.516	

*Using Mann-Whitney U test; Bold p-values indicate statistical significance

Table 14: Comparison of VAS scores between two groups

Parameter	DFDBA	N	Mean	Std. Deviation	P-value*
VAS score	Without	15	0.667	0.976	**0.999**
	With	15	0.667	0.976	

*Using Man-Whitney U test

Table 15: Comparison of crestal bone height between baseline and 12 months in each group

Parameter	With DFDBA				Without DFDBA			
	N	Mean	SD	P-value*	N	Mean	SD	P-value*
Crestal bone height (mesial) - Baseline	15	0.000	0.000	-	15	-0.120	0.317	0.602
Crestal bone height (mesial) - 12 M	15	0.000	0.000		15	-0.067	0.180	
Crestal bone height (midfacial) - Baseline	15	0.000	0.000	**< 0.0001**	15	0.000	0.000	**< 0.0001**
Crestal bone height (midfacial) - 12 M	15	-0.280	0.178		15	-0.787	0.348	
Crestal bone height (distal) - Baseline	15	0.000	0.000	0.334	15	0.000	0.000	**0.044**
Crestal bone height (distal) - 12 M	15	-0.067	0.258		15	-0.187	0.327	

*Obtained using paired t-test; Bold p-values indicate statistical significance

Table 16: Comparison of crestal bone height between two groups

Parameter	Group	N	Mean	Std. Deviation	P-value*
Crestal bone height (mesial) - Baseline	Without DFDBA	15	-0.120	0.317	0.153
	With DFDBA	15	0.000	0.000	
Crestal bone height (mesial) - 12 M	Without DFDBA	15	-0.067	0.180	0.162
	With DFDBA	15	0.000	0.000	
Crestal bone height (midfacial) - Baseline	Without DFDBA	15	0.000	0.000	-
	With DFDBA	15	0.000	0.000	
Crestal bone height (midfacial) - 12 M	Without DFDBA	15	-0.787	0.348	**< 0.0001**
	With DFDBA	15	-0.280	0.178	
Crestal bone height (distal) - Baseline	Without DFDBA	15	0.000	0.000	-
	With DFDBA	15	0.000	0.000	
Crestal bone height (distal) - 12 M	Without DFDBA	15	-0.187	0.327	0.274
	With DFDBA	15	-0.067	0.258	

*Using t-test for independent samples; Bold p-values indicate statistical significance

Table 17: Comparison of buccal bone thickness between baseline and 12 months in each group

Parameter	With DFDBA				Without DFDBA			
	N	Mean	SD	P-value*	N	Mean	SD	P-value*
Buccal bone thickness at crest - Baseline	15	1.147	0.787	**0.002**	15	0.920	0.221	**0.004**
Buccal bone thickness at crest - 12 M	15	1.893	0.856		15	1.567	0.891	
Buccal bone thickness (5mm from crest) - Baseline	15	1.487	0.666	**0.002**	15	1.407	0.781	0.392
Buccal bone thickness (5mm from crest) - 12 M	15	1.820	0.594		15	1.480	0.883	
Buccal bone thickness (10mm from crest) - Baseline	15	2.113	1.240	0.999	15	2.347	1.459	0.334
Buccal bone thickness (10mm from crest) - 12 M	15	2.113	1.236		15	2.360	1.446	

*Obtained using paired t-test; Bold p-values indicate statistical significance

Table 18: Comparison of buccal bone thickness between two groups

Parameter	Group	N	Mean	Std. Deviation	P-value*
Buccal bone thickness at crest - Baseline	Without DFDBA	15	0.920	0.221	0.292
	With DFDBA	15	1.147	0.787	
Buccal bone thickness at crest - 12 M	Without DFDBA	15	1.567	0.891	0.315
	With DFDBA	15	1.893	0.856	
Buccal bone thickness (5mm from crest) - Baseline	Without DFDBA	15	1.407	0.781	0.765
	With DFDBA	15	1.487	0.666	
Buccal bone thickness (5mm from crest) - 12 M	Without DFDBA	15	1.480	0.883	0.226
	With DFDBA	15	1.820	0.594	
Buccal bone thickness (10mm from crest) - Baseline	Without DFDBA	15	2.347	1.459	0.641
	With DFDBA	15	2.113	1.240	
Buccal bone thickness (10mm from crest) - 12 M	Without DFDBA	15	2.360	1.446	0.619
	With DFDBA	15	2.113	1.236	

*Using t-test for independent samples

Table 19: Comparison of ridge width between baseline and 12 months in each group

Parameter	With DFDBA				Without DFDBA			
	N	Mean	SD	P-value*	N	Mean	SD	P-value*
Ridge width (2mm from crest) - Baseline	15	7.547	0.821	< **0.0001**	15	7.320	0.231	< **0.0001**
Ridge width (2mm from crest) - 12 M	15	6.960	0.727		15	6.420	0.556	
Ridge width (4mm from crest) - Baseline	15	7.693	0.758	< **0.0001**	15	7.613	0.285	<**0.0001**
Ridge width (4mm from crest) - 12 M	15	7.120	0.671		15	6.673	0.579	

*Obtained using paired t-test; Bold p-values indicate statistical significance

Table 20: Comparison of ridge width between two groups

Parameter	Group	N	Mean	Std. Deviation	P-value*
Ridge width (2mm from crest) - Baseline	Without DFDBA	15	7.320	0.231	0.312
	With DFDBA	15	7.547	0.821	
Ridge width (2mm from crest) - 12 M	Without DFDBA	15	6.420	0.556	**0.030**
	With DFDBA	15	6.960	0.727	
Ridge width (4mm from crest) - Baseline	Without DFDBA	15	7.613	0.285	0.705
	With DFDBA	15	7.693	0.758	
Ridge width (4mm from crest) - 12 M	Without DFDBA	15	6.673	0.579	0.061
	With DFDBA	15	7.120	0.671	

* Using t-test for independent samples; Bold p-values indicate statistical significance

Table 21: Comparison of vertical distance between baseline and 12 months in each group

Parameter	With DFDBA				Without DFDBA			
	N	Mean	SD	P-value*	N	Mean	SD	P-value*
Vertical distance (mesial) - Baseline	15	-0.493	1.646	< **0.0001**	15	0.480	1.907	0.174
Vertical distance (mesial) - 12 M	15	2.353	0.177		15	1.533	1.618	
Vertical distance (distal) - Baseline	15	-1.000	1.791	< **0.0001**	15	1.220	1.933	0.223
Vertical distance (distal) - 12 M	15	1.940	1.216		15	1.933	0.906	

*Obtained using paired t-test; Bold p-values indicate statistical significance

Table 22: Comparison of vertical distance between two groups

Parameter	Group	N	Mean	Std. Deviation	P-value*
Vertical distance (mesial) - Baseline	Without DFDBA	15	0.480	1.907	0.146
	With DFDBA	15	-0.493	1.646	
Vertical distance (mesial) - 12 M	Without DFDBA	15	1.533	1.618	0.061
	With DFDBA	15	2.353	0.177	
Vertical distance (distal) - Baseline	Without DFDBA	15	1.220	1.933	**0.003**
	With DFDBA	15	-1.000	1.791	
Vertical distance (distal) - 12 M	Without DFDBA	15	1.933	0.906	0.987
	With DFDBA	15	1.940	1.216	

* Using t-test for independent samples; Bold p-values indicate statistical significance

Table 23: Comparison of jumping gap measurement between baseline and 12 months in two groups

Side	Time	Group							
		With DFDBA			P-value*	Without DFDBA			P-value*
		N	Mean	SD		N	Mean	SD	
Buccal	Baseline	15	1.427	0.876	**< 0.0001**	15	1.120	0.816	**0.011**
	12 months	15	0.133	0.352		15	0.733	0.799	
Lingual	Baseline	15	0.667	0.723	**0.003**	15	0.240	0.542	0.109
	12 months	15	0.000	0.000		15	0.000	0.000	
Mesial	Baseline	15	0.993	0.725	**0.001**	15	0.540	0.417	0.05
	12 months	15	0.227	0.243		15	0.253	0.288	
Distal	Baseline	15	1.013	0.595	**< 0.0001**	15	0.380	0.433	**0.041**
	12 months	15	0.220	0.492		15	0.173	0.263	

*Obtained using paired t-test; Bold p-values indicate statistical significance

Table 24: Comparison of jumping gap measurement for each side between two groups at baseline and 12 months

Side - Time	Group						P-value
	With DFDBA			Without DFDBA			
	N	Mean	SD	N	Mean	SD	
Buccal - Baseline	15	1.427	0.876	15	1.120	0.816	0.33
Lingual - Baseline	15	0.667	0.723	15	0.240	0.542	0.078
Mesial - Baseline	15	0.993	0.725	15	0.540	0.417	**0.045**
Distal - Baseline	15	1.013	0.595	15	0.380	0.433	**0.002**
Buccal- 12M	15	0.133	0.352	15	0.733	0.799	**0.013**
Lingual - 12M	15	0.000	0.000	15	0.000	0.000	-
Mesial - 12M	15	0.227	0.243	15	0.253	0.288	0.786
Distal - 12M	15	0.220	0.492	15	0.173	0.263	0.748

*Obtained using t-test for independent samples; Bold p-values indicate statistical significance

Table 25: Comparison of radiolucent area between baseline and 12 months in each group

Parameter	With DFDBA				Without DFDBA			
	N	Mean	SD	P-value*	N	Mean	SD	P-value*
Radiolucent area (mesial) – Baseline	15	2.153	1.542	< **0.0001**	15	1.607	1.290	0.146
Radiolucent area (mesial) - 12 M	15	0.540	0.573		15	0.927	1.188	
Radiolucent area (distal) – Baseline	15	2.433	2.429	**0.005**	15	0.800	0.970	0.095
Radiolucent area (distal) - 12 M	15	0.453	0.913		15	0.613	0.927	
Radiolucent area (buccal) – Baseline	15	3.180	1.272	< **0.0001**	15	3.287	1.219	< **0.0001**
Radiolucent area (buccal) - 12M	15	0.187	0.192		15	0.693	0.548	
Radiolucent area (palatal) - Baseline	15	1.247	1.297	**0.002**	15	0.493	1.028	0.084
Radiolucent area (palatal) - 12M	15	0.000	0.000		15	0.000	0.000	

*Obtained using paired t-test; Bold p-values indicate statistical significance

Table 26: Comparison of radiolucent area between two groups

Parameter	Group	N	Mean	Std. Deviation	P-value*
Radiolucent area (mesial) - Baseline	Without DFDBA	15	1.607	1.290	0.301
	With DFDBA	15	2.153	1.542	
Radiolucent area (mesial) - 12 M	Without DFDBA	15	0.927	1.188	0.266
	With DFDBA	15	0.540	0.573	
Radiolucent area (distal) - Baseline	Without DFDBA	15	0.800	0.970	**0.022**
	With DFDBA	15	2.433	2.429	
Radiolucent area (distal) - 12 M	Without DFDBA	15	0.613	0.927	0.638
	With DFDBA	15	0.453	0.913	
Radiolucent area (buccal) - Baseline	Without DFDBA	15	3.287	1.219	0.816
	With DFDBA	15	3.180	1.272	
Radiolucent area (buccal) - 12M	Without DFDBA	15	0.693	0.548	**0.002**
	With DFDBA	15	0.187	0.192	
Radiolucent area (palatal) - Baseline	Without DFDBA	15	0.493	1.028	0.089
	With DFDBA	15	1.247	1.297	
Radiolucent area (palatal) - 12M	Without DFDBA	15	0.000	0.000	-
	With DFDBA	15	0.000	0.000	

* Using t-test for independent samples; Bold p-values indicate statistical significance

