

## RADIOGRAPHIC EVALUATION OF BONE HEIGHT CHANGES AROUND IMMEDIATELY PLACED IMPLANT RETAINING MANDIBULAR OVER-DENTURE IN ATRAUMATIC TOOTH EXTRACTION CASES

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### ABSTRACT

**Objective:** To evaluate the impact of atraumatic extraction with immediate implantation in preserving the vertical height of bone supporting two implants retaining overdenture.

**Materials & Methods:** Ten people were chosen at random from the Ain Shams University prosthodontics outpatient clinic. For this case, the patient must meet the following criteria: they must be between the ages of 40 and 60, have a totally edentulous maxillary arch, and have extractions advised for both canines in the mandibular arch. All patients in this research were transformed immediately with two implants in fresh sockets at the interforaminal region in the mandible by using two extraction techniques. Group I: immediately placed implants on the right side for canines extracted by a conventional method, and Group II: immediately placed implants on the left side for canines extracted by the atraumatic way (piezo tomes). Digital Radiographic assess the quantity of marginal bone loss throughout 12 months follow-up.

**Results:** There was a significant difference in mesial, distal, and overall. (baseline/12 months) was the highest. At the same time, there was a significant difference between other intervals by using Paired t test. After a year, group II had a noticeable reduction in vertical bone loss when compared to the other one.

**Conclusion:** It can be concluded that atraumatic extraction is a key prerequisite for immediate implant placement with immediate loading, & piezo tomes were the more efficient than conventional extraction.

**KEYWORDS:** Immediately Placed Implant, Atraumatic Tooth Extraction, piezo tomes

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## INTRODUCTION

Cases managed with implant overdenture have presented greater satisfaction levels and successful restoration of both function and esthetics than patients wearing complete removable dentures. An implant overdenture is a removable partial or complete denture that covers and rests on one or more dental implants. <sup>(1)</sup>

Implant insertion in extraction sockets that have recently undergone a traumatic extraction is extensively established. Immediate Implant implantation procedures show survival rates ranging from 94% to 100% throughout a three-month to seven-year recovery period.<sup>(2,3)</sup> The choice to pull teeth and immediately replace them with Implants Several criteria, including extensive periodontal attachment loss, crowns with loose endodontic posts, root caries, and an unfavorable crown-root ratio, as well as numerous combinations of these characteristics, affect the ultimate choice to extract teeth. The conventional Branemark Protocol recommends a 12-month healing interval following tooth extraction prior to implant insertion. In addition, a healing time of three to six months is recommended following implant fixture installation. This frequently left the patients toothless for a prolonged period of time. <sup>(2)</sup>

With the publication of the initial article on Implanting into fresh extraction sockets, interest in this procedure has grown due to: the reduction in time between tooth extraction & installation of the ultimate prosthesis. The patient will receive Immediate prosthetic restoration with high functional and esthetic outcomes. Decrease the number of surgical procedures. Immediate Implant will prevent marginal bone loss and preserve the alveolar ridge regarding height and width. <sup>(4)</sup>

Various methods have been developed for determining the degree of post-operative alveolar bone loss. They include systemic aspects like the overall health and behaviour of the patient. Local variables include tooth type and position (mandible

and maxilla), socket quality before extraction, and post-extraction care. Implant variables include implant diameter and microsurface roughness. It has been shown that the technique of extraction influences the degree of alveolar bone resorption, routine vs traumatic surgical extrusion. <sup>(5)</sup>

A dental extraction is a painful procedure that damages alveolar bones and soft tissue. Implant insertion prompted the invention of an atraumatic tooth extraction procedure that removes the tooth axially from its socket without causing direct damage to the socket wall or disrupting PDL. Atraumatic exodontia becomes an important step to reduce soft tissue injury and marginal bone by using a powered peristome, piezosurgery, benex extractor, a sonic instrument for bone surgery, and lasers. <sup>(6-8)</sup>

Immediate loading is the placement and restoration of an endosseous dental Implant during the same clinical visit. <sup>(9)</sup>

Many clinical types of research confirmed that immediate loading of 2 to 4 implant overdenture is an available treatment option due to many advantages such as quicker treatment because of no additional appointment, faster time from surgery to teeth, immediate full function of the new teeth, and optimum esthetic can be achieved at the time of the surgery. On the other hand, some disadvantages were demonstrated, not being suitable for all patients as needs particular cases, may delay or preventing bone osseointegration, and more chances of failure due to the implant's instability and unfavourable forces during the healing time. <sup>(10)</sup>

The much more essential aspect of assessing the effectiveness of an implant overdenture is marginal bone loss. and tooth extraction influences marginal alveolar bone and gingival contour. <sup>(11)</sup> This research aimed to determine the impact of atraumatic extraction with immediate implantation on the preservation of the vertical height of bone supporting 2 implants maintaining an overdenture.

