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Case Report

Fares Wedge Technique: A New Three-Dimensional Bone Augmentation Method. Technique Presentation and Report of Case Series

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Abstract

Purpose: Autogenous bone still considered the gold standard in bone augmentations prior to implants insertion in atrophic ridges. However, if large amounts of bone grafts are needed to augment multiple edentulous atrophic segments, extraoral donor sites may be mandatory. The aim of this report is to introduce the Fares Wedge Technique, as a new bone augmentation method that can augment multiple edentulous ridges with intraoral cortical bone grafts.

Methods: Patients with moderate to severe ridge atrophy in different regions of the jaws were treated over 6-years period with Fares Wedge Technique(FWT). Patients received panorex immediately after the surgery, and they were examined clinically and radiographically (periapical) every 2 weeks. At 4 months, computed tomography was performed to evaluate the bone gain. Reentry was performed after 4 to 5 months to evaluate the new bone volume and quality and to insert implants. At this stage specimen for histologic examination were also obtained.

Results: 39 augmentation site in 22 patients (15 women, 7 men: mean age 47 years) were followed 12 to 52 months The healing process was uneventful, with minimal morbidity The success rate was 95%, the bone gain average was 3-6 mm vertically and 3-9 mm horizontally. In two patients the graft was partially exposed and treated with shaving and rounding the exposed wedges, but the augmentations were saved. In one case the majority of the bone graft was lost. At 38 sites the patients had successfully received 113 implants.

Conclusions: Fares wedge technique can augment multiple segments of atrophic ridges with small amount of autogenic graft. The bone volume that achieved was satisfying, especially that the majority of the augmented areas were at posterior mandibular defects.

Keywords: *Bone augmentation; Aautogenic bone grafts; Allogenic bone substitute; Donor site; Space maintenance*

Abbreviations

FWT: Fares Wedge Technique

Introduction

Alveolar bone loss as a result of teeth extractions, periodontal disease, trauma, pathologic conditions, failed implants, and failed bone expansion procedures may provide poor bone quality in height, width, angulation and impaired intermaxillary relationships. Ridge augmentation may be considered in such cases to enhance placement of dental implants at a proper prosthetic position. Several augmentation methods and materials have been successfully used but much controversy still exists [1-10].

Autogenous bone grafts still the gold standard due to their biological activities, their safety and their excellent incorporation in the recipient bed. Common extra donor sites such as the iliac crest, rib, tibia and calvarium are used and provide large quantities of bone. The main disadvantages of extraoral donor sites are; the need for hospitalization, general anesthesia, prolonged healing time, morbidities, and visible scars [11-17]. Different intraoral donor's sites are widely used as bone blocks and or particulate bone, but the most typical are the chin and retromolar area [18-22]. They have different degrees of morbidities and complications [23-27].

Non autogenous bone grafts; allografts, xenografts, and synthetic bone are widely used either alone or in combinations [28-34]. They eliminate the potential complication associated with the donor site, their availability is unlimited but typically lacks osteoinductive characteristics and the ability to transfer osteoprogenitor cells to the recipient sites.

Autogenous bone graft goes through revascularization together with remodeling and substitution of the graft, which results in integration of the graft and the recipient bed [35]. There is a strong relationship between revascularization and osteogenesis inside and around the graft [36]. Revascularization of the bone graft begins when blood vessels sprouts grow and penetrate the bone block. They originate from two sources; 1- from the recipient bed, and 2- from the surrounding soft tissue. Hammack and Enneking in 1960 found that penetration of the blood vessels to the cortical graft was at the sixth day [37]. De Marco., *et al*. in 2005 reported the timing and the penetration rate of the blood vessels in the autogenic bone block in rats. New capillaries had migrated from the surface of the recipient bed and penetrated the graft to varying degree [38]. Graft fixation plays a key role in corticocancellous bone grafts survival and minimizing early graft volume loss and infections [4,39,40].

In this article I introduce a new bone augmentation method, Fares Wedge Technique(FWT). This technique is a biological approach that utilizes the main advantage of autogenic bone by transfer living cells, and the main advantage of the allogenic particulate graft that is readily available and unlimited in its quantity. The way that this technique employs the autogenic bone block with combination of particulate allogenic bone substitute makes the limited amount of bone harvested from intraoral donor sites enough for large augmentations, and may enhance the revascularization of the thin bone blocks (the bone wedges).

Patients and Methods

During a 6-years period, Fares Wedge Technique was used to augment different sites of atrophic ridges (Table1) (Figure 11). The majority of the patients were referred by their surgeons due to different types and degrees of alveolar bone deficiencies, a lot of them result from failed implants or failed previous bone augmentation attempts.

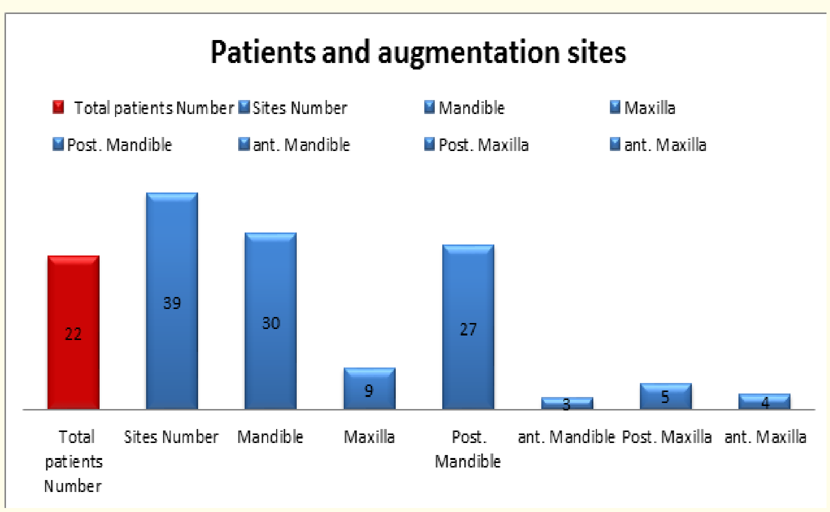


Figure 11: *Patients and augmented sites.*

Patient No.	Site's	Age	Sex	Augmented region	Available Bone		Donor Side
					Height	width	
1	1.1 1.2	48	F	44-47 35-36	4-5 5-7	1.2-2.4 2.5-3	**RT**
2	2.3 2.4	19	F	45-47 35-37	5.4-6.2 7-9	3.2-4.2 3-4.5	**RT**
3	3.5	28	F	13-23	10-12	1.5-2	**RT**
4	4.6 4.7	63	M	43-47 34-37	8-18 6-11	1.5-2.5 2-4	**RT**
5	5.8 5.9	29	F	32-42 44-47	9-12 6-10	1.5-3 2-6	**RT**
6	6.10 6.11	54	F	44-47 35-37	4.5-9 6-10	2-3.2 2.8-3.5	**LT**
7	7.12 7.13	54	F	44-47 35-37	6-10 6-8	3-4 4-6	**LT**
8	8.14 8.15	49	F	33-43 36-37	16-18 8-10	1.8-2.4 1-2	**LT**
9	9.16	63	M	35-37	7-9	2.5-5	**LT**
10	10.17	55	M	34-37	6-8	3-7	**LT**
11	11.18 11.19	47	F	34-37 45-47	5-7 5-8	2.4-4 2.8-4	**RT**
12	12.20 12.21 12.22	56	F	13-17 23-27 43-47	6-11 7-12 8-18	1.5-2.5 1.5-3 1-3	**RT&LT**
13	13.23	19	M	23-27	8-11	2.5-3.5	**RT**
14	14.24 14.25	39	F	43-47 34-37	5-7 5-7	6-8 6-8	**LT**
15	15.26	62	M	15-25	10-13	1-2	**RT**
16	16.27 16.28	67	M	34-36 44-47	5-7 5-8	2.4-4 2.9-4	**LT**
17	17-29 17-30	51	F	46-47 36-37	3-5 3.5-7	6 6	**RT**
18	18.31 18.32	30	F	12-15 33-43	8-11 14-18	2.5-3 2-3	**RT**
19	19.33 19.34 19.35	44	F	13-23 46-47 34-37	8-13 4-5 6-7	1.8-2.7 2-3 3-4.5	**RT**
20	20.36 20.37	54	F	44-47 35-37	3.5-4.8 4.6-5.2	4-5 3-6	**RT**
21	20.38	57	F	26-27	4-6	2-4	**LT**
22	22.39	53	M	35-37	8	2-4.5	**LT**

***Table 1:** Patients, augmented sites, and the donor site.*

Patients with informed consent underwent three-dimensional bone augmentation at least in one site in different arch regions to restore an atrophied alveolar ridge. The majority of the cases had; 1-at least two sites at one or both jaws, and 2- the majority of the sites were at the posterior mandible. Indications for the use of Fares Wedge.