Figure 1A: Column chart showing mean age of patients in two groups

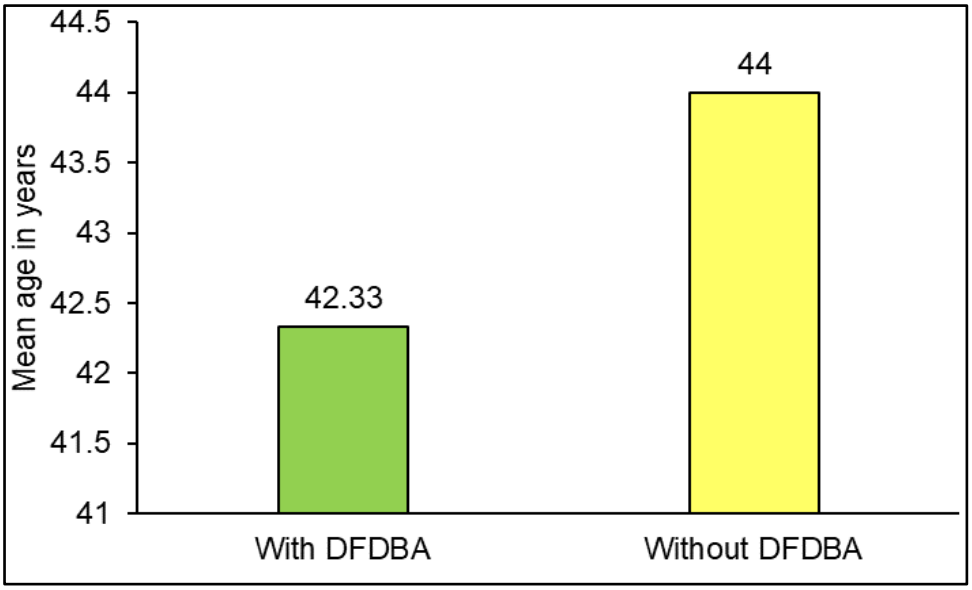


Figure 1B: Column chart showing mean age of patients in two groups

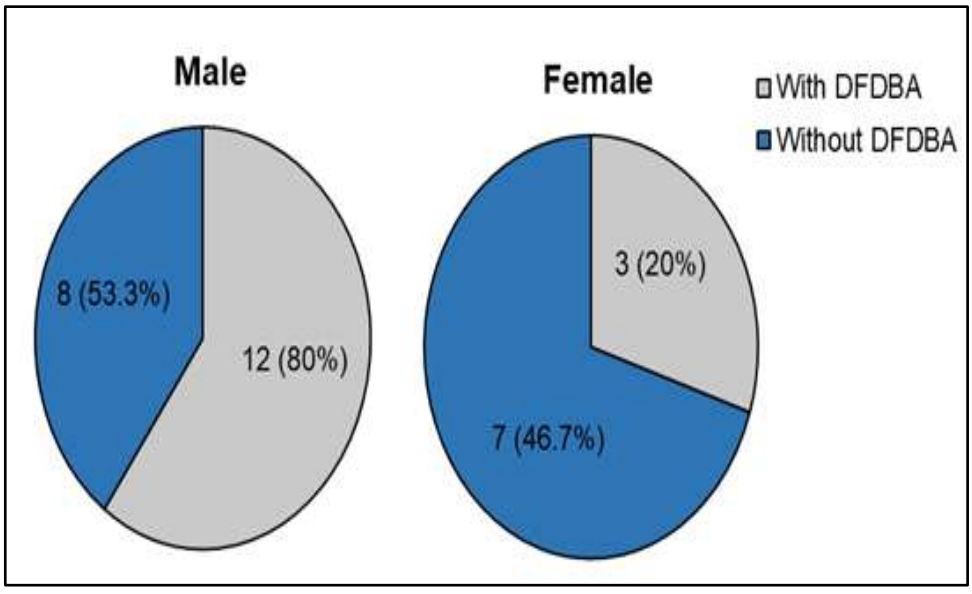


Figure 2: Column charts showing comparison of PI, between baseline and 12 months in each group.

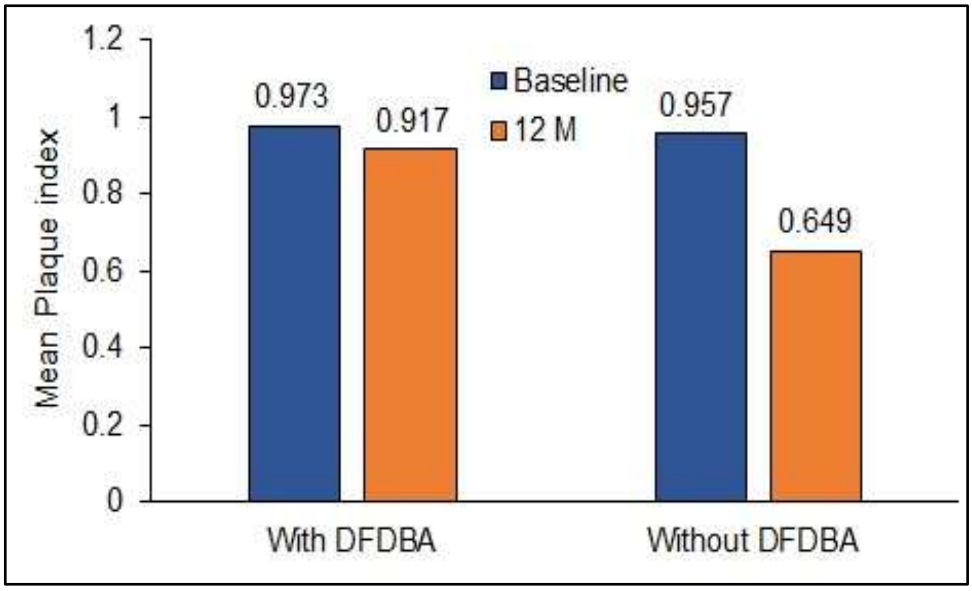


Figure 3: Column charts showing comparison of GI, between baseline and 12 months in each group.

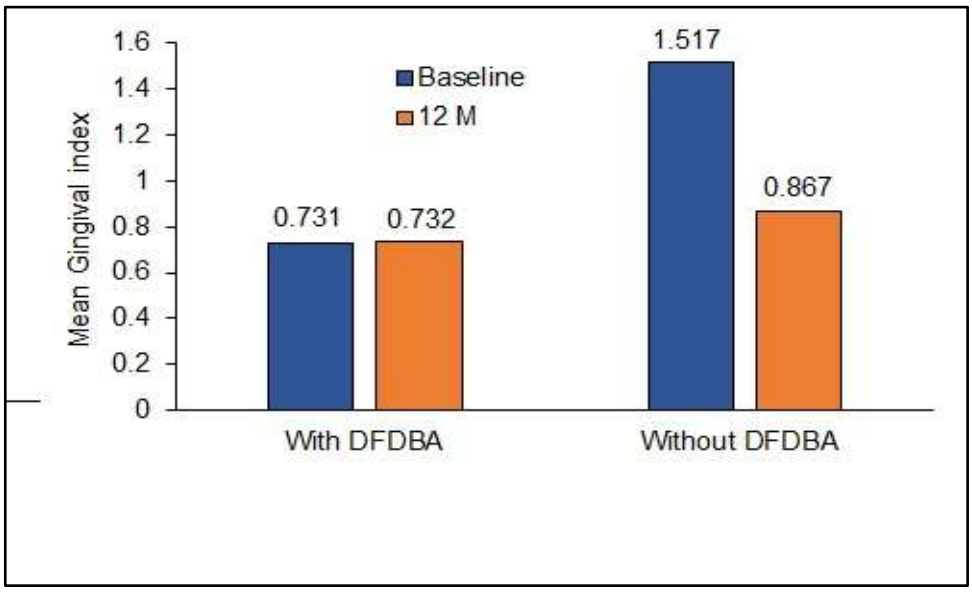


Figure 4: Column charts showing comparison of PPD between baseline and 12 months in each group

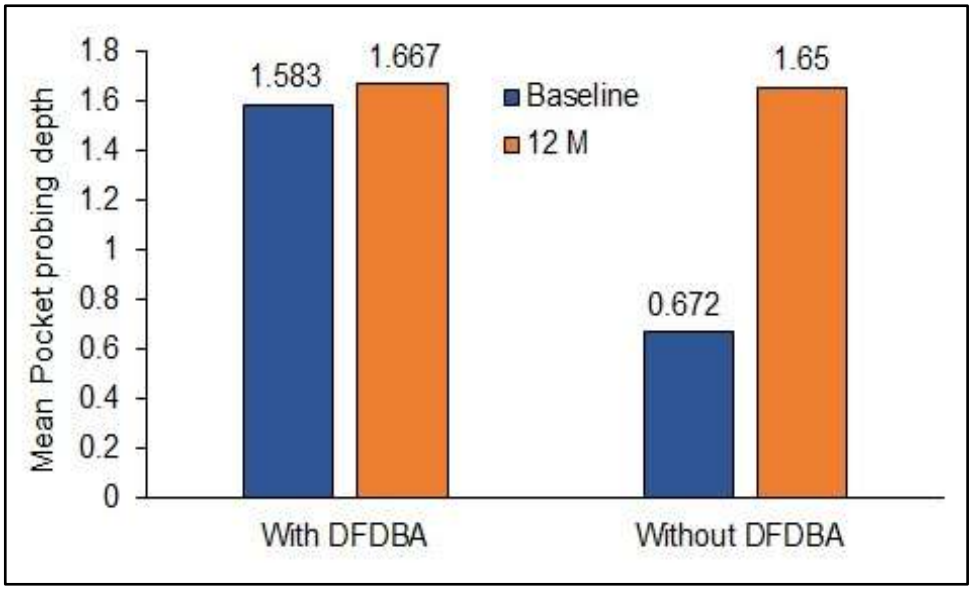


Figure 5: Column charts showing comparison of gingival thickness between baseline and 12 months in each group

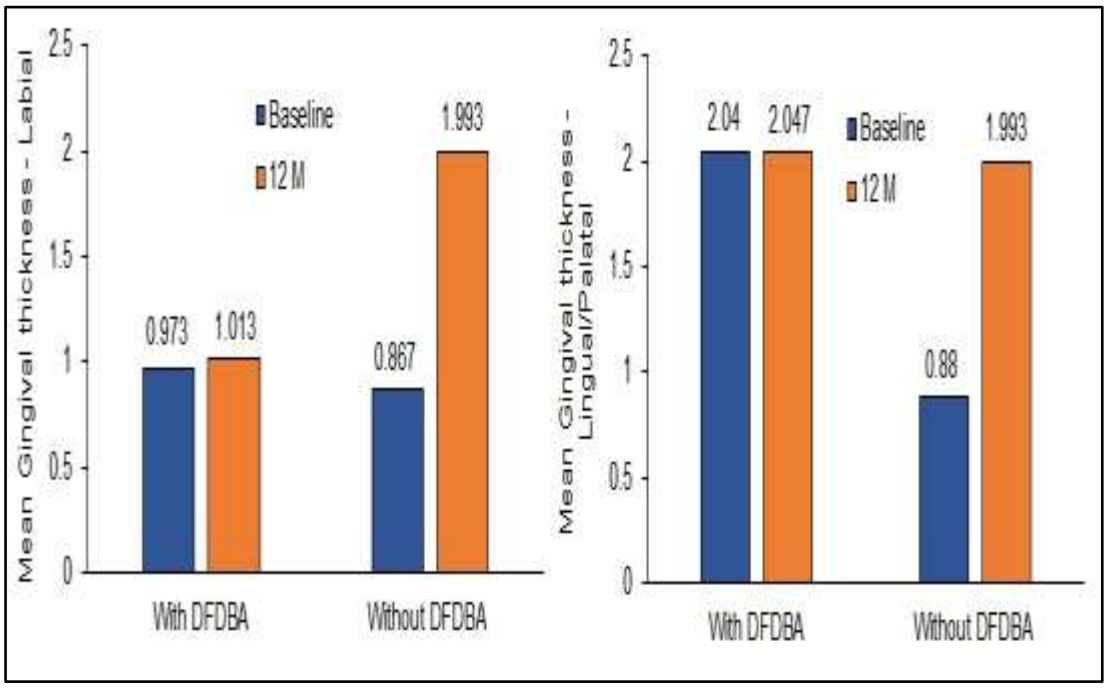


Figure 6 shows the comparison of ridge width between baseline, 6 months and 12 months in two groups.