## PATIENTS & METHODS

**Patient selection and study design:** Ten patients from the outpatient clinic of the prosthodontics department of the school of dentistry at Ain Shams University were selected to participate in this research, which was approved by the research ethics committee (FDASU-Rec IM 111906). According to the following criteria, all patients between the ages of 40 and 60 with a completely edentulous maxillary arch & bilateral canines in the mandibular arch indicated for extraction were informed of the necessary extraction of these canines & implant placement & signed an informed consent form. All the patients were informed that they would be participating in a study that required their full participation and were encouraged to do so by the therapy.

All patients' medical and dental histories were collected through direct interviews and questionnaire sheets. The extra and intra-oral examination was performed as part of the clinical evaluation. Exclusion criteria included those with severe acute periodontitis, bone metabolic disorders, uncontrolled diabetes, and smoking. Complete intraoral examination of the mandibular residual alveolar ridge should reveal appropriate height & width and mucoperiosteum that is solid, fibrous, and devoid of inflammatory symptoms. The retained canines were devoid of ulceration or flaccidity, possessed 10mm of bone support, and had a sufficient labial bone plate. The provision of enough inter-arch space was guaranteed by preliminary jaw relation recordings.

For all patients, pre-operative cone beam CT (CBCT) was performed. The teeth were considered markers in the interforaminal area in order to notice the existence of any pathological lesion and to evaluate the periodontal health, bone support, & appropriate labial plate of bone of the retained canines. In addition, the existing bone height & width from the ridge's crest to the mandible's inferior border in the canine region must measure at

least 5.5 mm and 13 mm, respectively, as illustrated in the diagram (figure 1a, b). When inserting an immediate implant, the retained canines must have at least 3 to 5 mm of bone beyond the apex and at least 10 mm of bone length for stability. The retained canine region lacks significant labial and circumferential bone abnormalities.

**Patient grouping:** according to the extraction process (Split-Mouth Study). All participants in this trial were promptly implanted with two mandibular implants.

**Group I:** the remaining canine on the arch on right side was retrieved using forceps and elevators (the conventional way). The implant was then immediately put into the freshly prepared socket. On the left side of the arch in **Group II**, the opposing canine was removed using piezo tomes or ultrasonic tips. The implant was then immediately put into the freshly prepared socket. Thereafter, each patient received two treatments on two distinct oral regions.

All cases had complete upper and lower dentures fabricated using the standard approach. On the basis of primary alginate impressions poured into dental stone to make study casts, selectively relieved acrylic resin customized trays were fabricated. The border of the tray was moulded with green stick compound, a second imprint was taken using Zinc Oxide Eugenol (cavex, Netherlands), and then impressions were poured into master moulds.

On the master castings, upper & lower occlusion blocks were manufactured. A face bow record was acquired for mounting the top cast, and for mounting the lower castings, centric occluding relation was noted using the inter-occlusal wax wafer technique. On a semi-adjustable articulator, castings were attached. Using the lingualized idea of occlusion, modified cross-linked acrylic teeth (Acrylic teeth, Acrostone dentistry, Egypt) were changed and placed. The waxed dentures (Base Plate Modeling wax, Cavex, Netherlands) were next tried in the patient's mouth to guarantee adequate facial shape,

extension, & harmony between centric occlusion & centric relation.

Mandibular and maxillary waxed-up dentures were flaked, and then the wax was removed and treated in acrylic resin that had been heated to cure. Following completing and polishing, the patient's denture was delivered. All required changes were done, and the patient was given post-insertion instructions.

### Surgical procedure:

On the day of surgery, deep anaesthesia (Articaine Hydrochloride) was administered to the patient in group I, and the retained canines were retrieved using forceps or elevators using the standard technique. After twisting motions with forceps to sever the gingival attachment and periodontal membrane to release the tooth from the bone, the standard extraction method is obtained. The socket is then widened by manipulating the root to enlarge its bony socket. In group II, the opposite retained canines were removed using ultrasonic tips or piezo tomes; the extraction point was inserted into the sulcus to a depth of 4-5 mm without separating the gingiva from the tooth and then penetrating further to sever the apical PDL fibers. The tooth was dislodged and extracted with tweezers.

After tooth extraction, the sockets were examined for osseous defects; all four walls were confirmed to be intact (figure 2).

