



CLINICAL AND RADIOGRAPHIC OUTCOMES FOLLOWING LATERAL ALVEOLAR RIDGE AUGMENTATION USING AUTOGENOUS DENTIN BLOCK GRAFT- A CLINICAL STUDY

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ABSTRACT

Objectives: Dentin block can be effective option in managing the lateral bone defect site indicated for implant placement. The Present study evaluates outcome of clinical use of the autogenous dentin block graft in lateral ridge augmentation and assess increase of the width of the alveolar ridge. **Subjects and methods:** The Eight patients were included in one group and all of them were subjected to A full-thickness muco-periosteal flap. The extracted tooth was trimmed to adapt very closely over the recipient bone. The recipient site was subsequently decorticated. The dentin block was stabilized with one titanium mini screw of suitable length. After 6 months, the ridge width and Bone density were recorded. **Results:** Ridge width: There was a statistically significant increase in ridge width after 6 month. The gain was 3.49 ± 0.83 . Bone Density, Mean bone density was 611.38 ± 257.40 after 6 month. **Conclusion:** Dentin block can be used as a grafting material. There is no donor site morbidity and this is considered one of advantages of this grafting material.

KEYWORDS: Alveolar Ridge Augmentation, Dentin Block Graft, Ridge width, Bone Density.

INTRODUCTION

Autogenous bone (AB) blocks extracted from intraoral donor sites are the most common therapy for lateral alveolar ridge augmentation (i.e., retromandibular, chin). Cortical bone blocks were shown to exhibit partial replacement resorption despite significant horizontal bone development. As a result, the defect location now contains a mixture of non-vital remnants and newly generated vital bone. AB blocks are also commonly utilised in

combination with contour augmentation procedures requiring slowly resorbing particle grafts and barrier membranes because they disintegrate fast ⁽¹⁻³⁾.

Dentin's inorganic and organic makeup closely mimics that of bone, as is widely known. Non-collagenous proteins such as phosphoproteins, Osteocalcin, proteoglycans, and glycoproteins are abundant in its organic matrix, which is dominated by collagen type I fibres. As a result, previous and current studies have focused on the use of

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dentin as a feasible bone replacement in a number of lesion scenarios. Dentin autografts, whether particulated or block autografts, were shown to have osteoconductive and osteoinductive capabilities, and were engaged in the bone remodelling process⁽⁴⁻⁶⁾.

Recent experimental studies have looked at using autogenous dentin block graft as an alternative substrate to aid bone regeneration in lateral alveolar ridge lesions. Differently conditioned dentin blocks (i.e., sound, endodontically treated non-infected, periodontally diseased) and intra-oral autogenous bone grafts did not differ substantially on various outcome parameters⁽⁷⁾. Previous studies discussed use of the dentin either in demineralized form or even in a partially demineralized form. Tooth was subjected to many processes before being ready for application as a graft material like dehydration, defatting, lyophilization, ethylene oxide sterilization in order to remove most of in-organic components from the tooth.

Few studies throughout past five years discussed use of dentin as a block in its non- demineralized form without any chemical treatment or special preparations⁽⁷⁾.

Present study evaluates outcome of clinical use of the autogenous dentin block graft in lateral ridge augmentation and assess increase of the width of the alveolar ridge.

SUBJECTS AND METHODS

A Prospective Clinical and Radiographic Study.

Study Setting and Population

This research comprised eight patients. They were chosen from the Oral and Maxillofacial Surgery Outpatient Clinics at the Faculty of Dental Medicine, Al- Azhar University, Boys, Cairo. The patient was chosen based on certain criteria for inclusion and exclusion.

Inclusion Criteria: Good general health condition without any systemic complications. Age

ranged between 18 to 60 year. Candidate for lateral ridge augmentation with insufficient alveolar ridge width less than 4 mm. One or more teeth indicated for extraction without signs of local pathologies (e.g., cysts). Sufficient alveolar ridge height at the recipient site

Exclusion Criteria: Oral cavity inflammatory or autoimmune illness. Diabetic patient with uncontrolled diabetes, cancer within the last 5 years, that required chemotherapy or radiation. Immunosuppressant, bisphosphonate, or high-dose corticosteroid treatment was used before, and women who are pregnant or nursing.