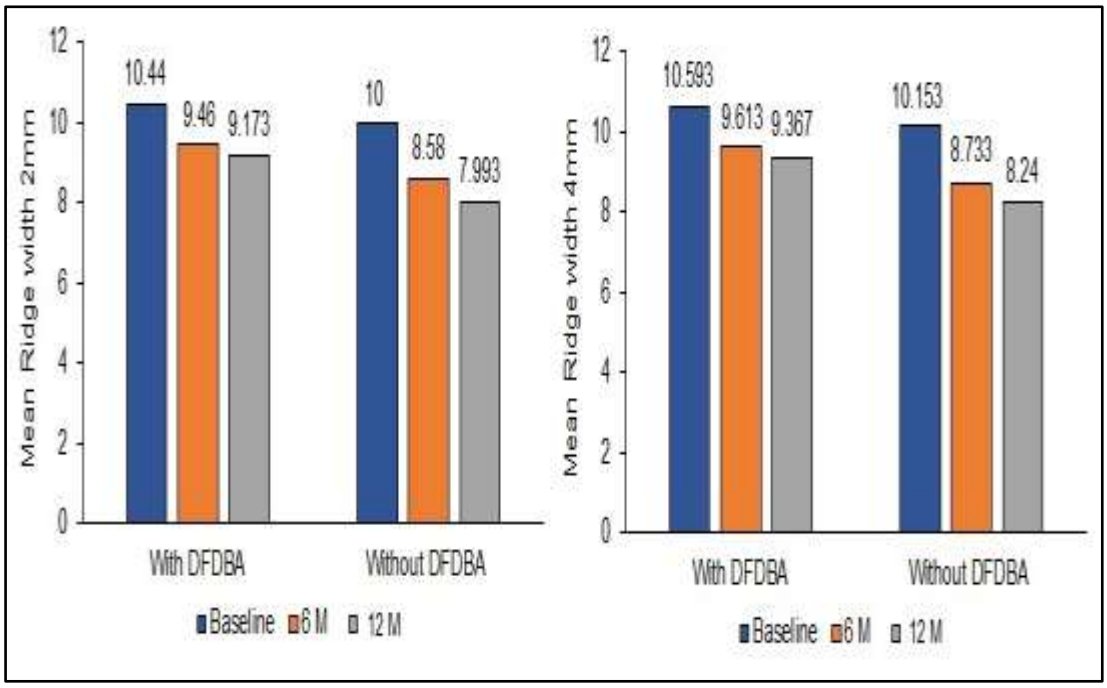


Figure 7: Column chart showing mean ridge width in two groups according to time

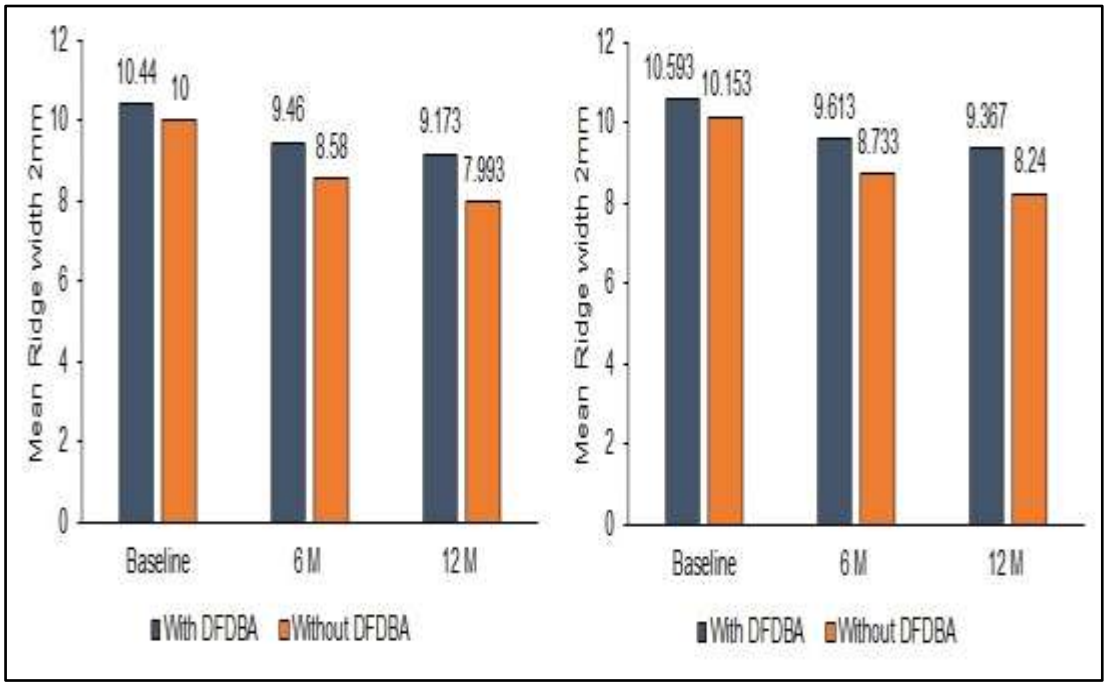


Figure 8: Column chart showing comparison of Testori criteria between baseline and 12 months in each group

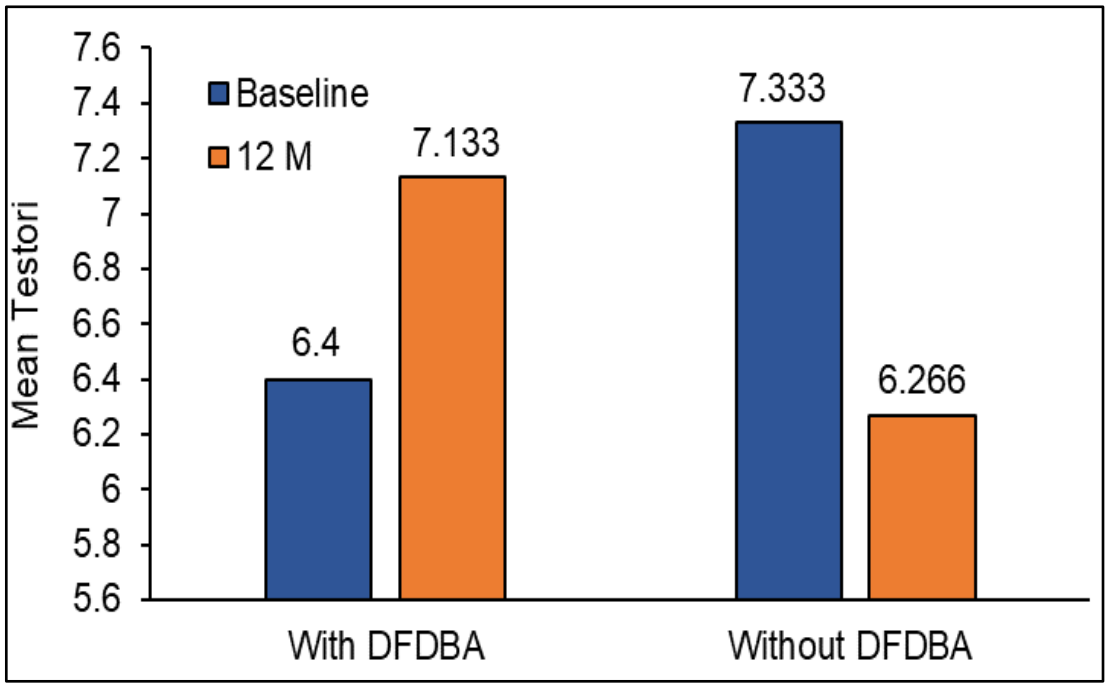


Figure 9: Column chart showing mean testori score in two groups according at baseline, 6 month, 12 Month

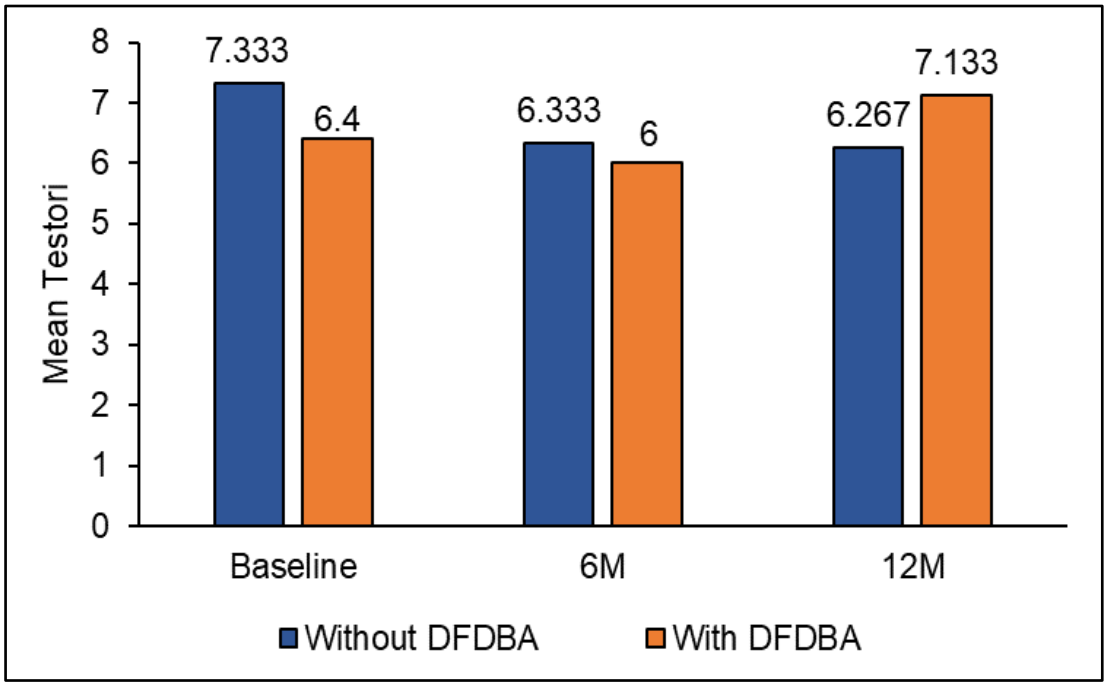


Figure 10: Column chart showing mean VAS score in two groups

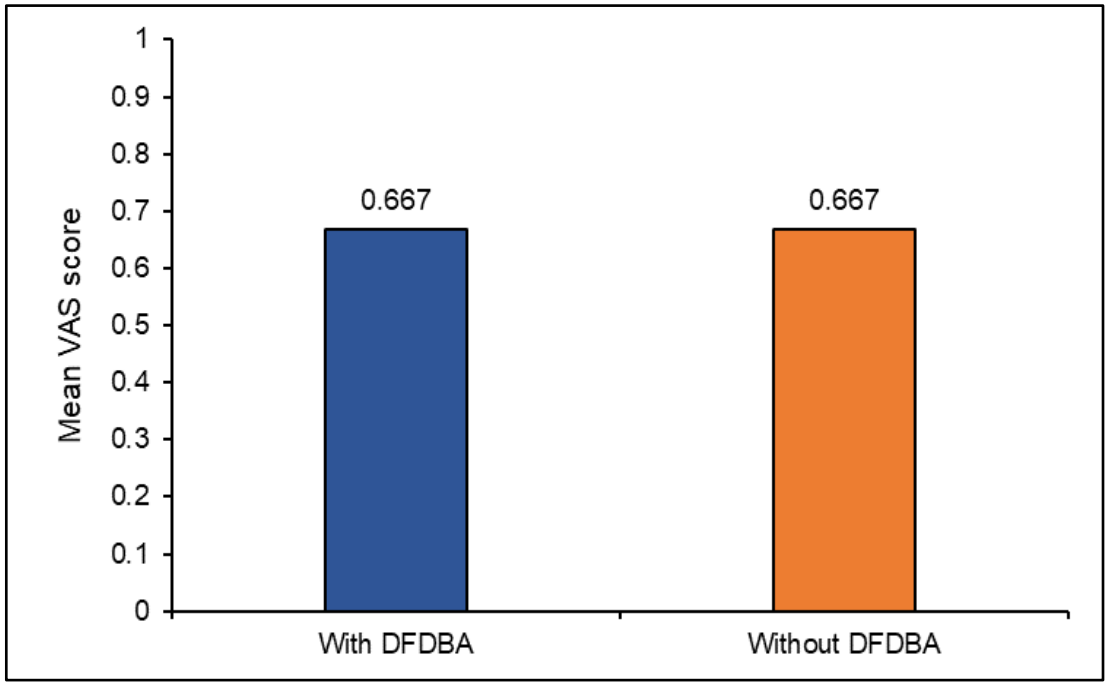


Figure 11: Column chart showing mean crestal bone height in two groups at baseline and 12 months

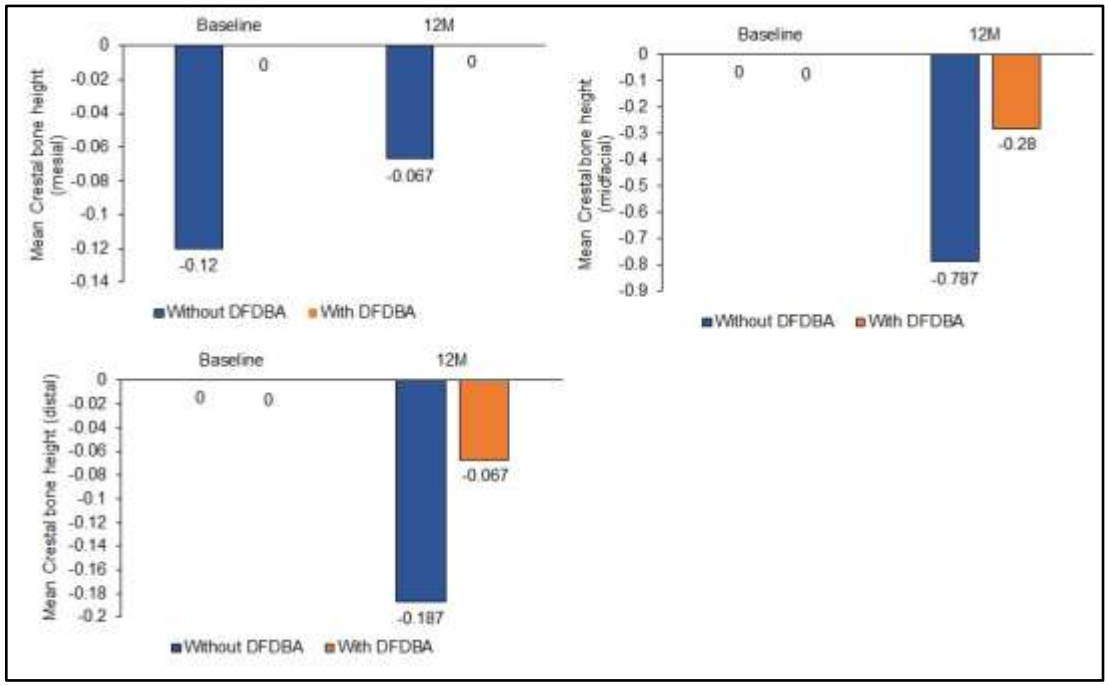


Figure 12: Column charts showing comparison of buccal bone thickness between baseline and 12 months in each group

