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Original research article

A Retrospective assessment of the Ridge Split using Piezotome in ridge resorbed edentulous region of Maxilla and Mandible followed by Immediate Implant placement

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Abstract

Aim: The aim of the present study to determine the Ridge Split with Piezotome in Deficient Edentulous Region of Maxilla and Mandible and Immediate Placement of Implant in Bihar region.

Methods: A retrospective study was conducted in the Department of Dentistry, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India, for 15 months. 30 patients of age 18-62 years, with partial or completelyedentulous alveolar ridges of insufficient alveolar ridge width (thin/ knife-edge ridges) of no less than 3 mm and indicated for a ridge augmentation by ridge split techniquewere included in the study. A standard aseptic surgical protocol was adopted in all thecases to place the implants. The IOPA's of all the patients were collected, at the time of implant placement and after 6 months post op. The length of the implant and the level of crestalbone on both mesial and distal sides are measured in millimeters (mm) with the help of a metallic scale.

Results: Out of 30 patients that were included 66.67% were female, inwhom 9 implants were placed in anterior maxilla, 11 implants in posterior mandible and 3 implant in posterior maxilla) and 33.33% were males in whom (6 implants were placed in anterior maxilla and 3 implant placed in posterior maxilla). Out of 32 implants, 6 implants were positive for percussion test and 3 implant shown lower ISQ value which resulted in the failure of the implant which was placed in the posterior maxilla. T-Test results were mean value for initial ridge width was 3.8 and the final ridge width was 7.5. The significantdifference is .001. In our study, the mean CRBL immediately at the time of implant placement in 0 months was .08 on the mesialaspect and 0.14 on the distal aspect. Mean CRBL value after 6 months was 0.57 on the mesial aspect and 0.45 on the distal aspect. There has been found a significant bone loss after 6 months of implant placement. P-value was 0.012 ($p<0.005$).

Conclusion: The modified ridge split technique in posterior mandible, anterior maxilla and posterior maxilla is a simple and predictable procedure with satisfactory results. Moreover, this approach is devoid of foreign materials usage and has a low rate cost, therefore, could be employed more often.

Keywords: CRBL, ISQ

Introduction

The posterior mandible has been referred to as ‘‘the most difficult region for reconstruction and early implant placement in cases of severe alveolar resorption in the maxillo-mandibular complex”.[1] In addition to complicating anatomic features, such as the inferior alveolar nerve, mental foramen, oblique ridge, and lingual undercut of the mylohyoid ridge, edentulous mandibular ridges have thicker cortices and decreased volumes of vascular trabecular bone than their maxillary counterparts.[2,3] Traditionally, resorbed alveolar ridges of the most severe nature have been treated with autogenous block graft.[4] Although these grafts can provide substantial augmentation, their use has been associated with patient morbidity at donor sites, and possibility of graft failure and, as such, alternative procedures yielding comparable gains to autogenous block grafts have been sought.[5] Ridge split technique in implant dentistry was introduced for the first time by Simion., et al. in 1992.[6] Further modifications of this technique have been done since 1992.[7] The ridge split is more proper to the maxilla than the mandible owing to the thinner cortical plates and softer medullary bone.[8] For creating split between the cortical plates, different osseous surgical tools such as hand and rotary instruments have been used. Piezo surgery instruments has been used successfully.[9,10] The problems mostly occurring in lower jaw are that cortical expansion is obtained by lingual displacement of lingual plates, and the buccal cortical plates will expand minimally.[10] Also, there is a high risk of malfracture of the osteomized buccal segment because of the lower flexibility and thicker cortical plates.[11] that’s why corticotomy of a rectangular buccal segment and staged ridge splitting technique are two ways to overcome these problems.[12] In the mandible, in order to achieve a safe and predictable ridge splitting, there must be no vertical bone defect. Also, there should be at least 3 mm of bone width, including at least 1 mm of cancellous bone. This minimum cancellous bone width is desired to insert a bone chisel and consequently expanding the cortical bones. Moreover, there should be abundant bone height superior to the mandibular canal (> 12 mm).[8] Once the buccal cortex is laterally positioned after greenstick fracture, the space between the buccal and lingual cortical plates can be filled with either autologous, allogenic, alloplastic graft materials, or without any graft material[13] Placement of bone substitutes in intercortical space (interposition bone grafting) has advantages of internal perfusion, prevention from particle migration and displacement, omission of the need for donor site and fixation screw and reduction of graft resorption probability.[6,14] Modification of ridge split technique in posterior mandible has done and published in the Annual Journal of Oral and Maxillofacial Surgery 2014 in which the bone plates were maintained in place by using small bone chips inserted deep in between the separated cortical plates. The gap was between 3 and 5 mm and was left to be filled with a blood clot giving the opportunity for normal wound healing resembling an extraction socket. Depending upon the fact that fresh extraction sockets in posterior mandible areas are always wider than 5 mm and they heal by secondary intension without the need for bone grafting or using guided regeneration techniques.[14]