Technique in the participants were: atrophic alveolar ridge with bone deficit that needs vertical or horizontal bone augmentation or both. The retromolar area was the donor site of the bone cortical wedges of this technique. Post-operative instructions include soft diet for six weeks, antibiotics for ten days, meticulous oral hygiene and any use of removable appliance was not allowed.

Follow up examinations were performed every 2 weeks. Four months after the operation, the recipient sites were evaluated clinically (to assess the contour and the volume of the augmented ridge), and radiographically (by computed tomography) to examine the bone gain and the new available bone to receive dental implants.

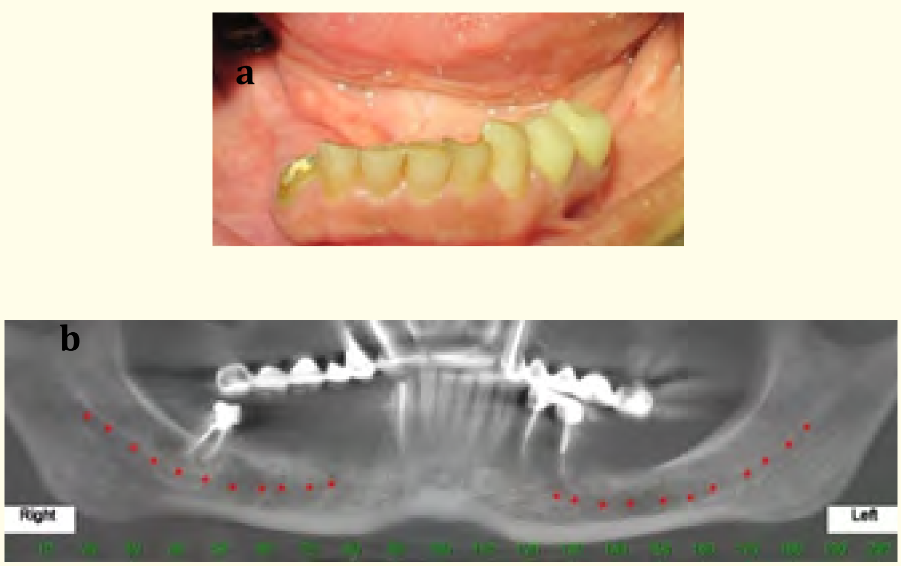
Reentry was performed after 4 to 5 months to evaluate the new bone volume, obtain biopsy specimens and insert implants. Patients were referred back to their dentists for prosthetic rehabilitation. Follow-up of the bone augmentations and implants that were inserted in these sites, included periodic clinical evaluation and periapical radiographs. All the surgical procedures and postoperative evaluations were performed by the author.

Technique:

Illustration case; 55 years old female was referred to pro-prosthetic unit at the cranial maxillofacial department at Brauch Pade Medical Center to augment her posterior mandible bilaterally and placement of dental implants.

On examination; healthy patient, bilateral posterior mandibular edentulism (Kennedy class-1), lingually position and angulation of both residual ridges (Figure 1a).

On CT scan; Moderate to severe atrophy of the both posterior mandibular ridges (Figure 1b&c). Short implants are not option due to the severe lingual angulation of the ridges. Guided implants placement is not an optional treatment due to the central position of the inferior alveolar nerve. This case necessitated bone augmentation and was treated with FWT.



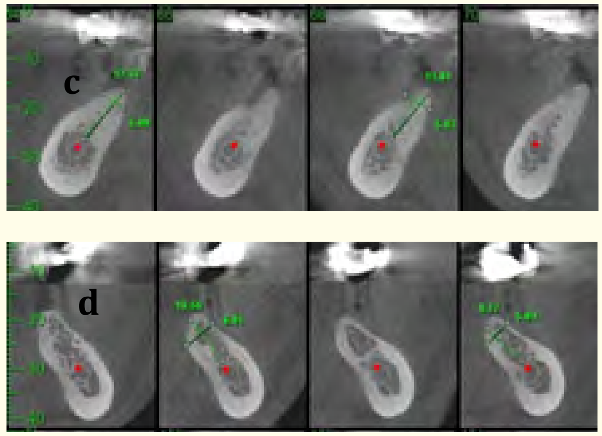


Figure 1: *FWT, illustration case; Bilateral posterior mandibular edentulism.*

Figure 1a: *Clinical view.*

Figure 1b to 1d: *Computed Tomography shows inadequate bone in height, width, and angulation.*

The Donor Site:

Retromolar region is the gold standard of Fares wedge technique. It can provide cortical bone block of 3-4mm thickness, 2-3 cm length, 8-12mm width, and its bone density is D1. At the present case the left retromolar area was the donor site.

Under general anesthesia, IV Augmentin 1 gr, and Iv Dexamethasone 20 mg, and local anesthesia with vasoconstrictor. A full-thickness mucoperiosteal flap was reflected with midcrestal incision distal to the second premolar. The incision was extended through the retromolar region to the ramus. An anterior oblique release incision was made at the first premolar and extended to the vestibular depth. This flap exposed the left augmented site (teeth 36 and 37 region), and the donor site of the bone block, it also allowed visualization of the lateral and inferior border of the mandible, the buccal shelf and the mental neurovascular bundle. The length (posterior-anterior) of the bone block, its width (superior-inferior) was determined and done by three complete osteotomies; posterior, anterior, and inferior (Figure 2a) with micro saw. The superior (crestal) edge was perforated with small holes by small round bur in a straight handpiece, and the determined the thickness of the bone block.

The block harvest was completed by straight osteotomy that was malletted along the superior holes. The block was carefully released and obtained to avoid injury to inferior alveolar neurovascular bundle. The donor site was lifted to spontaneous healing.

The wedge Preparation:

The wedge preparation was done by multiple splitting of the harvested bone block. At the present case the bone block splitting was performed in its longitudinal axis, the first split yielded two thinner bone blocks, and further splitting at the same axis gave 4 thin bone blocks from the original bone block (Figure2b to2d).