Sample Size Calculation: To study the effect of autogenous tooth on ridge augmentation, paired t test was used for comparison of different observations within the same group. According to a previous study by Parvini et al (2018)⁽⁴⁾, cross sectional grafted area was 22.07 ± 12.98 . A total sample size of 8 was sufficient to detect: an effect size of 1.2, a power (1- β error) of 0.8, Using a two-sided hypothesis test, Significance level (α error) 0.05 for data

Ethical Consideration: Al-Azhar University's Local Ethical Committee accepted the protocol (EC Ref No.345/1134/03/11/19). All patients were informed about the research methodology, and they agreed to take part in the study after signing the Al-Azhar University informed consent form, which contained all information about the surgical procedure and post-operative care.

Study Grouping: The study was conducted in patients assigned according to sample size calculation. The Eight patients were included in one group and all of them were subjected to the same procedures.

Surgical Procedures

The tooth that needed to be extracted was extracted under local anaesthetic. To expose the

defect as well as the surrounding tissue, crestal incisions were done. A releasing incision was performed at the mesio-buccal line angle, linked to the horizontal incision, for maximum accessibility and visualisation. A full-thickness muco-periosteal flap was reflected buccally to expose at least 3 mm of bone to support the dentin block. The tooth was appropriately curetted to remove all debris and calculus. A diamond stone was used to remove cementum until the underlying dentin was exposed under copious irrigation. After that, the tooth was decapitated at the cement-enamel junction, and the pulp was extirpated using a lot of saline. Based on the estimated defect site, the extracted tooth was cut to fit extremely firmly over the transplant bone. The recipient location was examined for any bone abnormalities before decortication with a round bur was performed to induce bleeding. Depending on the defect and available host bone thickness, one titanium micro screw of appropriate length (8 to 10 mm) was used to support the dentin block. Sutures were used to close the flaps. **fig (1)**

Postoperative Follow- Up and Assessment

Clinical Evaluation: The patients were recalled on the third, fifth, seventh days for re-evaluation using the following clinical parameters: pain intensity using visual analogue scale (VAS), facial edema using fixed reference points, soft tissue condition for any (swelling, inflammation, infection, dehiscence) and maximum incisal opening using caliber. Following this, the patient was kept under regular follow-up once a month for 6 months to assess the soft tissue condition and any possible complications. Assessment of soft tissue healing after surgery and throughout 6 months was done by wound healing index score.

Radiographic Evaluation: After 6 months of surgery, the patients were re-evaluated. The ridge width was recorded with a CBCT. Bone density value was measured.

Statistical analysis of the data: Significance of the obtained results was judged at the 5% level. The used tests were ANOVA with repeated measures and Paired t-test.