Following canine extraction, the implant drill was utilized to create the osteotomy for rapid implant insertion. To prevent perforation of the labial plate, the osteotomy must be kept on the lingual face of the alveolus. In the last phase of implant implantation, a ratchet wrench with an insertion torque of at least 35N was employed. The 4.5 mm diameter and 13 mm length implants (dental express vitronex, Italy) were immobile within the osteotomy.

### Prosthetic procedure:

A ball abutment attachment type was screwed into implants immediately after implant placement and picked up intraorally with cold-curing acrylic resin to prevent any lock with the hard-pickup resin with implant surface (Hard pick-up material, Acrostone). An elastomeric block-out shim (spacer) was adopted on the gold ball abutment, and a female housing cap was attached to the ball. On the fitting surface of the lower denture, regions corresponding to the two inserted attachments were designated, and relief areas were constructed to ensure the entire seating without interfering with the original fit when in maximum intercuspation. As shown in figure (3)

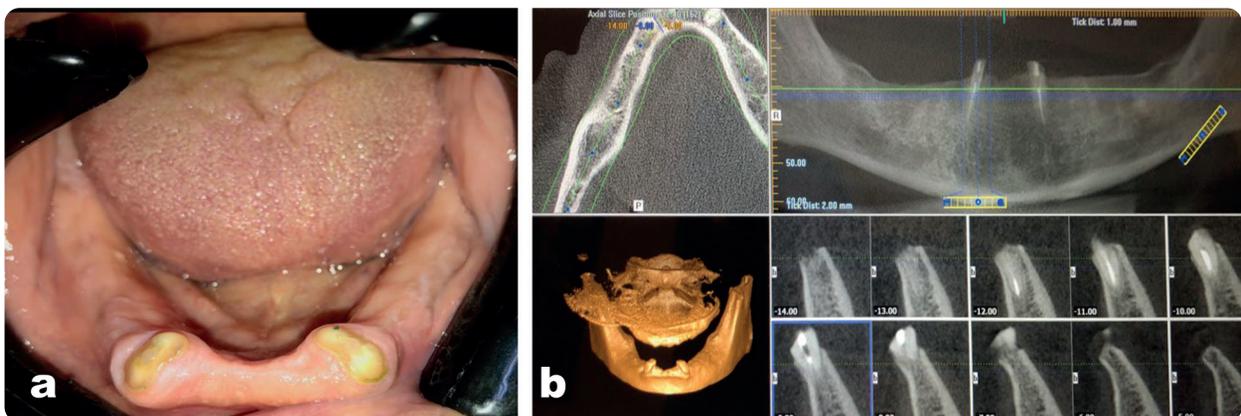


Fig. 1(a): Intraoral view of the mandibular arch with two remaining canines b): CBCT view for two remaining canines