Further transverse splitting of the four thin bone blocks gave 8-10 thin bone blocks and each is called bone wedge (Figure2e and 2f). In general, we can make the splits of the original block at its transverse axis, and receive four thick bone blocks. Further splitting of those blocks at their long axis can give 8-10 thin bone wedges (Figure2g to2j).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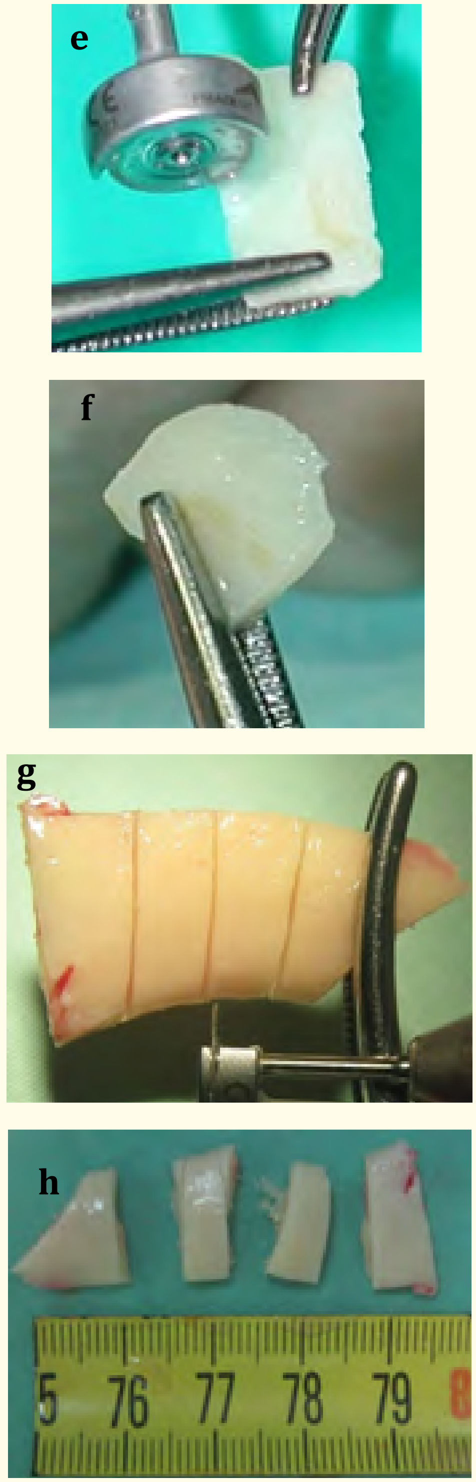
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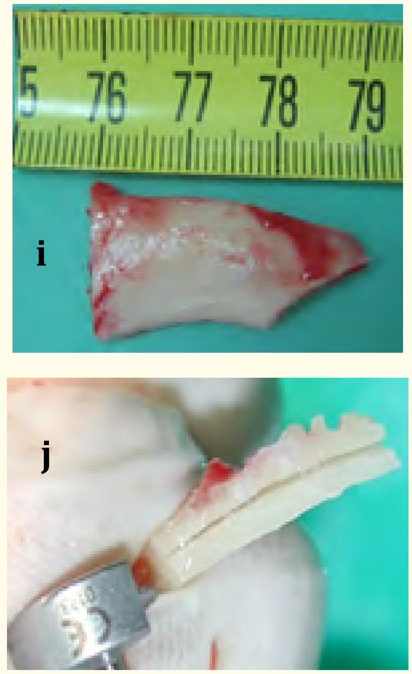


Figure 2: *FWT, the donor site and the wedge preparation.*

Figure 2a: *Bone block harvest from the left retro molar area.*

Figure 2b to 2f: *Multiple splitting of the bone blocks result in multiple small bone wedges.*

Figure 2g to 2j: *Transverse splitting of the harvested bone block maybe also done to create the bone wedges.*

Recipient site:

The left recipient site was already exposed, the augmented bed is prepared by making grooves (slots, fissures) with high speed straight thin bur, low speed small straight bur or by piezo. In the present recipient site three bucco-lingual grooves were made (Figure 3a and 3b). The number of the grooves are determined by the length of the augmented ridge, and the depth of the grooves is limited by its distance from the inferior alveolar nerve that can measured on the dental CT scan. In general, the groove should be through and through bucco-lingually, and as deep as possible. The role of the groove by this technique is biological and mechanical retention of the bone wedge.

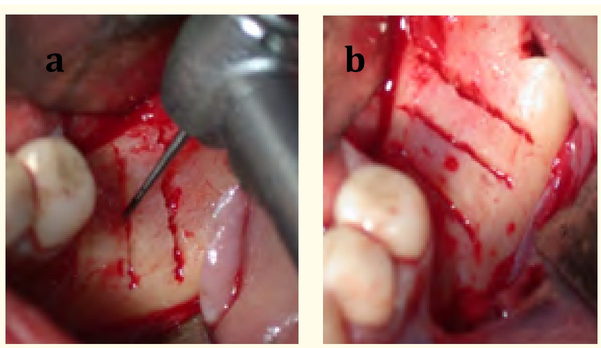


Figure 3: *FWT, The recipient site.*

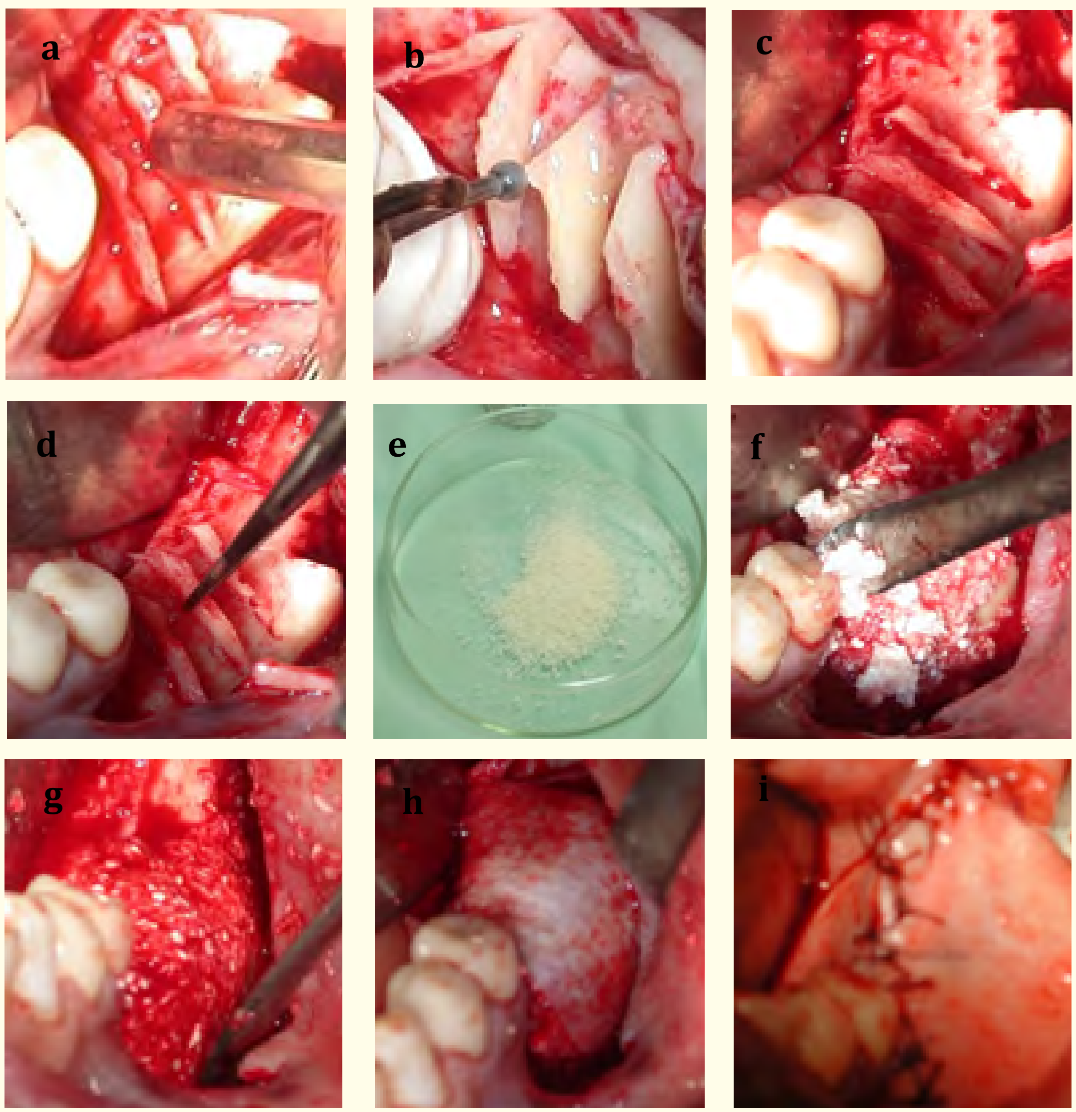
Figure 3a: *Grooves are created by height speed, low speed or piezoelectric.*

Figure 3b: *Three grooves were created at the right side.*

The augmentation procedure:

Try- in the bone wedges into the grooves at the recipient bed, and adaptation of one bone wedge to each groove. Thereafter one wedge is inserted and taped into one groove using flat edge cylindrical instrument and hummer (Figure 4a). It is extremely important to check the stability of each wedge by trying to take it out from the groove, unstable wedge should be removed and changed by stable one. The next step is trimming of sharp edges of each wedge to prevent trauma to the soft tissue overlying the augmentation (Figure 4b and 4c).