Material and methods

A retrospective study was conducted in the Department of Dentistry, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India, for 15 months, after taking the approval of the protocol review committee.

Methodology

Total 30 patients of age 18-62 years, with partial or completelyedentulous alveolar ridges of insufficient alveolar ridge width (thin/ knife-edge ridges) of no less than 3 mm and indicated for a ridge augmentation by ridge split techniquewere included in the study. Patients with insufficient alveolar ridge height for implant placement without violation of implant crown ratio, immunocompromised patients, chronic smokers, infections/pathological conditions at the

planned surgical site, medically compromised patients, and poor oral hygiene were excluded. Preoperative clinical assessment of the ridge width was done with calipers and radiological assessment of the height and width of the residual bone ridge was done with CBCT.

Methodology

A standard aseptic surgical protocol was adopted in all thecases to place the implants. Under local Anesthesia, a mid-crestal incision was given over the edentulous area and vertical releasing incisions were given on both sides for reflection of a full thickness mucoperiosteal flap. Mid-crestal osteotomy with a piezotome was performed intothe alveolar ridge. This osteotomy was extended as far as the narrow alveolar crest present. Two vertical cuts were then used on the proximal and distal ends of the mid- crestal osteotomy. Vertical osteotomies were deepened 3 mm through the cortical bone with preservation of intact cancellous bone. A green-stick fracture of thecephalad (maxilla) / caudal (mandible) horizontal corticotomy was carried out with the introduction of a thin chisel. Following this maneuver, progressive thick osteotomes were introduced between buccal and palatal orlingual cortical plates in order to obtain the desired widening of the inter-cortical gap. The sequential introduction of the osteotomes from a smaller to bigger width allowed safer and more controlled splitting of the alveolar ridge. Finger pressure was applied to stabilize the facial plate of bone. After establishing the initial ridge split, spiral drills were used to enlarge the implant osteotomy. After preparation of the implant osteotomysite, the implant was transferred on the respective site. Gaps around the implant were filled with hydroxyapatite bone graft and closure done. The second stage surgery was done after a healing period of 6 months. The implant was exposed without damaging the surrounding bone.

Primary implant stability was assessed with the help of reverse torque test at the time of the placement of the implant. The post-operative assessment was done to clinically measure alveolar ridge width by physicalcaliper. Crestal bone loss was assessed on intraoral periapical radiographs which were taken at immediate and6 months after implant placement and implant stability by ostell mentor at immediate and time before placing gingival former.

The IOPA's of all the patients were collected, at the time of implant placement and after 6 months post op. The length of the implant and the level of crestalbone on both mesial and distal sides are measured in millimeters (mm) with the help of a metallic scale.

The bone levels were calculated and both mesial and distal sides of theimplants using the photographs of the radiographs taken just after implant placement, and at 6 months. The same procedure was repeated for all the radiographs and the crestal bone loss on the mesial and the distal sides was recorded.

Clinical results of this study were statistically analyzed in the form of mean, standard deviation (SD) values. T-Test, NPar tests, and Wilcoxon signed ranks test were used for statistical analysis.

Results

Out of 30 patients that were included 66.67% were female, inwhom 9 implants were placed in anterior maxilla, 11 implants in posterior mandible and 3 implant in posterior maxilla) and 33.33% were males in whom (6 implants were placed in anterior maxilla and 3 implant placed in posterior maxilla).

Out of 32 implants, 6 implants were positive for percussion test and 3 implant shown lower ISQ value which resulted in the failure of the implant which was placed in the posterior maxilla. (Table 3).