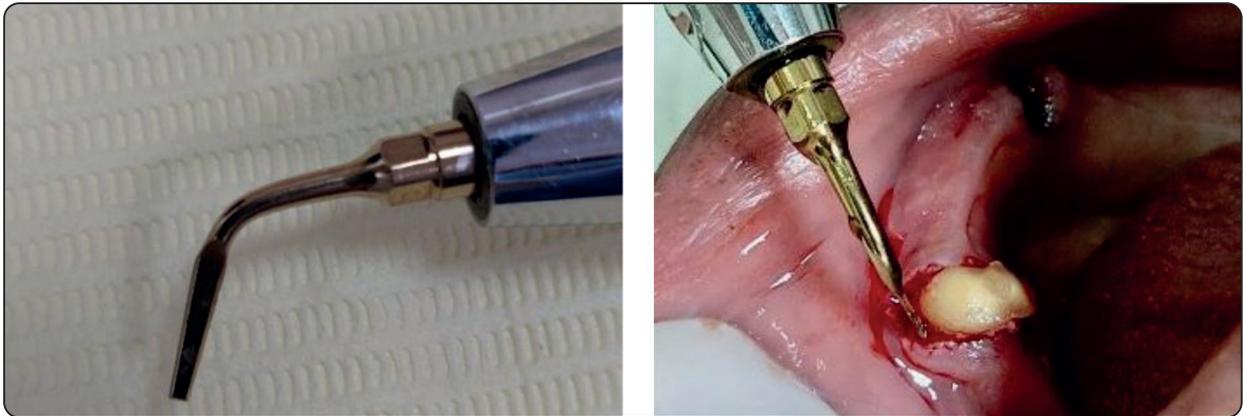


Fig. (2): Piezotomes



Fig. (3): Ball attachment and housing cap

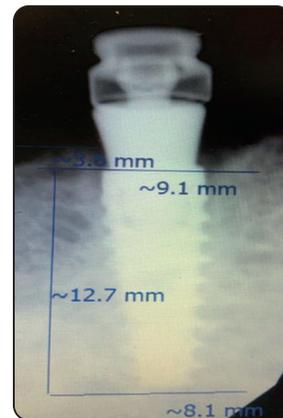


Fig. (4): Liner measurements

### Methods of evaluation:

Radiographic periapical assessment with the long cone parallel approach. Standard, repeatable digital periapical radiographs were produced using a specialized radiographic template. The GXS-700 digital system (GXS-700 DIGITAL intraoral sensor-GENDEX-USA) was performed on the mandible for all patients on the day of implant insertion, 3, 6, and 12 months after implant insertion for measurements of crestal bone changes in relation to implants. The change in vertical bone loss over time was measured by first marking the radiographic landmarks (implant shoulder and apical tip). Last, the height of the alveolar bone was noted on the mesial & distal implant surface. The method for image analysis computed the ratio between

the selected spots. As shown in the figure, these measurements were transformed or normalized to calculate the magnification in the image processing system. **Figure (4).**

### RESULTS

Microsoft (Excel) 2016 and statistical package for social science (SPSS) version 20 were utilized in statistical analysis. The level of significance was fixed at  $p < 0.05$ . The paired t-test was utilized to compare the groups. Repeated One-Way ANOVA followed by Tukey's post hoc test for multiple comparisons to compare follow-up durations within groups. The mean & standard deviation of total bone loss at different intervals for groups I and II are shown in table (1) and figure (5).

TABLE (1) Mean and standard deviation of overall regarding both groups and comparison between them at all intervals:

Interval	Overall								
	Group I		Group II		Difference (Paired t-test)				
	M	SD	M	SD	MD	SEM	95% CI		P value
						L	U		
Baseline –After three mon.	0.50 a	0.06	0.30 a	0.075	0.2	0.03	-0.26	-0.13	<0.0001*
After three months –6 months.	0.42 a	0.1	0.25 a	0.05	0.17	0.02	-0.22	-0.11	<0.0001*
After six months–12 months.	0.41 a	0.12	0.28 a	0.075	0.13	0.03	-0.21	-0.04	0.004*
Baseline –After 12 months.	1.33	0.18	0.83	0.07	0.5	0.06	-0.62	-0.37	<0.0001*
P value	0.11 ns		0.26 ns						

*M: mean*

*SD: standard deviation*

*MD: mean difference*

*SEM: standard error mean*

*CI: confidence interval*

*\*Significant difference as  $P < 0.05$*

*ns: non-significant difference as  $P > 0.05$*

*Means with the same superscript letters were insignificantly different as  $P > 0.05$ .*

*Means with different superscript letters were significantly different as  $P < 0.05$ .*

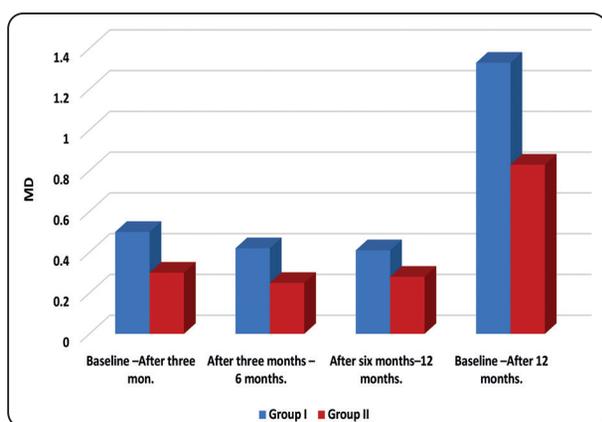


Fig. (5): Bar chart showing mean bone loss overall Regarding both groups

### Effect of time:

Comparison between different intervals revealed a significant difference between them within the same group in both groups I & II as  $P > 0.05$ .

### Effect of group:

Matching among both groups revealed a significant difference amongst them at all intervals as  $P < 0.05$  (Group I was significantly greater than group II).

## DISCUSSION

Studies, both preclinical & clinical, have shown that alveolar ridge volume loss following extraction is an irreversible process involving both horizontal and vertical shrinkage.