Multiple bone compartments are achieved from the above stages, (Figure 4d). The next step is the filling of those compartments with allograft (Figure 4e and 4f). The final product is the planned bone augmentation volume (Figure 4g), that then is covered with resorbable membrane (Figure 4h). The final step is tension free closure of the flap (Figure 4i). Free buccal fat pad graft may be used to enhance flap closure.



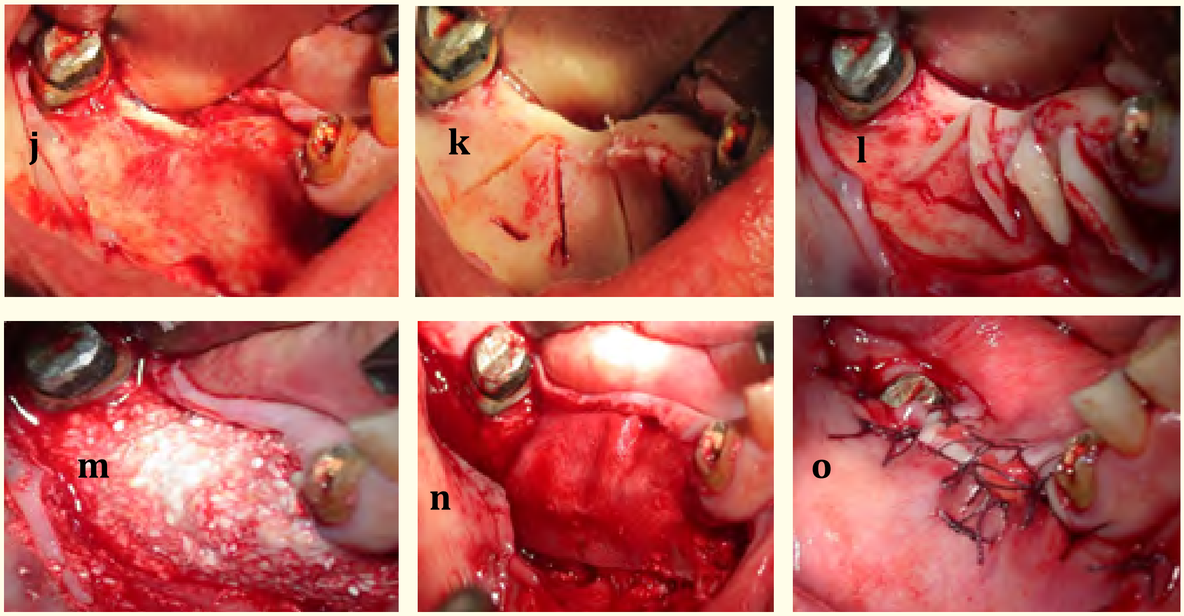


Figure 4: *FWT, Bone Augmentation.*

Figure 4a: *Inserting and tapping of the wedges inside the grooves.*

Figure 4b: *Trimming of sharp edges.*

Figure 4c: *Checking the stability is crucial.*

Figure 4d: *Bone compartments at the recipient site.*

Figure 4e: *Bone filler allograft.*

Figure 4f: *Filling the bone compartments with allograft particles.*

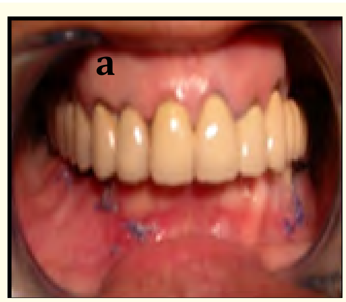
Figure 4g: *The final bone volume.*

Figure 4h: *Resorbable membrane.*

Figure 4i: *Tension free closure.*

Figure 4j to 4o: *FWT bone augmentation RT side.*

Follow-up 3 times every two weeks then once monthly (Figure5a and 5b). After 4 months the patient was referred to CT dental to evaluate the amount of the bone gain from the augmentation procedure (Figure5c to 5e). The dental implants were inserted under local anesthesia (Figure6). Then 3-4 months later the patient was referred to her dentist for prosthetic rehabilitation (Figure 7a to 7b). This case is followed 62 months (Figure 7c to7e).



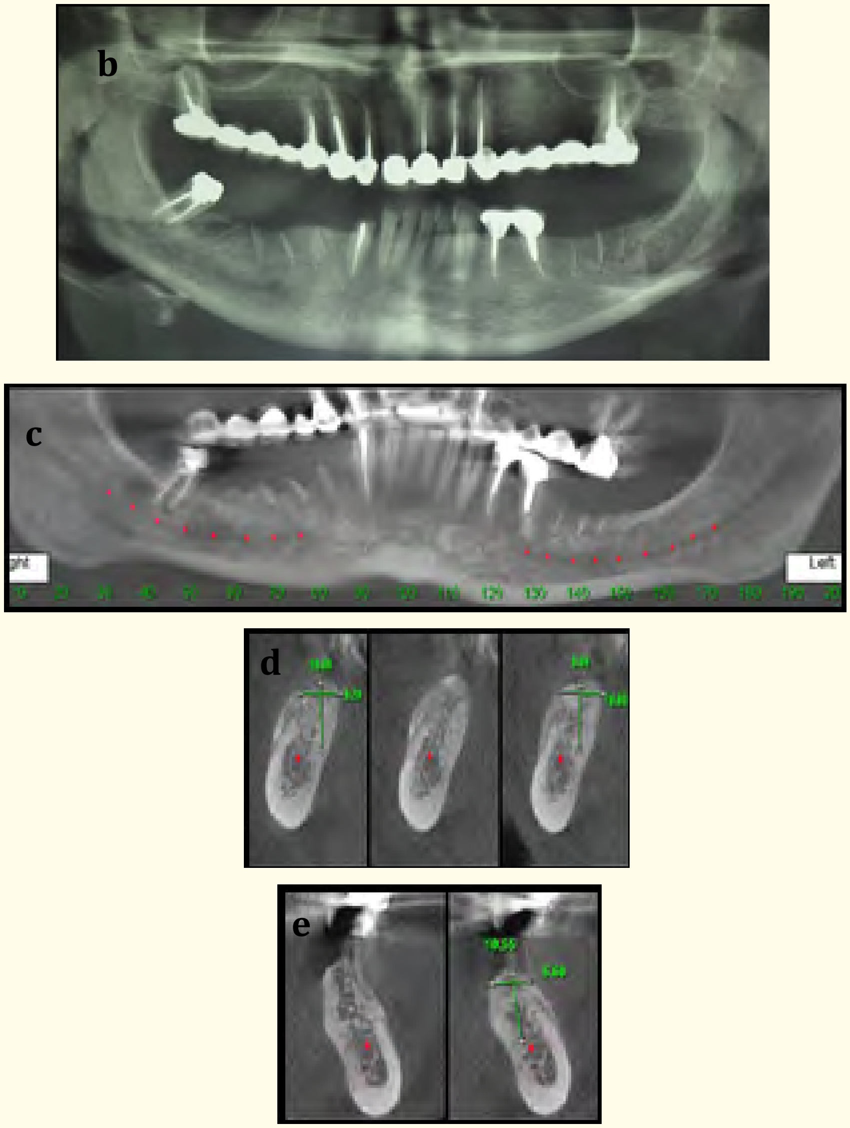
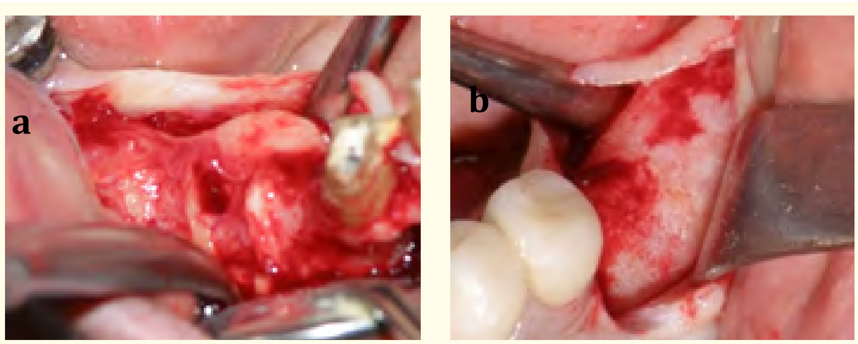