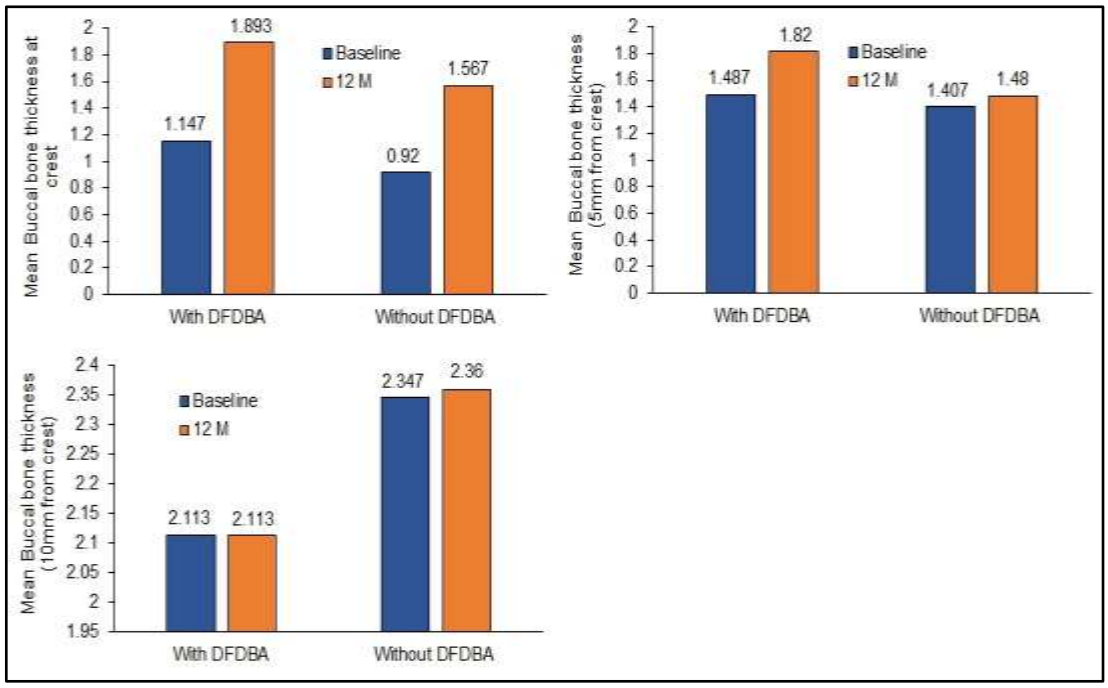


Figure 13: Column chart showing mean buccal bone thickness in two groups at baseline and 12 months

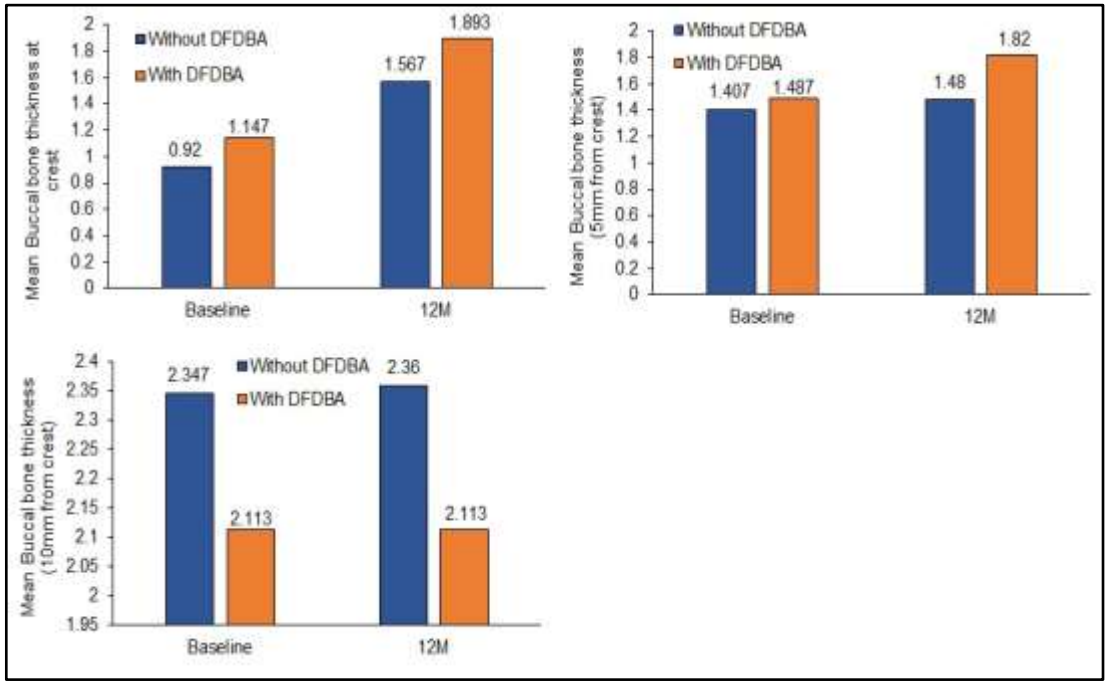


Figure 14: Column charts showing comparison of ridge width between baseline and 12 months in each group

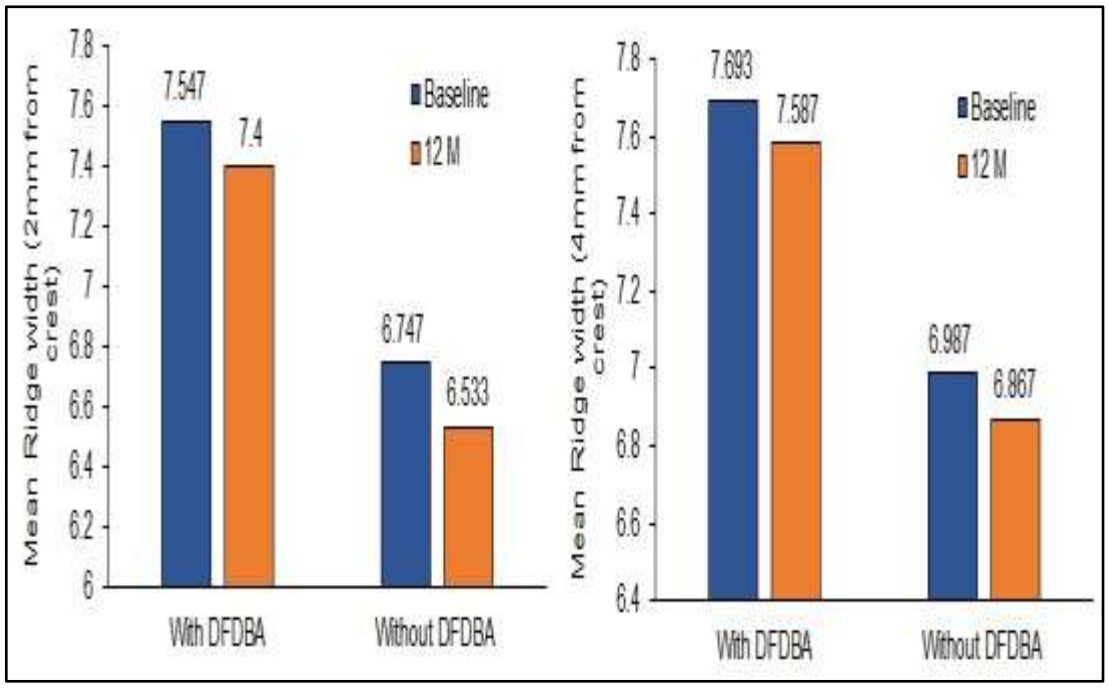


Figure 15: Column chart showing mean ridge width in two groups at baseline and 12 months

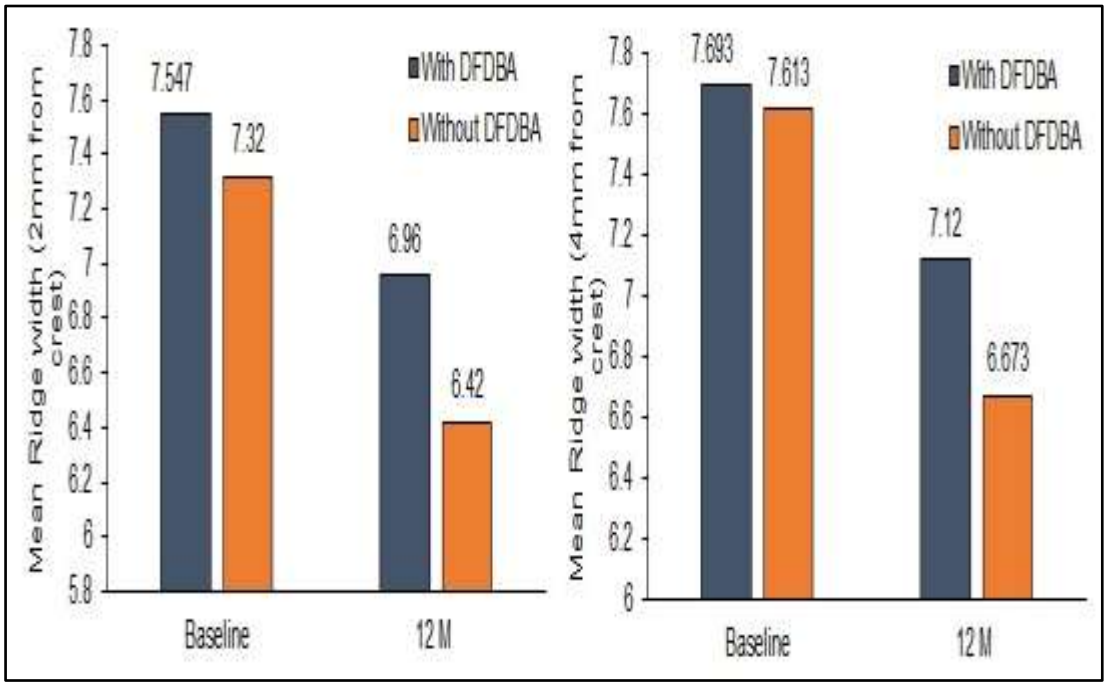


Figure 16: Column chart showing mean vertical distance in two groups at baseline and 12 months

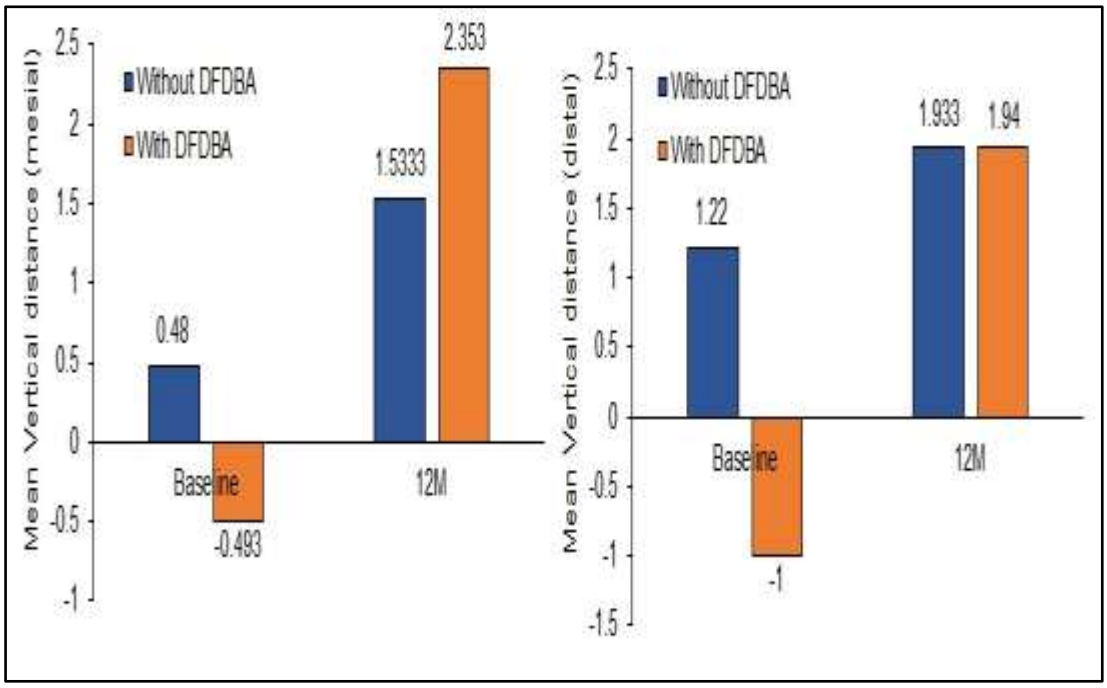


Figure 17: Column chart showing mean vertical distance in two groups at baseline and 12 months