The degree of bone loss has a direct bearing on the achievement level of later dental implant treatments and the cosmetic effects of post-treatment. Several studies have demonstrated that roughly 30% of the alveolar ridge is lost due to resorption following tooth extraction. Following tooth extraction, buccal alveolar ridge resorption is more severe than lingual alveolar ridge resorption. The lateral walls of the socket experience strong resorption, resulting in a notable drop in alveolar ridge height. <sup>(12)</sup>

Immediate implantation of implants is the optimal method for replacing hopeless teeth. It decreases surgical time, protects alveolar bone, preserves soft tissue, and simplifies the design of the prosthesis. The efficacy of dental implant therapy for individuals with missing or no teeth has been thoroughly demonstrated. <sup>(13)</sup>

To achieve primary stability, the interforaminal area of the jaw was selected due to its high bone volume & density. Initial implant stability is the most crucial aspect of implant osseointegration, which is determined by bone quality, implant length, and implant diameter. Hence, the optimum location has enough alveolar bone around the socket, allowing the implant to completely fill the socket area.

Using one-stage surgical procedures and immediate loading of implants by mandibular overdentures simplifies implant treatment<sup>(14)</sup>, prevents instability & multiple relining of transitional prostheses during the healing period<sup>(15)</sup>, reduces dental rehabilitation time, and attains significant case satisfaction<sup>(16)</sup>. Many published investigations<sup>(17-20)</sup> on the initial loading of two un-splinted mandibular implant overdentures found an implant survival rate of 96.4%. Nevertheless, a systematic study by *Papaspyridakos et al.*<sup>(21)</sup> indicated that the loading strategy had no effect on the prosthodontic survival rates of implant-retained complete mandibular arches.

Several writers<sup>(22)</sup> believe that monitoring marginal bone loss surrounding implants is an essential factor in assessing the success of implants. These criteria are widely recognized as a trustworthy predictor of the bone's reaction to the surgical operation and subsequent occlusal loads.<sup>(23)</sup> Crestal bone loss in both groups over the first year after implant implantation & loading is within the usual range. The success criteria for dental implants include an average bone loss of less than 1.5mm during the first year of prosthesis loading.<sup>(24)</sup>

There is no significant difference in peri-implant bone height loss among the 2 groups at any of the time intervals (baseline/3 months), (3 months), and (6 months/12 months), indicating that bone resorption stabilized beyond the first phase. This may contradict the findings of *Cardaropoli et al.*<sup>(25)</sup>, who found that most bone resorption happens within the first few months due to bone remodelling, which

becomes active after eight weeks of recovery. However, this study followed a study by *Thapliyal and Pawar*<sup>(26)</sup>, which revealed that surgical trauma & micromovement of the implant owing to functional stresses in rapid loading might cause peri-implant bone loss. The bone is a dynamic tissue that adjusts to the external environment's physical demands, and well-planned loading forces transmitted to the implant may improve bone healing in early stages because functional loading strengthens the physicochemical bone-implant bond; therefore, the hypothesis that greater MBL would be observed in immediately loaded implants during early stages was rejected.<sup>(27)</sup>

The greatest difference between the MBL levels of the 2 groups occurred at (baseline/12 months). This considerable loss was attributed by *Tatarakis et al.*<sup>(28)</sup> to the healing process, biological bone turnover, occlusal stress, the formation of biological width, & micromotion at the prosthetic abutment contact.

In matching amid MBL values of mesial & distal surfaces, there was a significant difference among the two sides at all intervals (distal had higher MBL than mesial) because of increased strain values on bone tissue at distal sides as a result of the posterior cantilever as occlusal loads were concentrated mainly at posterior teeth of the denture leading to vertical tissue-ward movement and rotation of the denture around the two implants which acted as a fulcrum leading to denture's encroachment on the distal aspects and higher bone loss, this explanation was agreed with the finding of *Akca et al.*<sup>(29)</sup>.

Bone loss in overall of group I and group II revealed a great significant difference between all intervals, especially over six months; traumatic extraction in group I showed (After 6months-12 months)  $0.24\pm 0.10\text{mm}$  and (0-12 months)  $0.68\pm 0.18\text{mm}$  and atraumatic extraction at group II showed (After 6-12 months)  $0.07\pm 0.075\text{mm}$  and (0-12 months)  $0.32\pm 0.07\text{mm}$  so group I was

significantly greater than group II because atraumatic extraction technique using piezo tomes. Ultrasonic vibrations provide a precise and selective cutting motion, resulting in better accuracy, safety, & less tissue damage and bone resorption by preserving bundle bone during extraction and, overcoming soft tissue recessions and preserving thick gingival biotype; on the other hand, the forceful tearing of PDL during conventional extraction will interfere with vascular blood supply due to loss of PDL and bundle bone.<sup>(30)</sup>

### CONCLUSION

It can be concluded that atraumatic tooth extraction is a key prerequisite for immediate implant placement with immediate loading, & Piezosurgery was more efficient than conventional extraction.

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