Figure 5: *Follow-up two weeks.*

Figure 5a: *Clinical view.*

Figure 5b: *The panoramic view demonstrates one donor site and two recipient site.*



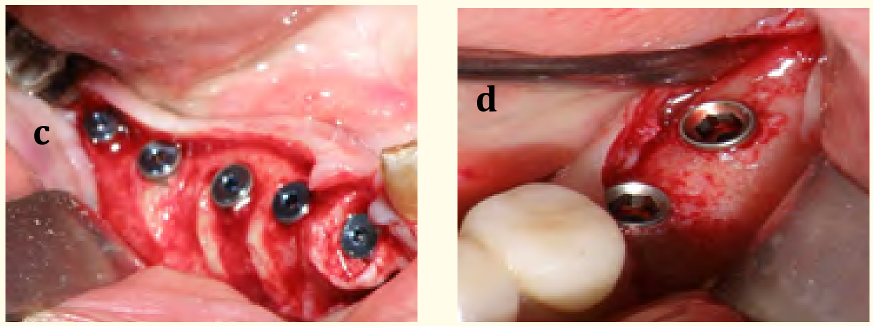


Figure 6: *Reentry 4 months. Nice bone gain.*

Figure 6a: *RT side.*

Figure 6b: *lt side.*

Figure 6c and 6d: *Implants placement.*

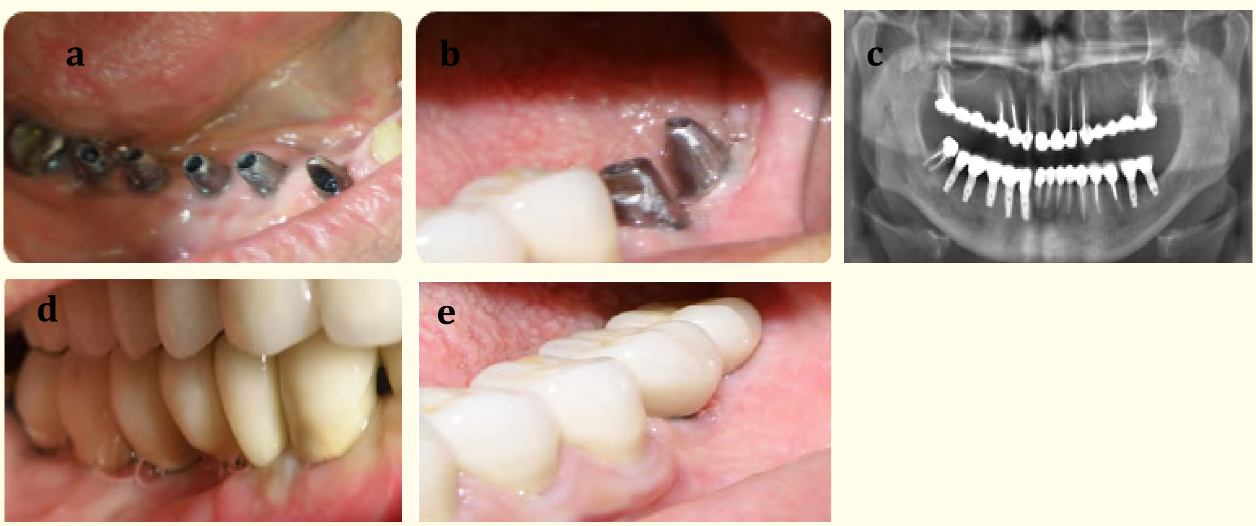


Figure 7: *Rehabilitation and follow up.*

Figure 7a and 7b: *Crowns rehabilitation.*

Figure 7c to 7e: *Panoramic radiograph and clinical view 36 months after the surgery.*

Case Presentations:

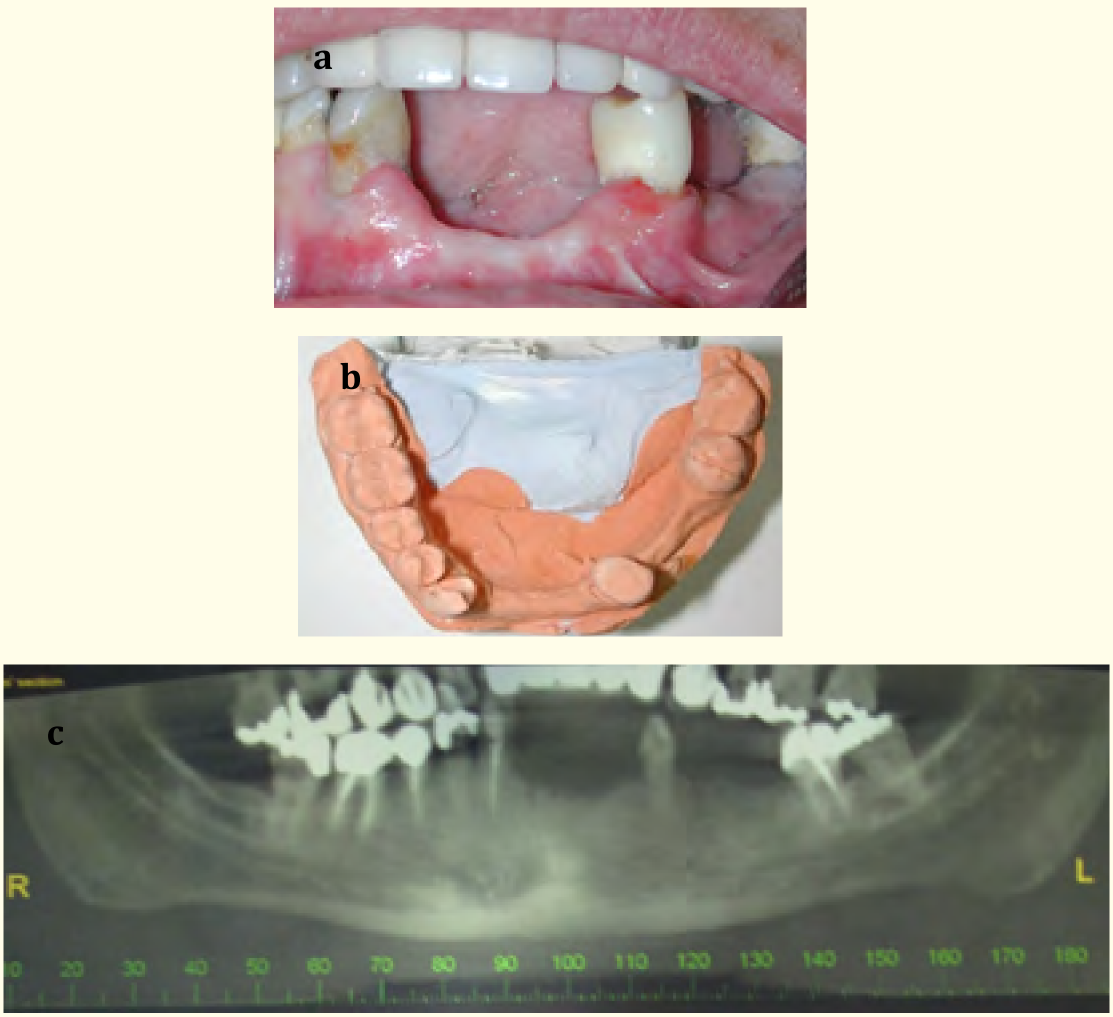
Case 1

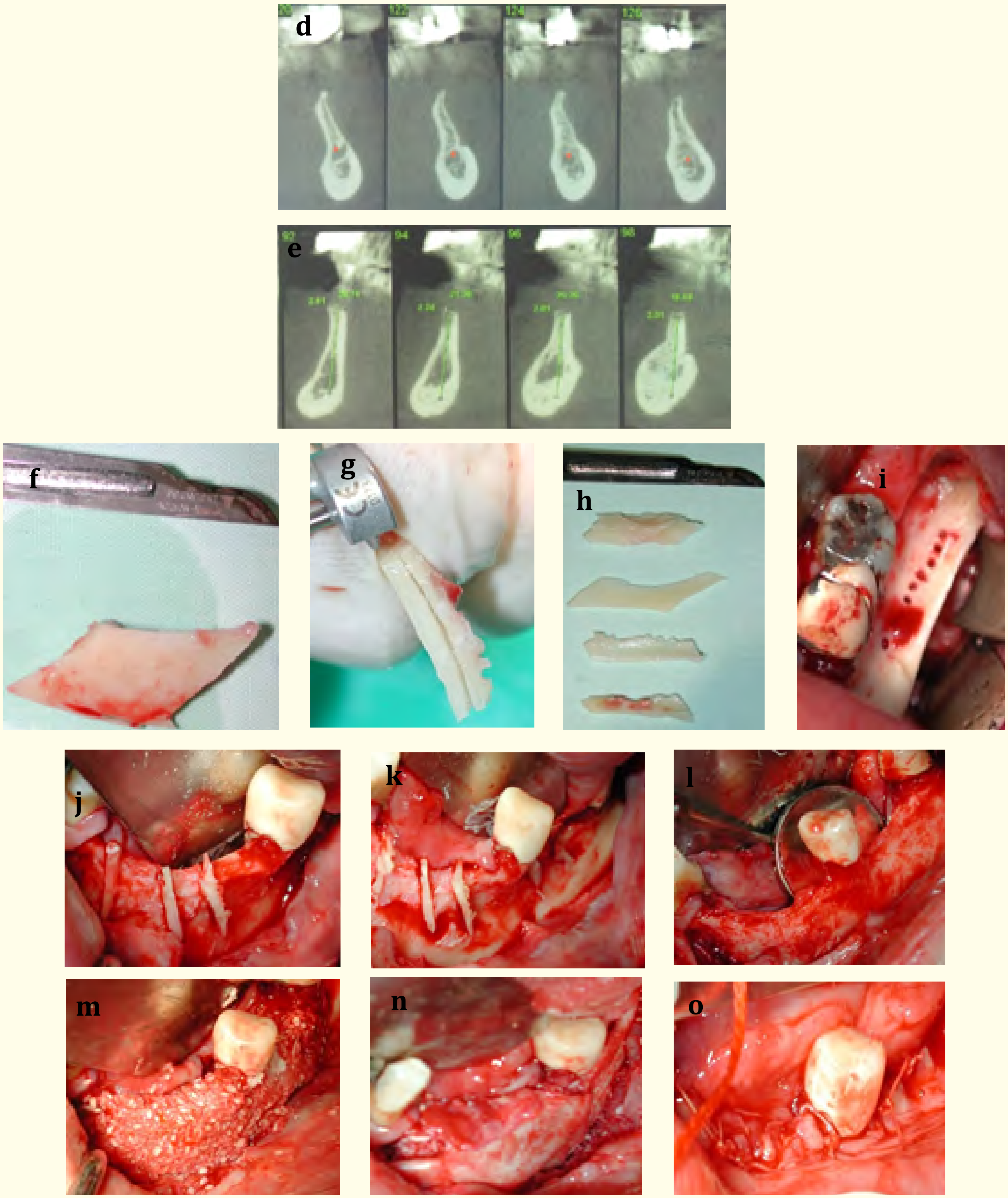
A 45- year- old woman was referred to our department to augment atrophic ridges at the anterior and LT posterior mandible.

On examination; partial edentulism of the mandible with missing anterior and Lt posterior teeth (43-33 and 35,36) teeth 34 and 44 were with poor prognosis (Figure 8 a to c). Computed tomography was performed and demonstrated the bone deficit in height and width at the anterior and left mandible (Figure 8 d and e). She was treated in two stages. At the first stage FWT was performed to augment the anterior and left mandibular region.

Under general anesthesia the bone block was harvested from LT retromolar area (the same surgical site), the bone block was splitted and bone wedges were achieved (Figure 8f to i). The recipient sites were prepared by creating grooves, and thereafter 7 bone wedges were inserted into the grooves in stable position. Several bone compartments were achieved (Figure 8j to l), and after the trimming of sharp edges the produced compartments were filled with particulate allograft bone substitute. A final bone volume was achieved (Figure 8m), and covered with resorbable membrane (Figure 8n). Then the recipient sites were closed tension free (Figure 8o). Temporary bridge based on teeth 34 and 44 was performed. The healing process was uneventful during the follow up period.

Computed dental tomography was performed after 4 months to evaluate the available bone for dental implants (Figure 8p to8r). The bone gain was 4-6 mm horizontally and vertically. Under local anesthesia the reentry revealed new bone volume, the bone wedges were integrated into the new bone mass (Figure 8s), and 6 implants were inserted (Figure 8t to 8u). Immediate loading was performed over the anterior implants (Figure 8v). All implants were successfully osteo integrated (Figure 8w and 8x) and the final rehabilitation was performed after 3 months (Figure 8y). This case is followed 48 months (Figure 8z).

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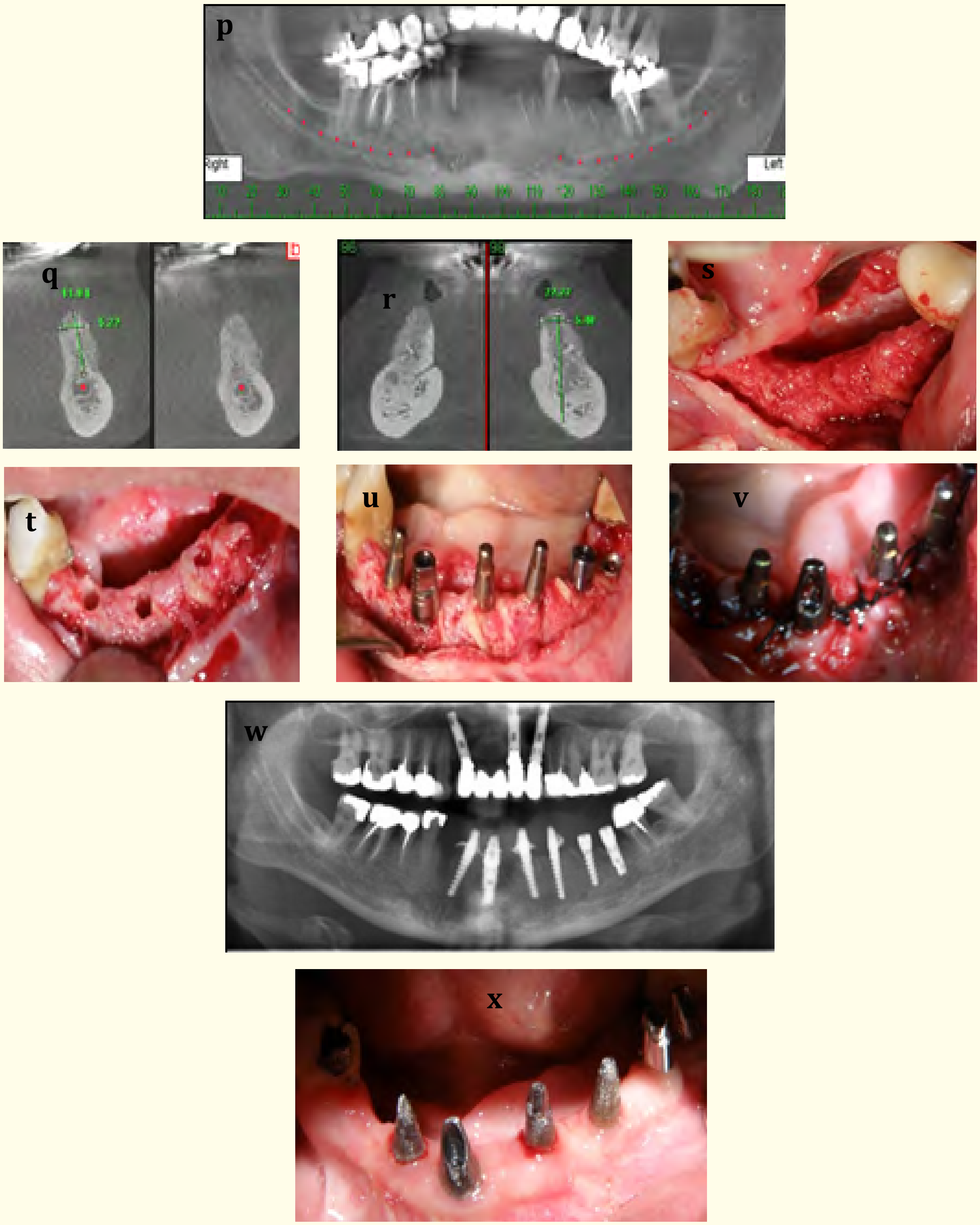
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Figure 8: *Case 2.*