Table 1: Demographic profile of the patients

Gender	Number=30	Percentage
Male	10	33.33
Female	20	66.67

Table 2: Placed of implant

	Number =32	Percentage
Anterior maxilla,	15	46.87
Posterior mandible	11	34.38
Posterior maxilla	6	18.75

Table 3: ISQ values on implants

Parameter	Evaluated at the time of	No. of implants	Mean	Std. Deviation	p-value
ISQ	0 month	32	61.07	5.77	
ISQ	6 months	32	74.88	5.23	0.013

T-Test results were mean value for initial ridge width was 3.8 and the final ridge width was 7.5. The significantdifference is .001. In our study, the mean CRBL immediately at the time of implant placement in 0 months was .08 on the mesialaspect and 0.14 on the distal aspect. Mean CRBL value after 6 months was 0.57 on the mesial aspect and 0.45 on the distal aspect. There has been found a significant bone loss after 6 months of implant placement. (table.4) P-value was 0.012 ($p<0.005$).

Out of eleven implants, one implant reported withinfection and wound dehiscence, which was placed in posterior maxilla (D4 bone) and one implant reported withinfection, which was placed in posterior mandible(D3 bone). One implant (D3 bone) was recovered from infection which was placed in posterior mandible afterantibiotic therapy.

Table.4: Mean crestal bone loss around the implant

Mean crestal bone	Mesial	Distal aspect
CRBL value at 0 months	.08	0.14
CRBL value after 6 months	0.57	0.45

In the present study, implant success rate was found to be 90%.

Discussion

The use of the piezoelectric system gives a fundamentalqualitative advance to the alveolar ridge splittingtechnique. It allows control and safety in the osteotomy aswell as adequate visibility in the intraoperative stage(Olate et al. 2013).[15] Ultrasonic devices have the ability tocut mineralized hard tissues as teeth or bone in a very safeand precise way, with minor tissue damage. Soft tissuessuch as nerves, blood vessels, or the Schneider an membrane are not altered by the cutting tip because oftheir ability to oscillate at the same speed and amplitude asthe cutting tip.[16] Ultrasonic cuts have also been reported tobe more precise and to cause less splintering at the marginof the incision. Moreover, surgical accuracy is facilitated by good visibility in the surgical field due to reducedbleeding. The ultrasonic osteotome also allows curvedcuts that are impossible with rotatory instruments oroscillating saws.[17]

The split-crest procedure in combination with immediate implant placement was described more than two decades ago. This procedure avoids the need for only grafts taken from a

secondary surgical site, which exhibits post- operative morbidity associated with bone harvesting.[18]

Using the split-crest approach, no complications related to the surgical procedure were reported in any case. All implants were placed following general guidelines for implant insertion, using a low-speed drilling procedureand with irrigation, and were placed in different anatomical positions and using different types of prostheses. Edentulous alveolar ridges of less than 3 mm in width were considered for bone augmentation procedures after implant placement, to establish a bony wall of at least 1 mm around screw-type implants and thusprovide a successful long-term function and esthetics.

A study by Blus and Szmukler- Moncler[18] reported the application of ultrasonic bone surgery to perform split- crest procedures on 57 patients over a period of three anda half years. The aim was to place 230 implants (78 in the mandible and 152 in the maxilla) to rehabilitate nine full arches, three hemiarcades, 43 partial bridges, and 24 single crowns. The initial mean value of the ridge width was 3.2 mm, whereas at the end of the surgery the final mean width was 6 mm. Ninety-nine percent of the implants were placed and eight of them failed to osseointegrate at second stage surgery (96.5% success rate). After loading (at least 2 months for all implants), no implant failed, being the cumulative implant survival rate of 100%.In this study, a mean ridge expansion of 3.8 mm has been obtained after using the split-crest technique. The procedure has permitted a predictable implant treatment ofclinical situations that otherwise would not have allowed the insertion of implants. Interestingly, the use of an ultrasonic device for bone cutting has shown clear advantages compared with other alternatives for bone cutting in different surgical procedures. The results of this study support the use of ultrasonic bone surgery in ridge split technique for adequate implant placement in patients with edentulous bone ridges of maxilla and mandible region. Because implants had been loaded after 6 months postoperatively and the status of the implants and the surrounding soft and hard tissues are indicative of thesafety and effectiveness of the approach.

There are certain limitations in the present study such as a smaller sample size due to strict inclusion and exclusion criteria, Patient affordability for implants, the costly equipment (Ostell Mentor), Prolonged overall treatment time and short follow up period.

Conclusion

It can be concluded that modified ridge split technique in posterior mandible, Anterior maxilla and Posterior maxilla is a simple and predictable procedure with satisfactory results. Moreover, this approach is devoid of foreign materials usage and has a low rate cost, therefore, could be employed more often.

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