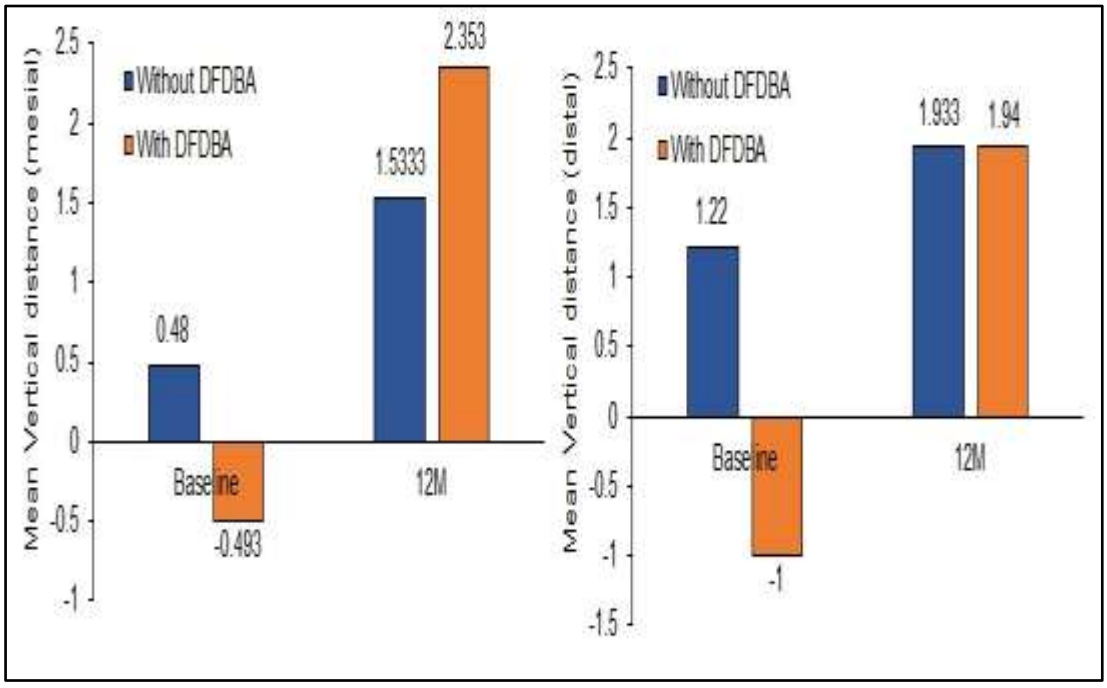


Figure 18: Column charts showing comparison of jumping gap measurement between baseline and 12 months in two groups

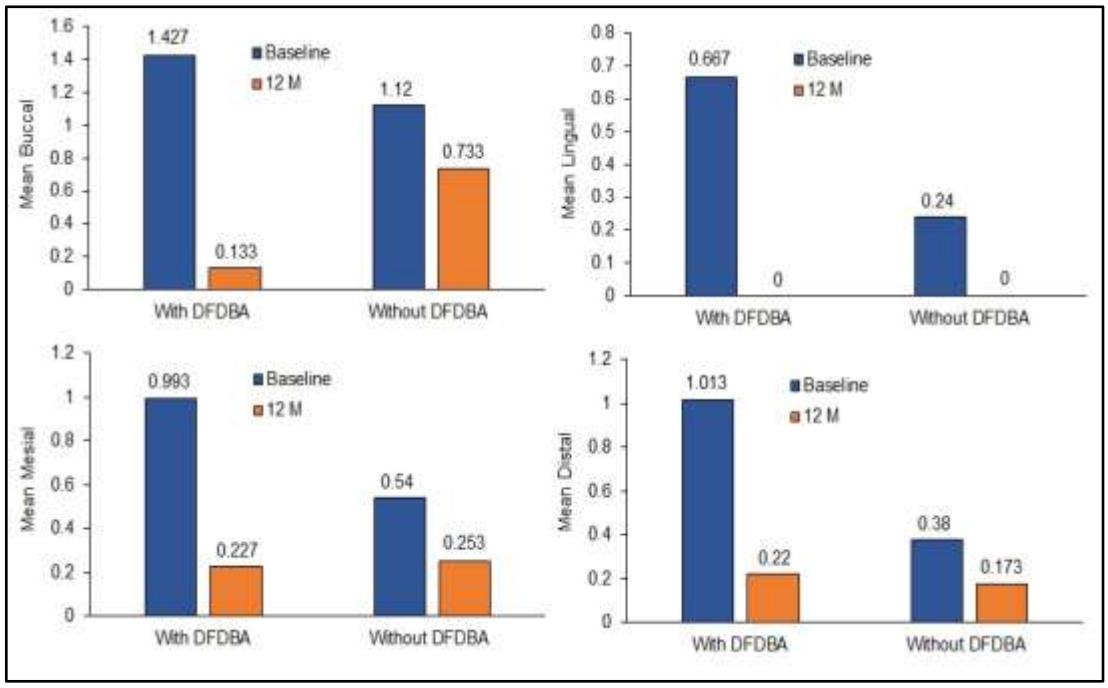
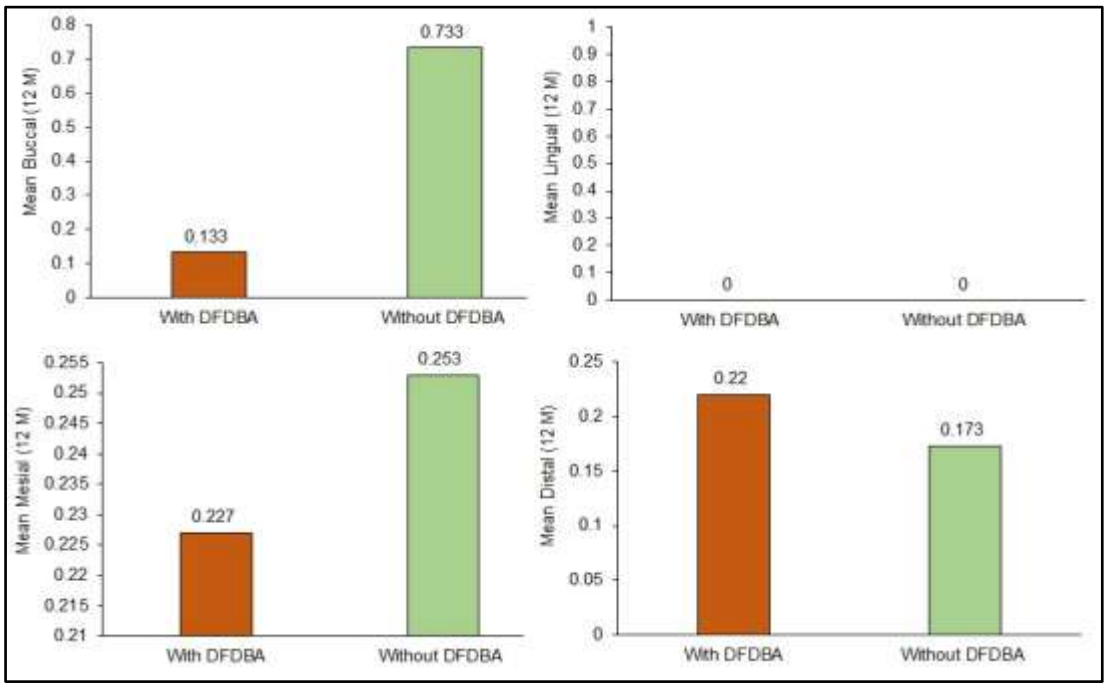


Figure 19: Column charts showing comparison of jumping gap measurement between baseline and 12 months in two groups



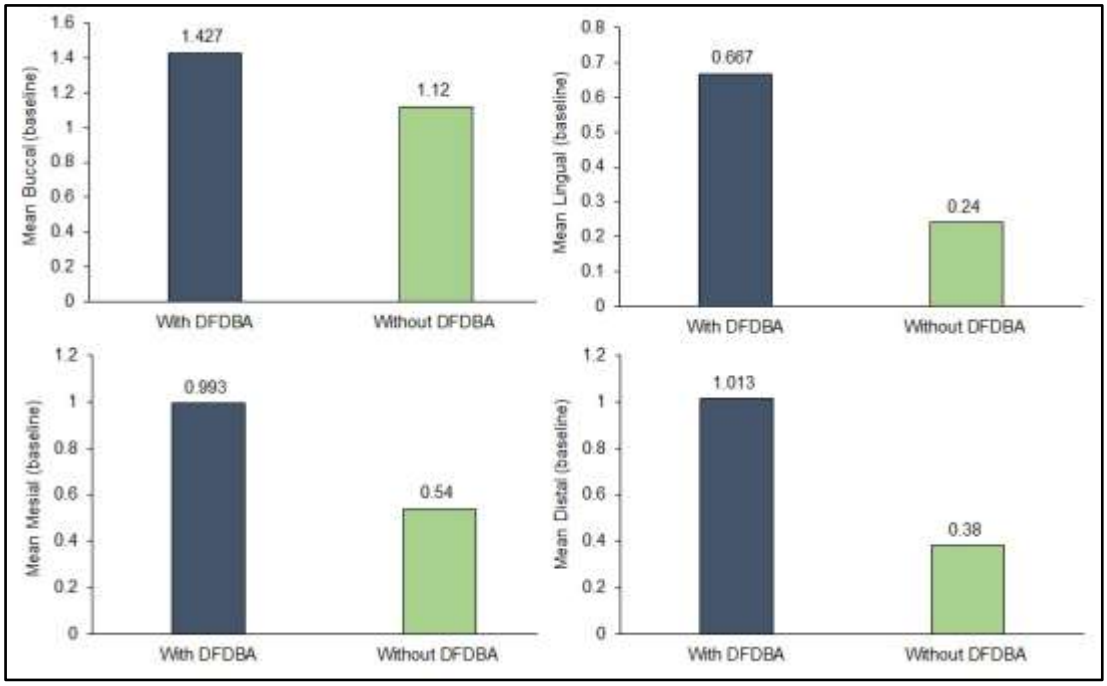


Figure 20: Column chart showing mean jumping gap according to side at baseline and 12M in two groups

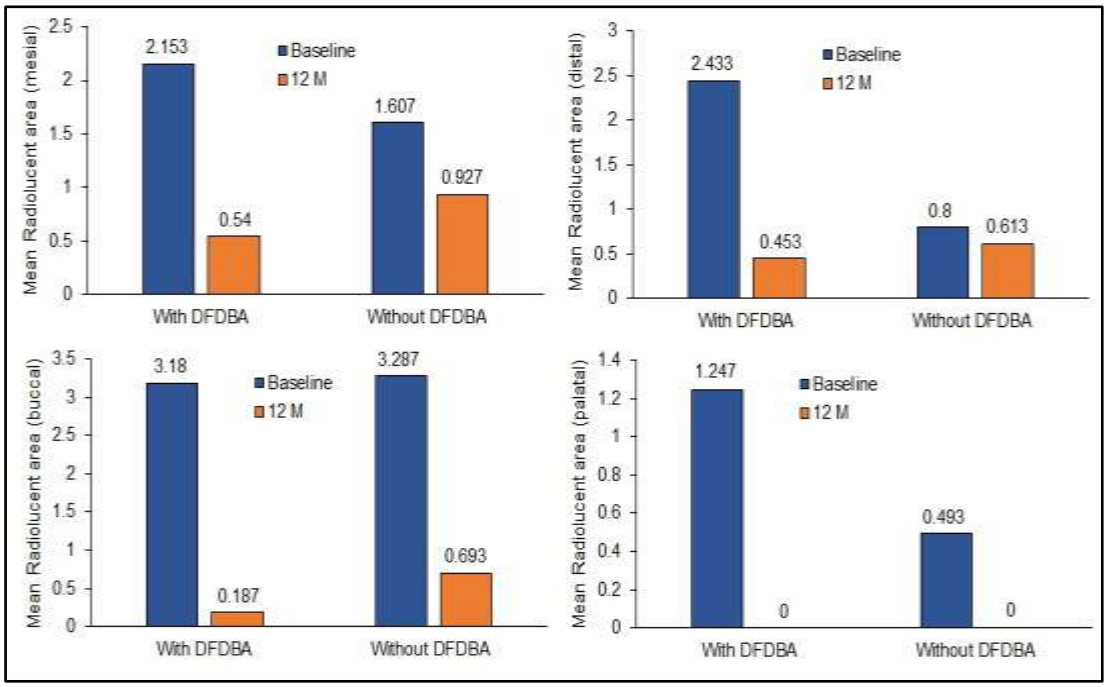
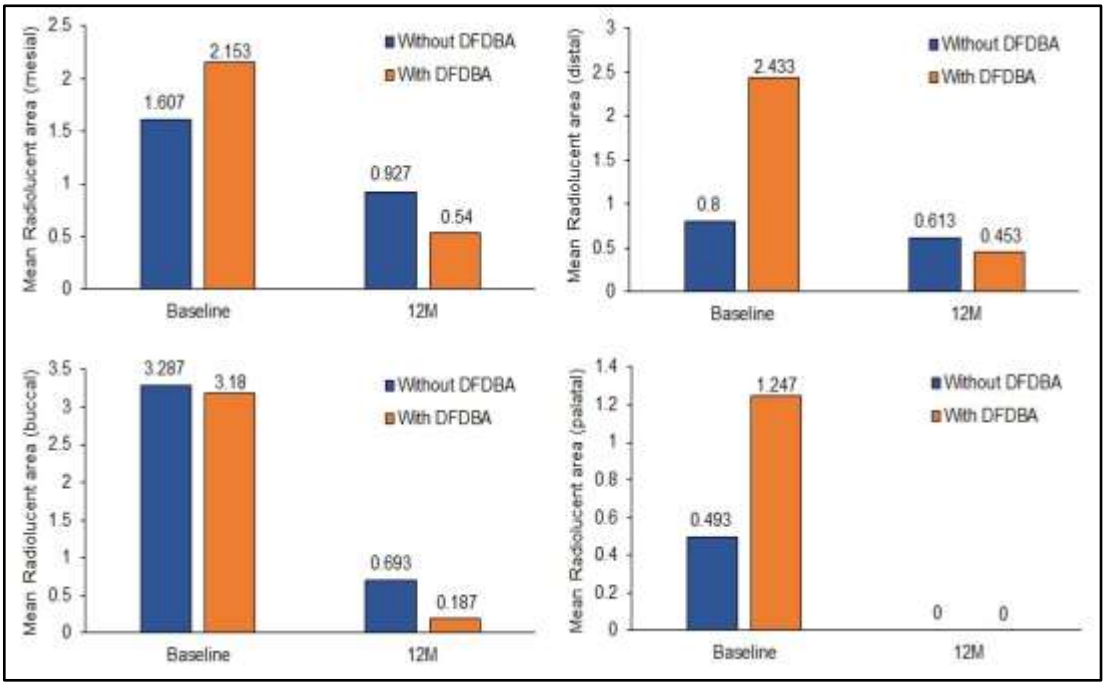