Figure 8a to 8e: *clinical and radiographic view.*

Figure 8f to 8i: *bone block harvest and preparation of the bone wedges.*

Figure 8j to 8o: *FWT bone augmentation anterior and left mandible.*

Figure 8p to 8r: *computed tomography 4 months after bone grafting.*

Figure 8s to 8v: *reentry and implants insertion 4 months after the augmentation surgery.*

Figure 8w: *radiographic view-follow up.*

Figure 8x to 8y: *crowns rehabilitation.*

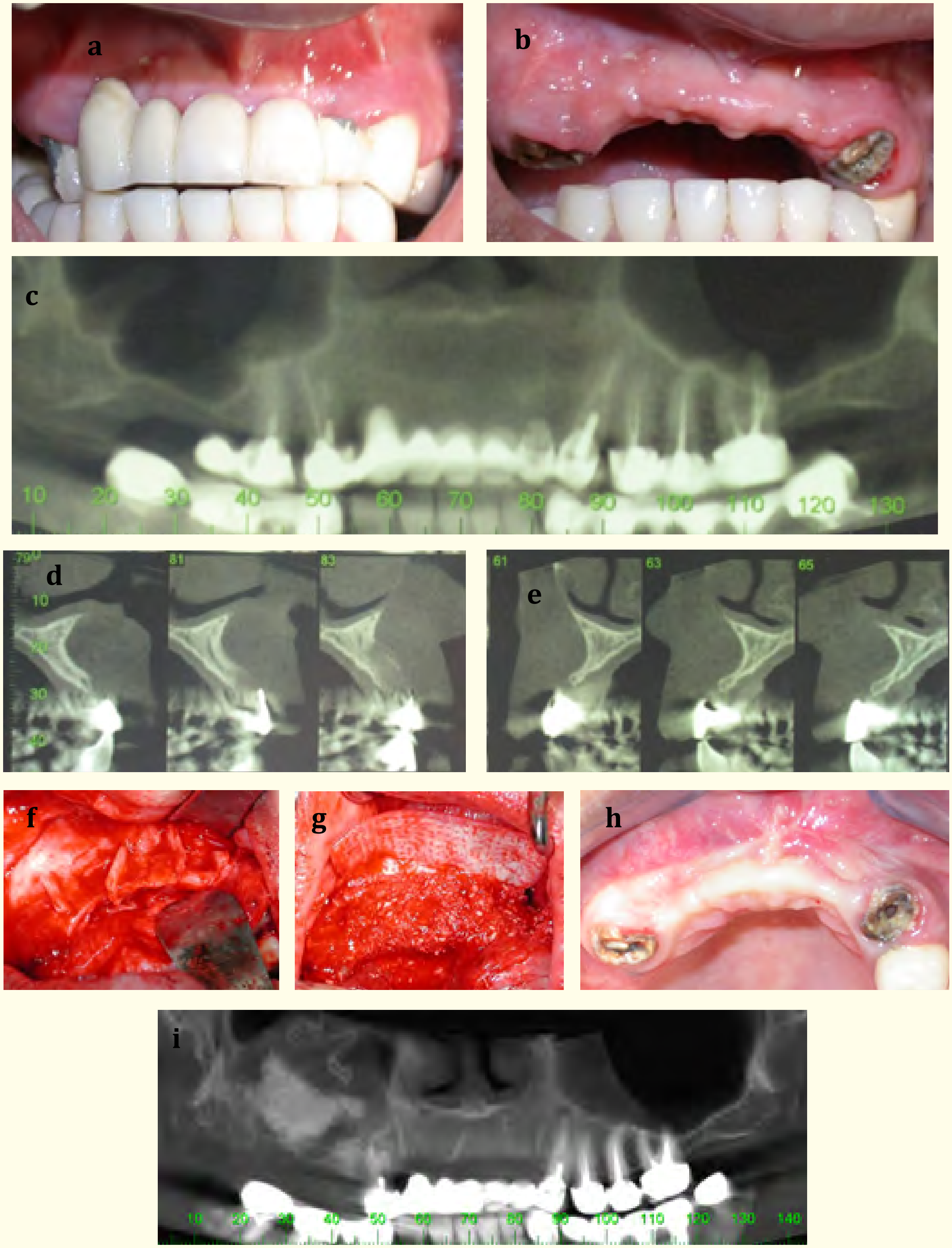
Figure 8z: *48 months-follow-up.*

Case 2

A 28-year-old woman was referred because of sever atrophy of anterior maxillary region that was treated unsuccessfully by bone augmentation by her surgeon. Clinical and radiographical examinations revealed sever atrophy of the anterior maxillary ridge and pneumatization of the RT maxillary sinus (Figure 9 a to9e), teeth 23, 14 and 15 were with poor prognosis. She was treated in three stages. First, bone augmentation of the anterior maxilla with FWT, extraction and socket preservation of tooth 15 and open sinus augmentation at the RT maxillary sinus under general anesthesia. The RT mandibular retromolar area was the donor site for the bone block. Four cortical bone wedges were inserted at the grooves that were prepared at the recipient site (Figure 9f). Particulate allograft bone substitute was used as the bone filler between the bone wedges (Figure 9hi). Teeth 14 and 23 were preserved to hold temporary acrylic bridge during the healing period.

Follow-up examinations at 2 weeks, and three months (Figure 9h), showed excellent recovery. At 4 months, computed tomography showed the new bone gain and the available bone (width; 6 to 10 mm) for implant insertion (Figure 9i to 9k). At stage-two surgery, the intra-operative views showed a good alveolar ridge, the bone wedges had excellent integration in the new bone volume (Figure 9m), and (Figures 9n and 9p), demonstrate the drilling through those wedges. Teeth 14 and 13 were extracted and particulate allograft bone substitute was used to preserve their sockets. At this stage 4 implants were placed at the anterior augmented region with immediate loading (Figure 9q to 9s).