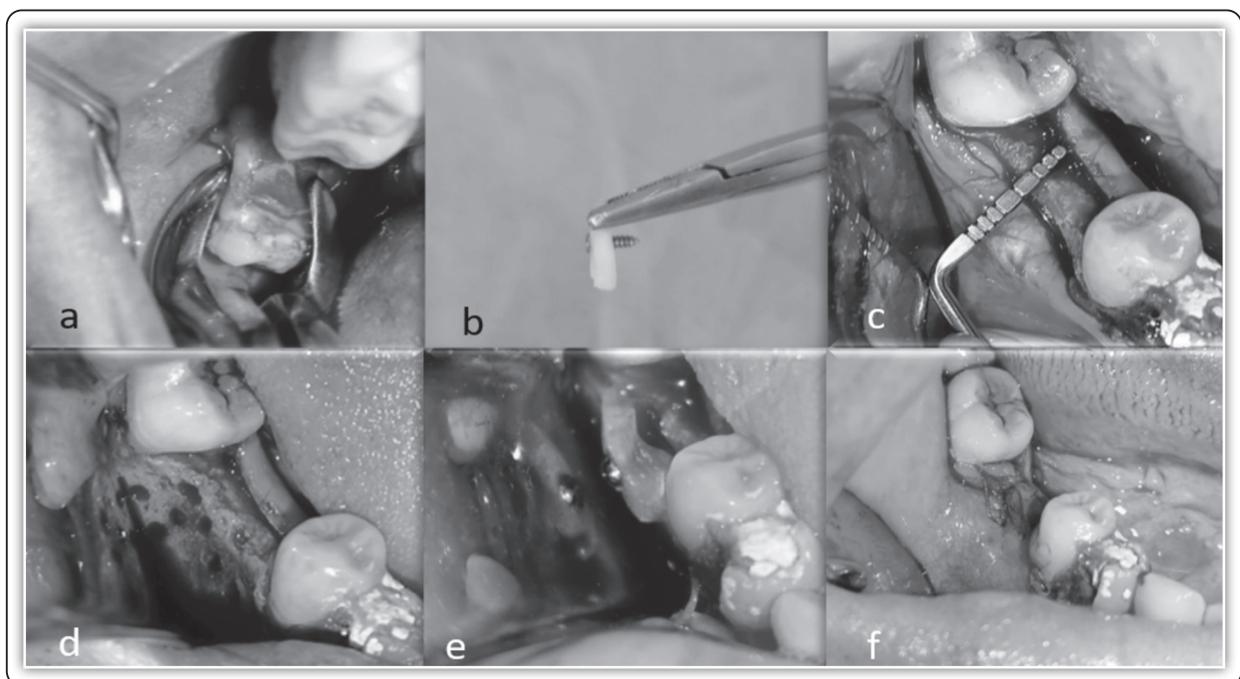


FIG (1) a, Atraumatic Tooth Extraction, b, Prepared Dentin Block, c, Assessment Of The Width Of The Alveolar Ridge, d, Decortication, e, Block Graft Rigidly Fixed to the Ridge Using the Screw, and f, Tension Free Primary Closure of The Wound.

RESULTS

Eight patients were selected from the out-patient clinic, all were females, ranging in age from 22 to 35 years, with mean age of 28.87 years. There was no exclusion for any patients and every patient had one or more tooth that was indicated for extraction due to unrestorable caries , impaction or it was remaining roots. Also, every patient had horizontal bone defect on lower posterior region. All patients completed the study steps.

Clinical findings:

Regarding swelling, there was a significant increase after 3 and 5 days ($p<0.001^*$ respectively) followed by insignificant decrease after 7 days

($p=0.160$). There was a significant rise in MIO after 3 and 5 days ($p<0.001^*$), followed by a statistically significant drop after 7 days ($p=0.009^*$). At Day 3, the MIO decreased by 2.63 ± 0.74 , At Day 5, the MIO decreased by 3.38 ± 1.06 , while At Day 7, the MIO increased by 1.25 ± 0.71 . regarding pain, there was a significant decrease after 5 and 7 days ($p<0.001^*$ respectively) (Table 1).

Radiographic findings:

Ridge width: Table (2): mean Ridge width pre was 3.56 ± 0.42 and 6 month was 7.05 ± 0.74 . There was a statistically significant increase in ridge width after 6 month ($p<0.001^*$). The gain was 3.49 ± 0.83 . Bone Density, Mean bone density was 611.38 ± 257.40 after 6 month.

TABLE (1) Comparison between the different time periods according to swelling, MIO, and Pain.

	Pre	Day 3	Day 5	Day 7	F	p
Swelling	88.33 ± 2.14	90.83 ± 2.50	92.04 ± 2.68	89.75 ± 2.46	25.420*	0.001*
MIO	42.38 ± 3.96	39.75 ± 3.85	39.0 ± 3.51	41.13 ± 3.76	30.333*	<0.001*
Pain		7.38 ± 0.92	5.50 ± 0.93	2.25 ± 0.71	170.509*	<0.001*

TABLE (2) Comparison between the different time periods according to Ridge width and Bone Density.