Figure 21: Column chart showing mean radiolucent area in two groups at baseline and 12 months



Demographic Data for Control Group

SR NO	Name	Age	Sex
1	Arun deshabtar	64	M
2	Arun deshabtar	64	M
3	Sushil Rawale	33	M
4	Kanor Pancheshwar	32	M
5	Umesh Daberao	29	M
6	Prabhakar Sant	65	M
7	SmitaDeshpande	48	F
8	Smita deshpande	48	F
9	Sushil rawale	33	M
10	Shamkala rangdale	46	F
11	Shamkala rangdale	46	F
12	Priya Balwani	39	F
13	Priya Balwani	39	F
14	shahista shah	32	F
15	Jayant deshmukh	42	M

Demographic Data for Test Group

SR NO	Name	Age	Sex
1	Ankit Pandey	30	M
2	Shailendra Godbole	29	M
3	Pooja shelke	42	F
4	Niraj bokade	28	M
5	Renu upadhaye	34	F
6	Jayant Deshmukh	42	M
7	Moreshwar Bhoyar	36	M
8	Ghanshyam Bhoskar	31	M
9	Prabhakar Sant	65	M
10	Harshwardhan Gadpale	62	M
11	satish rahate	46	M
12	indira wankhede	50	F
13	Jayant Deshmukh	42	M
14	Archana Sirsude	44	M
15	Purshottam Pandya	54	M

PI of Control Group

Sr. No	**Baseline**	**6 months**	**12 months**
1	1	0.89	0.75
2	0.8	0.89	0.75
3	0.8	1	0.75
4	0.5	0.5	0.58
5	1	0.87	1
6	1	0.5	1
7	1.39	1.09	1.7
8	1.08	1	1
9	1.08	1	1.06
10	0.95	1	1
11	1	0.75	0.58
12	1	0.87	0.5
13	0.8	0.5	0.75
14	0.95	0.5	0.58
15	1	0.87	1

PI in Test Group

Sr. No	**Baseline**	**6 months**	**12 months**
1	1	0.89	0.75
2	0.8	0.89	1
3	0.8	1	0.75
4	1.25	0.5	0.58
5	1	1	1
6	1	0.5	1
7	1.39	1.09	1.7
8	1.08	1	1
9	1.08	1	1.06
10	0.95	1	1
11	0.5	0.5	0.58
12	1	0.87	1
13	0.8	0.5	0.75
14	0.95	0.5	0.58
15	1	0.87	1

GI in Control Group

Sr. No	Baseline	6 months	12 months
1	0.75	0.6	0.6
2	0.75	0.6	0.6
3	0.5	0.6	0.6
4	0.45	0.33	0.375
5	0.5	0.5	0.89
6	0.5	0.5	0.5
7	0.45	0.75	0.375
8	0.5	0.5	0.89
9	0.69	0.5	0.89
10	1	0.6	0.5
11	0.69	0.6	1
12	1	0.75	1
13	0.75	0.6	0.6
14	0.45	0.33	0.375
15	0.75	0.5	0.89

GI Test Group

Sr. No	Baseline	6 months	12 months
1	0.75	1	1
2	0.75	0.6	0.6
3	0.5	0.75	0.6
4	1	0.33	0.375
5	0.5	1	0.89
6	1	0.5	0.5
7	0.45	0.33	0.375
8	1	0.5	0.89
9	0.69	0.5	0.89
10	0.69	0.6	1
11	0.69	0.6	1
12	1	0.75	1
13	0.75	0.6	0.6
14	0.45	0.33	0.375
15	0.75	0.5	0.89

PPD in Control Group

Sr. No	Baseline	6 months	12 months
1	0.75	1	1
2	0.75	0.6	0.6
3	0.5	0.75	0.6
4	1	0.33	0.375
5	0.5	1	0.89
6	1	0.5	0.5
7	0.45	0.33	0.375
8	1	0.5	0.89
9	0.69	0.5	0.89
10	0.69	0.6	1
11	0.69	0.6	1
12	1	0.75	1
13	0.75	0.6	0.6
14	0.45	0.33	0.375
15	0.75	0.5	0.89

PPD in Test Group

Sr. No	**Baseline**	**6 months**	**12 months**
1	2	2.5	2.5
2	1.75	2.5	2
3	1.25	1.5	1.5
4	1.75	1.5	2
5	1.5	1.25	1.25
6	1.5	2	1.5
7	1	1.5	1.5
8	1.75	1.25	1.25
9	1	1.25	1.25
10	1.75	1.75	1.75
11	1.75	1.5	1.5
12	1.75	2	2
13	2	2	2
14	1.5	2	2
15	1.5	1.25	1

GT in Control Group

Sr. No	Baseline		12 months	
	Labial	Lingual/ palatal	Labial	Lingual/ palatal
1	0.9	2.1	1	2.1
2	1.1	1.9	1.2	1.9
3	0.8	2	0.8	2
4	1	1.8	1	1.8
5	1	2.2	1	2.2
6	0.9	2.1	1	2.1
7	1	2.4	1	2.4
8	1.2	1.9	1.3	1.9
9	0.8	2	0.8	2
10	1	1.7	1	1.7
11	0.9	2	0.9	2.1
12	1.2	2.1	1.2	2.1
13	1	1.9	1	1.9
14	0.8	2.3	0.8	2.3
15	1.2	2.2	1.2	2.2

GT in Test Group

Sr. No	**Baseline**		**12 months**	
	Labial	Lingual/ palatal	Labial	Lingual/ palatal
1	0.8	1.9	0.8	1.9
2	0.8	1.8	0.8	1.8
3	0.7	2.2	0.8	2.2
4	1	2.3	1	2.3
5	0.8	1.9	0.8	1.9
6	0.9	2	0.9	2
7	0.9	2.1	0.9	2.1
8	1.2	1.9	1.2	1.9
9	1	2.3	1	2.3
10	0.8	1.9	0.8	1.9
11	0.9	2	0.9	2
12	0.9	1.7	0.9	1.7
13	0.8	1.9	0.8	1.9
14	0.8	1.8	0.8	1.8
15	0.7	2.2	0.8	2.2

RW in Control Group

Sr. No.	Baseline		6 Months		12 Months	
	At 2mm	At 4mm	At 2mm	At 4mm	At 2mm	At 4mm
1	10.5	10.6	9.2	9.3	8.8	9
2	10.7	10..7	9.4	9.4	8.9	9..1
3	10.3	10.5	9	9.2	7.4	7.8
4	10.4	10.6	9.1	9.3	7.9	8.1
5	10.3	10.5	9	9.2	7.8	8.1
6	10.2	10.4	8.9	9.1	8.4	8.7
7	9.5	9.7	8	8.2	7.6	8
8	9.4	9.6	7.9	8.1	7.6	7.8
9	9.5	9.8	8	8.3	7.7	8
10	10.6	10.7	9.1	9.2	8.6	8.8
11	10.7	10.7	9.2	9.2	8.8	8.9
12	9.4	9.6	7.9	8.1	7.5	7.8
13	9.3	9.4	7.8	7.9	7.5	7.6
14	9.3	9.5	7.8	8	7.4	7.7
15	9.9	10	8.4	8.5	8	8.2

RW in Test Group

Sr. No.	Baseline		6 Months		12 Months	
	at 2mm	**at 4mm**	**At 2mm**	**At 4mm**	**At 2mm**	**At 4mm**
1	10.2	10.4	9.1	9.3	8.9	9.1
2	8.9	9.2	7.8	8.1	7.7	8
3	10.4	10.4	9.3	9.3	9	9.2
4	10.4	10.4	9.3	9.3	9.2	9.2
5	11.4	11.6	10.3	10.5	10	10.4
6	11.3	11.5	10.2	10.4	10	10.2
7	10.4	10.4	9.5	9.5	9.2	9.2
8	9.9	10.1	9	9.2	8.7	8.9
9	10.3	10.6	9.4	9.7	9.1	9.4
10	10.9	11.1	10	10.2	9.7	9.9
11	11.2	11.4	10.3	10..5	10	10.2
12	10.1	10.3	9.2	9.4	8.8	9.1
13	10	10	9.2	9.1	8.8	8.8
14	10.8	11	9.9	10.1	9.4	9.7
15	10.4	10.5	9.5	9.6	9.1	9.2

TS Score in Control Group

Sr. No	Baseline	6 months	12 months
1	8	6	6
2	7	6	6
3	7	6	6
4	7	6	6
5	8	7	6
6	8	7	7
7	7	6	6
8	7	5	6
9	7	6	6
10	8	6	6
11	7	6	7
12	7	7	7
13	7	7	6
14	8	7	7
15	7	7	6

TS in Test Group

Sr. No	Baseline	6 months	12 months
1	8	6	8
2	6	6	7
3	6	7	7
4	7	6	8
5	8	6	8
6	6	6	7
7	6	6	7
8	6	6	7
9	6	6	7
10	5	6	6
11	6	6	7
12	6	6	7
13	7	6	7
14	6	6	7
15	7	6	7

CBH in Control Group at Baseline and 12 Month

SR.NO	CBH at Base Line			CBH at 12Month		
	Mesial	**Midfacial**	**Distal**	**Mesial**	**Midfacial**	**Distal**
1	0	0	0	-0.6	-1.1	-0.5
2	0	0	0	0	-1.3	-0.8
3	0	0	0	0	-0.8	0
4	0	0	0	0	-1.4	0
5	0	0	0	0	-1.1	0
6	0	0	0	0	-1.2	-1
7	0	0	0	0	-0.4	0
8	0	0	0	0	-0.5	0
9	0	0	0	0	-0.4	0
10	0	0	0	-0.4	-0.6	0
11	0	0	0	0	-0.6	-0.3
12	0	0	0	0	-0.4	0
13	-0.9	0	0	0	-0.7	0
14	-0.9	0	0	0	-0.8	-0.2
15	0	0	0	0	-0.5	0

CBH in Test Group at Baseline and 12 Month

SR.NO	CBH at Base Line			CBH at 12Month		
	Mesial	**Midfacial**	**Distal**	**Mesial**	**Midfacial**	**Distal**
1	0	0	0	0	-0.4	0
2	0	0	0	0	-0.3	0
3	0	0	0	0	-0.4	0
4	0	0	0	0	-0.3	0
5	0	0	0	0	-0.5	0
6	0	0	0	0	-0.5	0
7	0	0	0	0	0	0
8	0	0	0	0	-0.3	0
9	0	0	0	0	0	-1
10	0	0	0	0	-0.2	0
11	0	0	0	0	-0.2	0
12	0	0	0	0	-0.2	0
13	0	0	0	0	0	0
14	0	0	0	0	-0.4	0
15	0	0	0	0	-0.5	0

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BBT in Control Group at Baseline and 12 Months