	Pre	6 month	t	p
Ridge width	3.56 ± 0.42	7.05 ± 0.74	11.901*	<0.001*
Gain		3.49 ± 0.83		
Bone Density		611.38 ± 257.40		

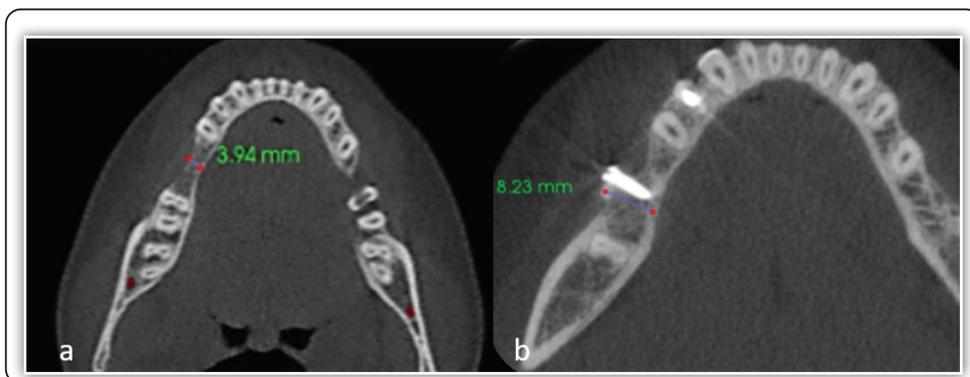


FIG (2) Axial Cut of The CBCT Showing Increase in Alveolar Ridge Width after Six Months (~ 8 mm) (A) in comparison to the pre-operative width (~ 4 mm) (B)

DISCUSSION

The purpose of this study was to examine the clinical and radiographic outcomes of lateral ridge augmentation with autogenous dentin block grafts. In order to assess graft integration, the width of the alveolar ridge was also measured. After extraction, alveolar ridge resorption is unavoidable, resulting in significant alveolar bone remodelling in the first 3–6 months. As a result, dimensional alterations occur, placing the future installation of the proper prosthesis in jeopardy. Failure to preserve the ridge during extraction results in a ridge that is considerably insufficient, necessitating a two-step rehabilitation treatment prior to implant placement. An augmentation surgery would be conducted once the socket had healed completely, followed by a 4–6 month waiting period before implant implantation⁽⁸⁾. The goal of this study was to see if a lateral (horizontal) ridge augmentation using an autogenous dentin block graft could build enough bone for implant placement while lowering the patient's treatment time and cost⁽⁶⁾.

From the results of the present study, it was discovered that mean ridge width pre-operatively was 3.56 ± 0.42 and after 6 month of using the dentin block in augmentation was 7.05 ± 0.74 . So there was a significant increase in ridge width after 6 month ($p < 0.001^*$). Also there was formation of new bone at the junction between the graft and the alveolar ridge, mean bone density was 611.38 ± 257.40 .

Over the years, several novel techniques and grafting material combinations for efficient bone regeneration in the lateral defect site have been studied and assessed. Autogenous bone is the gold standard among all transplants since it is both osteoconductive and contains live osteoblasts that help in the process of osteogenesis. However, it has a number of disadvantages, including the need for a second surgical site, donor site morbidity, and limited bone supply⁽⁷⁾. The idea of an auto tooth transplant (dentin block) is gaining attention due to

its physiochemical properties that are analogous to autogenous bone. The decision to use autogenous tooth graft (dentin block) in our study was based on earlier research by Kim et al⁽¹¹⁾ and Schwarz et al⁽¹⁰⁾. The properties of extracted teeth from patients were studied, and it was discovered that the crown portion was mostly made up of high-crystalline calcium phosphate minerals (mostly HA) with a higher Ca/P ratio, whereas the root portion was mostly made up of low-crystalline calcium phosphates with a lower Ca/P ratio. The root section, which has a lower crystallinity and a higher percentage of other organic elements, was shown to be more suited for bone grafting than the crown portion.