SR.NO	BBT at Base Line			BBT at 12Month		
	At Crest	5mm from crest	10mm from crest	At Crest	5mm from crest	10mm from crest
1	0.8	2.7	5.5	2.1	2.7	5.5
2	1	3.5	5	2.3	3.5	5
3	1.3	1.7	0.9	2.6	1.9	1.1
4	1	1.2	2.6	2.1	1.2	2.6
5	1.1	0.7	1.4	2.3	0.7	1.4
6	1.2	1.7	1.5	3.5	2.5	1.5
7	0.6	1	3.6	0.8	1	3.6
8	0.8	1.1	3.4	1	1.3	3.4
9	1.1	1.8	0.8	1.3	1.8	0.8
10	1	0.9	1.9	1.2	1.1	1.9
11	0.7	1	1.7	1.1	1.3	1.7
12	0.9	1.2	1.6	1.1	1.4	1.6
13	0.8	1	1.8	0.8	1	1.8
14	0.5	0.8	2.7	0	0	2.7
15	1	0.8	0.8	1.3	0.8	0.8

BBT in Test group at Baseline and 12 Months

SR.NO	BBT at Base Line			BBT at 12Month		
	At Crest	5mm from crest	10mm from crest	At Crest	5mm from crest	10mm from crest
1	0.7	0.9	0.5	2	1.2	0.6
2	0.7	0.7	2.2	2.1	1.3	2.2
3	0.8	0.7	1.4	2.5	1.4	0.9
4	0.7	1.4	2.2	2.2	2	2.3
5	0.6	0.8	0.6	2.5	1.7	0.9
6	0.8	1.2	1.6	2.4	1.9	1.6
7	0.7	2.1	4	0.7	2.1	4
8	0.8	0.7	1	1.1	0.9	1
9	3.5	2.5	1.5	3.5	2.5	1.5
10	1.8	1.6	1.7	2.3	1.9	1.7
11	1.8	2.6	3.8	2.8	3.3	3.8
12	1.1	1.3	1.5	1.1	1.3	1.5
13	0.7	2.1	4	0.7	2.1	4
14	1.8	1.6	1.7	1.8	1.6	1.7
15	0.7	2.1	4	0.7	2.1	4

RW in Control Group at Baseline and 12 Months

SR. NO	RW at Baseline		RW at 12 Month	
	2mm from crest	4mm from crest	2mm from crest	4mm from crest
1	7.8	8.2	7.2	7.8
2	7.8	8.3	7.3	7.5
3	7.1	7.5	6.2	6.3
4	7.3	7.4	6.2	6.6
5	7.3	7.6	6.2	6.6
6	7.6	7.8	7.2	7.4
7	7.2	7.4	5.7	6
8	7.1	7.5	5.9	6.3
9	7.2	7.5	6	6.2
10	7.3	7.7	7	7.2
11	7.3	7.6	7	7.1
12	7.1	7.4	6	6.2
13	7.3	7.4	5.9	6.1
14	7.2	7.5	6.1	6.2
15	7.2	7.4	6.4	6.6

RW in Test group at Baseline and 12 Months

SR. NO	RW at Baseline		RW at 12 Month	
	2mm from crest	4mm from crest	2mm from crest	4mm from crest
1	7.8	8	7	7.2
2	6.5	6.8	6	6.2
3	8.2	7.8	7.6	7.3
4	7.8	8	7.2	7.5
5	8.9	8.8	7.9	7.6
6	9	9.2	8.4	8.6
7	7.2	7.4	6.6	7
8	6.8	7	6.4	6.6
9	7.8	8	7.2	7.6
10	8	8.2	7.4	7.5
11	8.1	8.3	7.6	7.8
12	6.5	6.7	6.1	6.3
13	7	7.2	6.4	6.6
14	6.6	6.8	6.2	6.4
15	7	7.2	6.4	6.6

VD in Control Group at Baseline and 12 Months

SR.NO	RW at Baseline		RW at 12 Month	
	Mesial	**Distal**	**Mesial**	**Distal**
1	-2.3	-0.7	1.9	2
2	-1.9	-1.7	2.5	1.7
3	-2.2	-2.9	2.5	2.5
4	2.5	2.5	2.5	2.5
5	-1.9	-1.6	0	1.9
6	2.5	2.5	-3.3	0
7	1	2.5	2.5	2.5
8	0.8	2.5	2.5	2.5
9	2.5	1.8	2.5	2.5
10	-0.6	2.5	2.5	2.5
11	-0.9	2.5	2.5	2.5
12	2	2.5	2.2	2.5
13	1.8	2.5	0.8	2.5
14	2.5	2.5	0	0
15	1.4	0.9	1.4	0.9

VD in Test group at Baseline and 12 Months

SR.NO	VD at Baseline		VD at 12 Month	
	Mesial	**Distal**	**Mesial**	**Distal**
1	-1.9	-0.9	2.3	2.5
2	2.5	1.9	2.5	1.9
3	-1.2	-1.3	2.3	2.5
4	-1.8	-1	2.2	2.4
5	-1.4	-2.7	2.5	2.5
6	-0.6	-3.1	2.5	2.2
7	-0.7	-4.9	2.2	2.3
8	2	1.5	2.5	2.5
9	-3.3	0	2	0
10	-0.5	1.4	2.5	2.5
11	-0.4	-0.7	2.5	2.5
12	-1.4	-1	2.5	2.1
13	2.5	-1.8	2.5	-1.8
14	-0.5	-1.4	2.1	2.5
15	-0.7	-1	2.2	2.5

JG in Control Group at Baseline and 12 Months

SR. NO	**JG at Baseline**				**JG at 12 Month**			
	Buccal	Lingual /palatal	Mesial	Distal	Buccal	Lingual /palatal	Mesial	Distal
1	2.1	1.4	1.4	0.8	1	0	0.3	0.4
2	2	1.7	0	0.9	1	0	0.4	0.5
3	2.1	0	0.6	1	2	0	0	0
4	2	0	0	0	1	0	0	0
5	2	0	0.8	0.6	2	0	0.8	0.6
6	2.2	0	0	0	2	0	0.8	0
7	0.4	0	1.1	0	0	0	0	0
8	0.6	0	0.7	0	0	0	0	0
9	0.5	0	0	1	1	0	0	0
10	0.6	0.2	0.7	0	0	0	0.3	0
11	0.9	0	0.5	0	0	0	0	0
12	0.4	0	0.6	0	1	0	0	0
13	0.5	0.3	0.5	0	0	0	0.3	0
14	0.2	0	0.8	0.7	0	0	0.5	0.4
15	0.3	0	0.4	0.7	0	0	0.4	0.7

RA in Control Group at Baseline and 12 Months

SR. NO	**RA at Baseline**				**RA at 12 Month**			
	Buccal	Lingual /palatal	Mesial	Distal	Buccal	Lingual /palatal	Mesial	Distal
1	2.1	1.4	1.4	0.8	0.9	0	1.5	2.5
2	2	1.7	0	0.9	1.2	0	2.1	1.9
3	2.1	0	0.6	1	1	0	1.2	0
4	2	0	0	0	1.3	0	1.3	0
5	2	0	0.8	0.6	2	0	1.8	1.8
6	2.2	0	0	0	1.1	0	1.9	0
7	0.4	0	1.1	0	0.4	0	0	0
8	0.6	0	0.7	0	0.3	0	0	0
9	0.5	0	0	1	0.6	0	0	0
10	0.6	0.2	0.7	0	0	0	0.7	0
11	0.9	0	0.5	0	0.4	0	0	0
12	0.4	0	0.6	0	0.5	0	0.4	0
13	0.5	0.3	0.5	0	0	0	0.8	0
14	0.2	0	0.8	0.7	0.3	0	1.5	1.3
15	0.3	0	0.4	0.7	0.4	0	0.8	1.7

RA in Test Group at Baseline and 12 Months

SR. NO	**RA at Baseline**				**RA at 12 Month**			
	Buccal	Lingual /palatal	Mesial	Distal	Buccal	Lingual /palatal	Mesial	Distal
1	4.3	2.6	5.6	1.7	0.4	0	1.3	0
2	4.7	0	0	3.3	0.3	0	0	3.3
3	4.2	3.2	3	2.5	0.5	0	1.4	0
4	3.2	2.4	3.3	5.2	0.3	0	0.9	0.7
5	5.1	2.1	2.5	1.2	0.4	0	0	0
6	5.7	0	1	3	0.4	0	0.7	0.4
7	2	2.8	3.4	9.8	0	0	0.6	0.8
8	2.9	0	0.7	1	0	0	0	0
9	2.4	0	4.1	0	0	0	1.1	0
10	2.1	1.6	1.6	1.4	0.2	0	0	0
11	2.3	0	2.1	2.8	0.3	0	0	0
12	2.4	0	2	1.7	0	0	0	1.6
13	2.3	0	0	0	0	0	0	0
14	1.9	1.2	1.6	1.4	0	0	0.7	0
15	2.2	2.8	1.4	1.5	0	0	1.4	0

JG in Test Group at Baseline and 12 Months

SR. NO	**JG at Baseline**				**JG at 12 Month**			
	Buccal	Lingual /palatal	Mesial	Distal	Buccal	Lingual /palatal	Mesial	Distal
1	2.2	1.3	2.3	1.5	0	0	0.6	0
2	2.4	0	0	1.9	0	0	0	1.9
3	2.3	1.9	1.5	0.5	1	0	0.3	0
4	2.1	1.7	1.7	1.7	0	0	0.3	0.3
5	2.6	1.3	2.5	1.2	0	0	0	0
6	2.9	0	0.6	1	1	0	0.6	0.3
7	0.5	1.3	1.1	1.8	0	0	0.3	0.4
8	0.6	0	0.8	0.8	0	0	0	0
9	0.8	0	0.8	0	0	0	0.4	0
10	0.9	0.6	0.8	1.3	0	0	0	0
11	1.2	0	0.6	0.7	0	0	0	0
12	1	0	0.7	0.9	0	0	0	0.4
13	0.5	0	0	0	0	0	0	0
14	0.9	0.6	0.8	1.3	0	0	0.3	0
15	0.5	1.3	0.7	0.6	0	0	0.6	0

CASE HISTORY PROFORMA

Comparative evaluation of hard and soft tissue changes in immediate implant placement using flapless approach with and without Demineralised freeze dried bone allograft clinically and radiographically using Cone Beam Computed Tomography.

NAME: **OPDNO:**

AGE/SEX: **DATE:**

ADDRESS: **PHONENO:**

OCCUPATION:

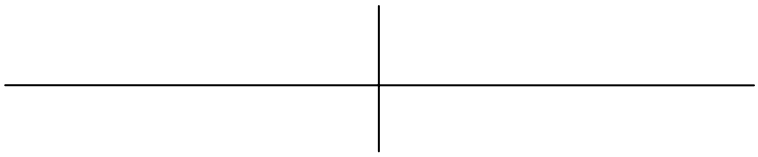
CHIEF COMPLAINT:

PAST DENTAL HISTORY:

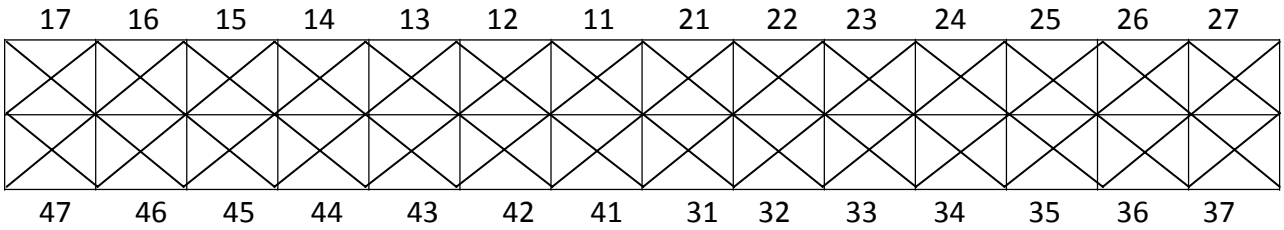
PAST MEDICAL ORY:

ORAL HYGIENE HABIT:

TEETH PRESENT:



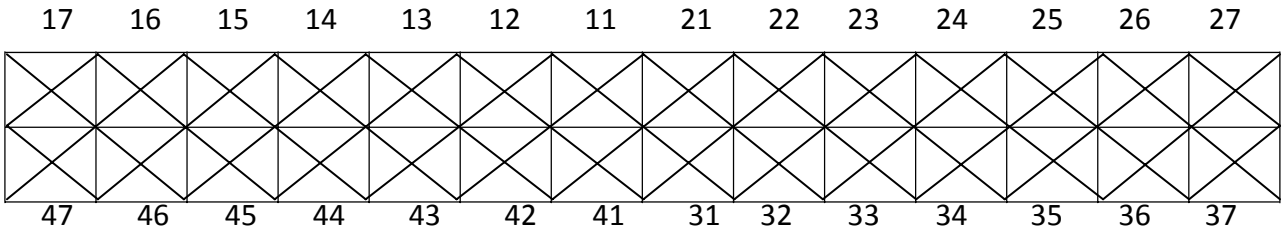
PLAQUE INDEX *(Sillness and Loe 1964)* Baseline



$$\frac{\text{Total scores of all teeth}}{\text{Total number of teeth examined}}$$

SCORE:

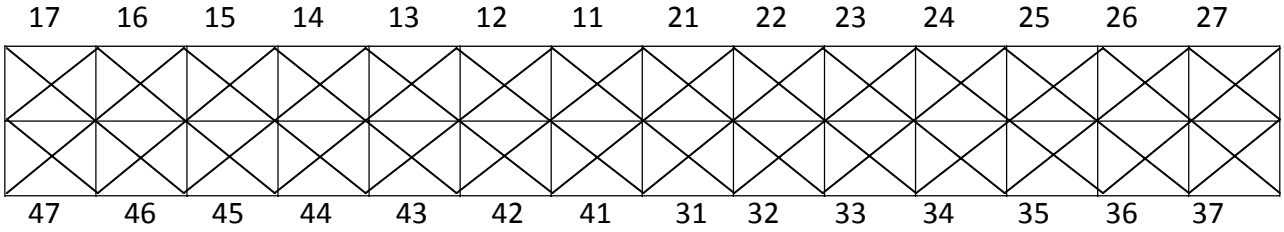
PLAQUE INDEX *(Sillness and Loe 1964)* *at* 6 months



$$\frac{\text{Total scores of all teeth}}{\text{Total number of teeth examined}}$$

SCORE:

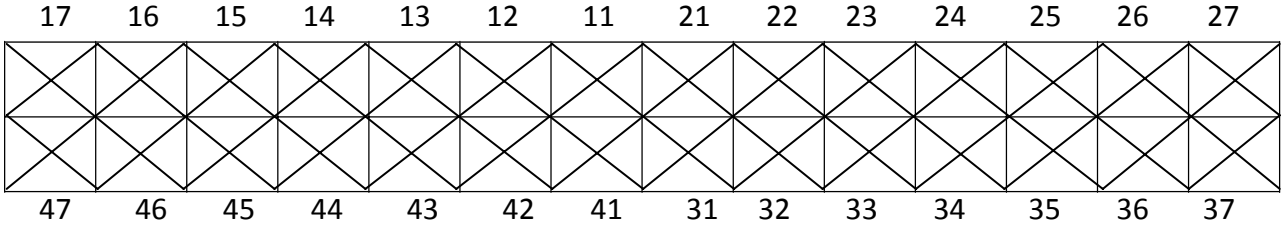
PLAQUE INDEX *(Sillness and Loe 1964)at* 12 months



$$\frac{\text{Total scores of all teeth}}{\text{Total number of teeth examined}}$$

SCORE:

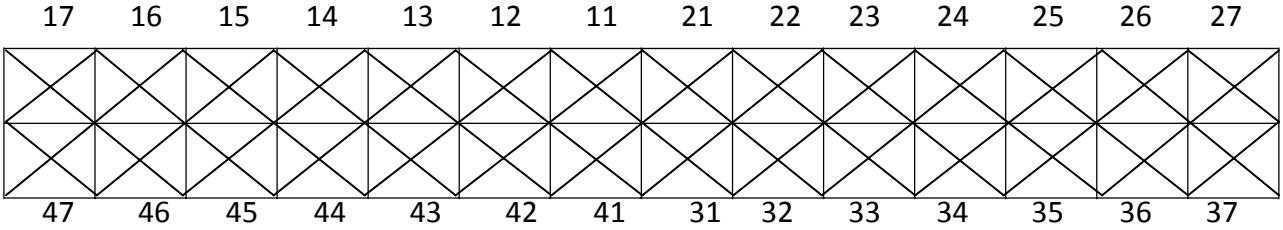
GINGIVAL INDEX *(Loe and Sillness 1963)* Baseline



$$\frac{\text{Total scores of all teeth}}{\text{Total number of teeth examined}}$$

SCORE:

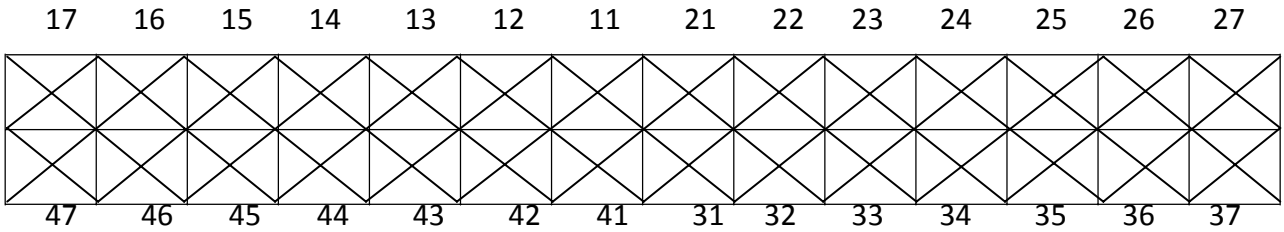
GINGIVAL INDEX *(Loe and Sillness 1963)* *at* 6 months



$$\frac{\text{Total scores of all teeth}}{\text{Total number of teeth examined}}$$

SCORE:

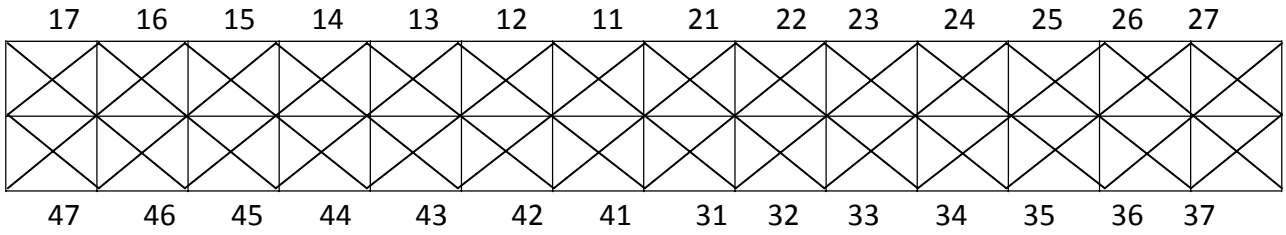
GINGIVAL INDEX *(Loe and Sillness 1963)* at 12 months



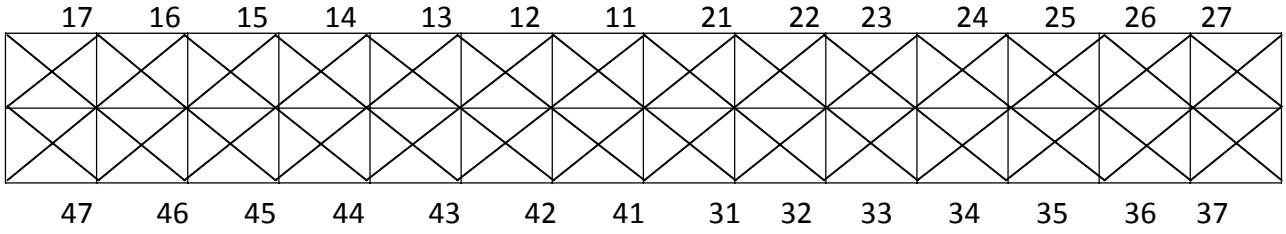
$$\frac{\text{Total scores of all teeth}}{\text{Total number of teeth examined}}$$

SCORE

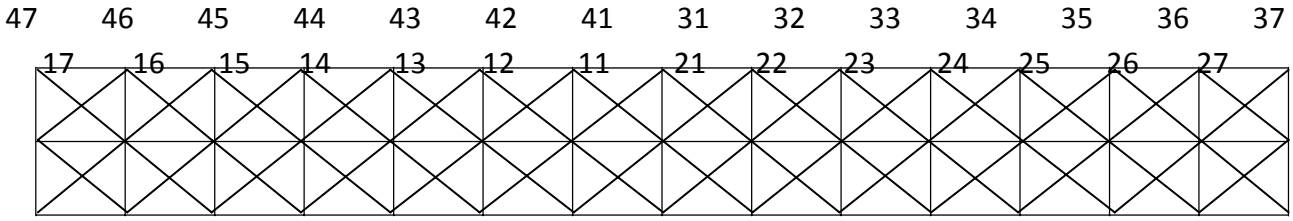
PROBING POCKET DEPTH (mm): Baseline



PROBING POCKET DEPTH (mm): at 3 months



PROBING POCKET DEPTH (mm): at 6 months



CLINICAL FINDINGS:

A) Soft Tissue Assesment

1) According Testori Score)

Soft tissue parameter	Baseline	At 6 months	At 12 months
Presence of mesial and distal papilla			
Stability of mesial and distal papilla			
Texture of Peri-Implant soft tissue			
Colour of Peri-Implant soft tissue			

Gingival Countour			

2)Thickness of Gingiva using CBCT

Site	Baseline	At 12 months
Labial		
Palatal/Lingual		

3)Ridge Width (RW)

Using Bone Gauge

RW	At Baseline	At 12 Months
2mm from crest		
4mm from crest		

B)Hard Tissue Findings (Using CBCT)

1) Crestal Bone Height (CBH)

Parameter	At Baseline from CEJ			At 12 Months from CEJ		
	Mesial	Midfacial	Distal	Mesial	Midfacial	Distal
CBH						

2) Buccal Bone Thickness

Site	Baseline	At 12Months
At Crest		
5mm from Crest		
10mm From Crest		

3) Ridge Width (RW)

RW	At Baseline	At 12 Months
2mm from crest		
4mm from crest		

	Baseline	At12Month
Mesial		
Distal		

1) Amount of Mesial Bone loss - mm

2)Amount of Distal Bone loss - mm

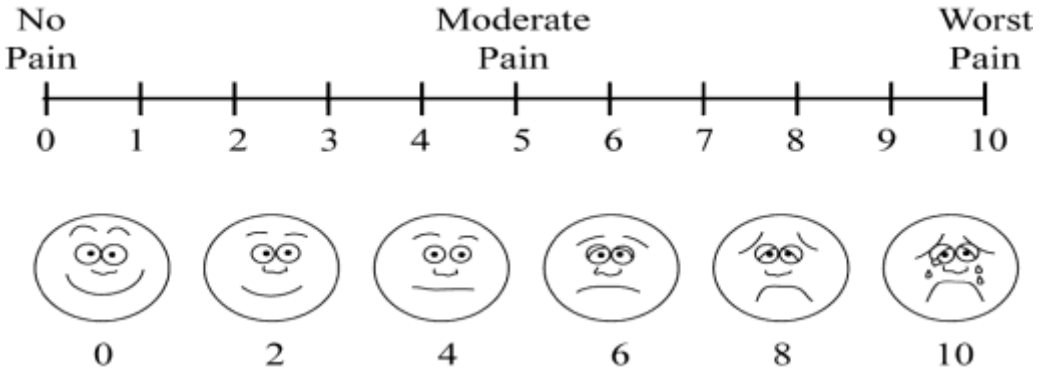
5) Jumping Gap Measurment

Site	Baseline	At 12 months
Buccal		
Palatal/Lingual		
Mesial		
Distal		

6) Measuring the radiolucent area between shoulder of implant and bone crest.

Basline	At 12 Months
mm2	mm2

7) VAS Scale



VAS SCORE	

9) IMPLANT SPECIFICATIONS

(Confidential)

Informed Consent Form

Comparative evaluation of hard and soft tissue changes in immediate implant placement using flapless approach with and without Demineralised freeze dried bone allograft clinically and radiographically using Cone beam computed tomography .

NAME: Mr./Master/Mrs./Miss._____

Resident of: _____

_____aged_____years,

exercising my free will/choice, without any pressure/lure of incentive in any form, hereby give my consent for the project to be conducted by **Dr. Mukesh J Purohit**

I acknowledge the receipt of "patient's information sheet", and also the doctor has informed me about this research project suitably and sufficiently to my satisfaction.

I agree to undergo the surgical placement of dental implants upon me with or without demineralised freeze dried bone allograft(DFDBA),Potenial benefit, risk and complication related to material used in surgry have been explained to me

I authorize placement of implants in the areas of teeth_____.

I have chosen to undergo this procedurefter considering the alternative forms of treatment for mycondition, which include no treatment at all, complete or partial dentures, or fixed or removable bridges. Each of these alternative forms of treatment has its own potential benefits, risks and complications which have been explained to me.

I agree to let my X-rays, photographs, blood investigations, other investigations to be taken as required.

I am aware that in comparison to conventional radiograph the CBCT scan will involve moreradiation exposure but at the same time it will give more detail of implant placement site thus enabling a better treatment.

I consent to the administration of anesthesia or other medications before, during or after the procedure by qualified personnel. I understand that all anesthetics or sedation medications include the very rare potential of risks or complications, such as damage to vital organs including the brain, heart, lungs, liver and kidneys; paralysis; cardiac arrest; and/or death from both known and unknown causes.

I understand that there are potential risks, complications and side effects associated with any dental procedure. Although it is impossible to list every potential risk, complication and side effect, I have been informed of some of the possible risks, complications and side effects of dental implant surgery.

I agree to take part in this project and will not mix any other projects during the period of this trial. I shall report to the dental hospital or other place where called on given appointment datesand time.

I certify that I have read or had read to me the contents of this form.

_____Date _____

Patient /legally authorized representative signature