Becker et al⁽⁹⁾ compared autogenous tooth roots to autogenous bone blocks (AB) for lateral alveolar ridge augmentation after two-stage implant insertion in another investigation. After six months, they found no statistical difference in crestal breadth between the two groups, as both allowed for effective implant insertion. As a result, they came to the conclusion that tooth root might be a feasible alternative to other block grafts in lateral alveolar ridge augmentation. Based on these findings we hypothesized that tooth root block graft (dentin block) can be used to augment the defective alveolar ridge laterally (horizontally).

The ridge width after 6 months was considerably greater than at baseline, indicating evident ridge width growth and fresh bone development at the graft-alveolar ridge junction. This is due to natural bone remodelling throughout the healing process, as tooth roots include both inorganic and organic material, which is comparable to bone in composition. Bone morphogenetic protein and many other proteins with osteoinduction ability, including type I collagen similar to that found in alveolar bone, are among the organic components. Our findings are consistent with those of Schwarz et al., who investigated, observed, and concluded that autogenous tooth root graft (dentin block) may be employed well for lateral (horizontal) ridge

augmentation. Without any extra directed bone regeneration, we were able to obtain adequate bone following augmentation ⁽¹²⁾.

In a study conducted by Parvini et al ⁽⁴⁾, they assessed and compared CBCT outcomes following lateral alveolar ridge augmentation using tooth root (dentin block) and autogenous bone grafts. When compared to the AB group, dental root grafts were shown to be related with considerably larger mean surface area values after a 26-week healing period.

In conclusion, the study found that TR grafts may be related with enhanced surface area and clinical width values following lateral alveolar ridge augmentation, within its limitations ⁽⁴⁾. The present study's findings are within the range of the prior study's findings.

Shejali et al⁽¹³⁾ investigated the clinical and radiological efficacy of an autogenous tooth root used as a block bone graft in restoring vertical and horizontal dimensions at periodontally hopeless extraction sites. Findings of the present study are in accordance with the findings obtained by Shejali Jana et al regarding increase of the alveolar ridge width after using the dentin block graft in ridge augmentation.

Ramanauskaitė et al⁽¹⁴⁾ conducted a comprehensive study to assess the current level of clinical evidence for the effectiveness of autogenous tooth (dentin block) for the repair of alveolar ridge deficiencies. Lateral alveolar ridge augmentation was performed using AT blocks (15 patients) and compared to AB blocks (15 patients). The tooth root blocks were made from impacted or partly retained teeth. 30 implants were placed in the enhanced regions after 26 weeks of recovery. The mean increase in alveolar ridge width with AT blocks was 5.53 ± 1.88 mm, which was substantially larger than the increase seen with AB blocks (3.93 ± 1.41 mm, $p = 0.014$). After 26 weeks after healing, CBCT examinations demonstrated a homogeneous density of both AT and AB grafts at the recipient location with no evidence of graft separation ⁽¹⁴⁾.

As secondary outcomes, Exposure of the fixation screw heads was reported in two patients at the final follow-up visit (26 weeks), but this event was not associated with any signs of wound infection. Also, after 26 weeks of healing, the implants could be successfully placed in all patients investigated. In the former defect, there was often a homogeneous integration of both types of block grafts, and implant bed preparation demonstrated similar bleeding characteristics inside the grafted hard tissue regions ⁽¹⁴⁾.

In the present study MEAN Ridge width pre-operatively was 3.56 ± 0.42 mm and after 6 month of using dentin block in lateral alveolar ridge augmentation was 7.05 ± 0.74 mm, so there was a statistically significant increase in ridge width after 6 month ($p < 0.001$). Mean bone density was 611.38 ± 257.40 and that showed all completed cases had newly formed bone at the junction between the graft and the ridge and had D3 type of bone according to Carl Mesch HU Chart ⁽¹⁵⁾.

CONCLUSION

Dentin block can be used as a grafting material. Dentin block can be effective option in managing the lateral bone defect site indicated for implant placement. There is no donor site morbidity and this is considered one of advantages of this grafting material. Other advantage is the cost effectiveness of such grafting material.

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