At stage-three surgery, additional 4 implants were placed; 3 at the RT maxilla and one implant at tooth 23. Four months later the patient was referred to her dentist for fixed prosthesis over the implants (Figure 9t to 9u).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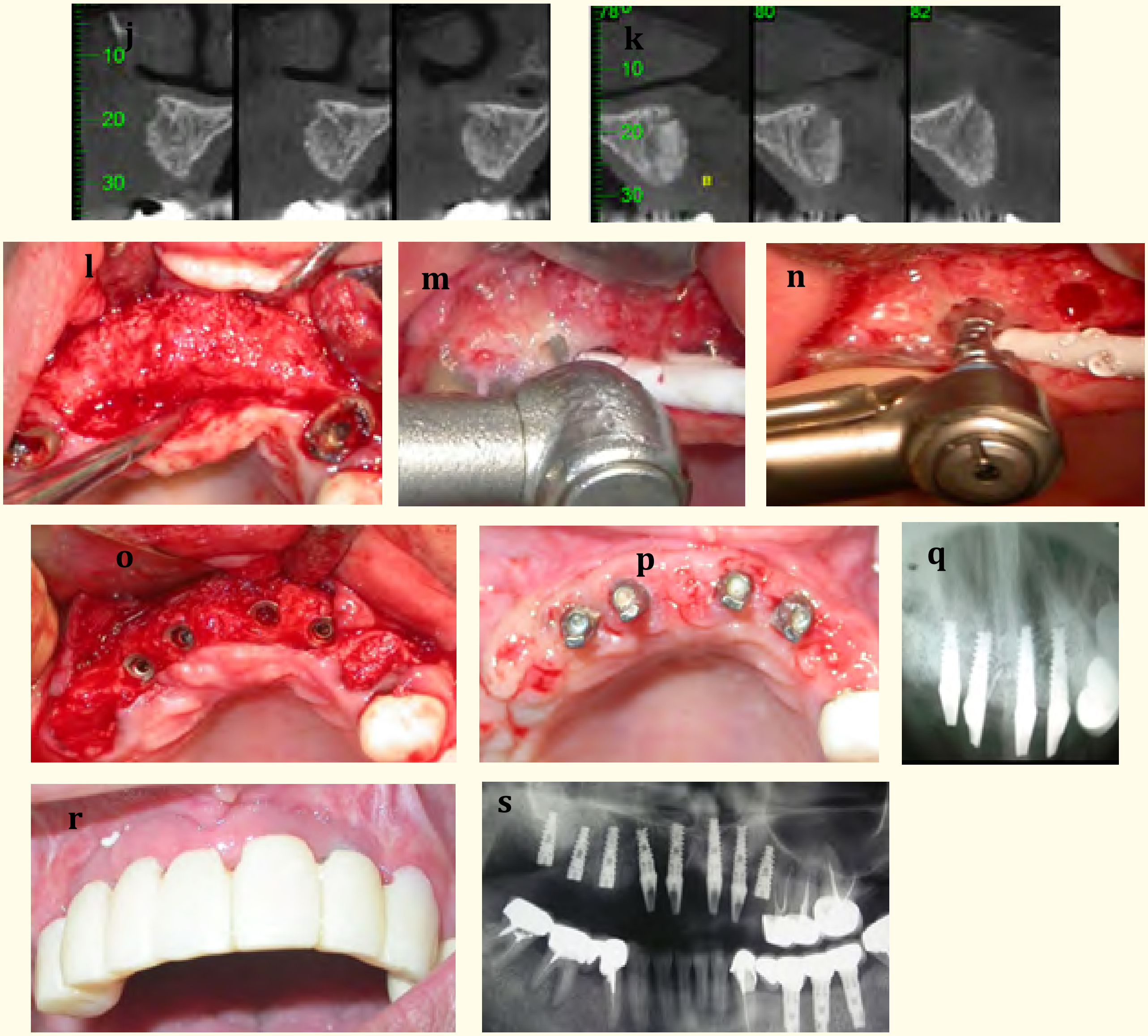

Figure 9 to 9u: *Case 2.*

Figure 9a and 9b: *Clinical view- anterior maxilla.*

Figure 9c to 9e: *Computed tomography- anterior maxilla.*

Figure 9f to9g: *FWT bone augmentation.*

Figure 9h to 9k: *Clinical and radiographic view- follow-up four months.*

Figure 9l: *Reentry 4 months, nice bone volume.*

Figure 9m and 9o: *The drilling for the implants was performed inside the bone wedges.*

Figure 9p: *4 implants were placed in the recipient site.*

Figure 9q and 9r: *Clinical and radiographic view at 4 months after the reentry.*

Figure 9s to 9t: *Temporary rehabilitation follow up, 6 months after implants insertion.*

Results

Clinical Outcomes

Bone augmentation with FWT was performed in 39 sites in 22patients (15 women, 7 men; mean age 47 years; range 19to 67 years). The healing process was uneventful. The donor site for the bone block (the retromolar area) healed very well without complications and spontaneous regeneration of the site was observed during the follow-up period.

In 21 patients the recipient sites healed very well, and the bone augmentations were maintained without wound dehiscence.

In one patient, partial breakdown of the wound occurred, and the majority of the augmented bone was lost; this patient had completed treatment with nerve transposition.

Four months after the augmentation surgery, in 21 patients, clinical evaluation of the recipient sites revealed new hard tissue volume and good ridge contour. Computed tomograms showed that good bone volume was obtained; bone gain was 4 to 8 mm horizontally and 3-6 mm vertically.

The second surgery that was performed for implant insertion revealed a new and good bone volume, with excellent integration of the bone wedges in the recipient site. 113 implants were inserted of adequate lengths (10-16 mm) and diameters(2.8-4.2 mm). Further follow-up of the augmentation sites and the implants revealed stable outcomes. The mean follow-up period was 32 months.

Histologic Findings

At the reentry stage for implant insertion, hard tissue specimens were taken from the wedge area for histologic evaluation (Figure 10a and 10b). The histologic specimen of the bone wedge revealed osteocytes inside the bone wedge, osteoblasts and osteoclast in its periphery (Figure 10c). Those findings may indicate the vitality and remodeling of the graft.

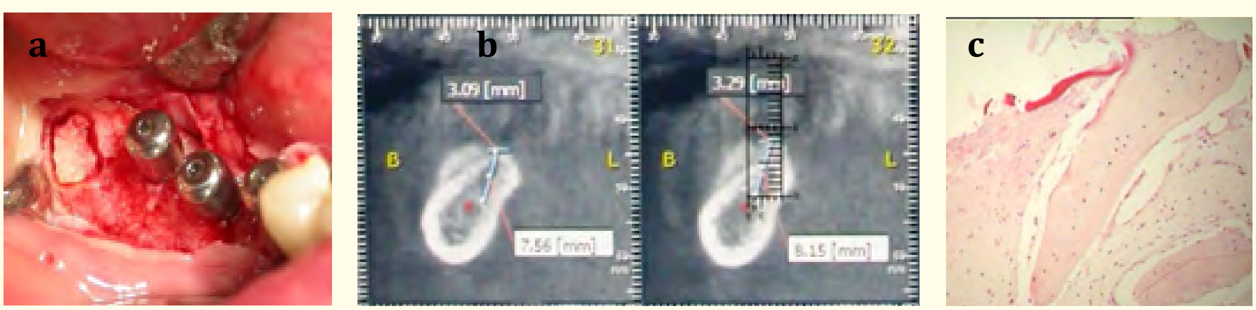

Figure 10a to 10c: *Histologic examination.*

Figure 10a and 10 b: *the site of the wedge biopsy.*

Figure 10c: *the bone wedge is obvious at the center of the figure.*

Discussion

Autogenous bone grafts have been used many years for ridge augmentation and still considered the gold standard. Intraoral donor sites, mandibular symphysis and ramus are widely used. Extraoral donor sites are also used, and they are combined with major disadvantages that include the morbidity of the donor site, the high treatment costs, and heigh resorption rates [11-17].

Retromolar/ramus area is used as donor site, and the majority of the bone block that obtained is a cortical bone. Pikos in 2005 stated that one donor site can provide adequate bone volume for three-tooth segment, and can augment 3-4 mm as horizontal or vertical bone augmentation [41].

If extensive bone graft is required for one or more sites in the same mouth, then it may be necessary first to harvest simultaneously bilaterally from the ramus area and from the symphysis, or it may be necessary to make multiple augmentation of the same site. Schwartz reported the use of multitier technique for such cases. In addition, some surgeons may use extraoral donor sites for extensive or multiple sites augmentations [42]. Among the major concerns in the bone block augmentation, two are important. First, bone block dislodgment during the implants insertion [43], and second, the presence of connective tissue layer between the block graft and the recipient bony site [44].

The present report describes the fares wedge technique as a novel bone augmentation method that can be useful for multiple site augmentations as horizontal or vertical bone augmentation or both.

The multiple splitting of one harvested block may give 12 to 16 thin cortical bone wedges (0.6 to 1 mm thickness for each wedge), and 3 to 4 wedges that are used in the recipient site can augment three-tooth segment. A simple calculation shows that one harvested bone block can augment 3 to 4 sites of three-tooth segment. The use of cortical bone wedges that are inserted into the grooves at the recipient site create bone compartments that are filled with bone particles, usually allograft, are the basic concept of this technique. This combination in this way make it possible to augment more than one site (usually 2 to 3 sites) from one harvested bone block.

The grooves that are prepared at the recipient site by FWT have several functions that include; 1- mechanical retention of the cortical bone wedge so there is no need for fixation materials like screws, and in this way the hazards of hardware infection and expenses can be eliminated. 2- biological retention of the cortical bone wedge, and this is because the grooves are a kind of recipient site decortication, and the injury to the blood vessels can enhance angiogenesis and revascularization of the thin bone wedge in one hand, and in the other hand can accelerate the regional acceleratory phenomenon which have an important function in the healing of the operated organs. It is well documented in the relevant literature that the success of bone grafting procedures depends mainly on the amount of revascularization (quality and intensity). De Marco et al in 2005 reported that several vascular sprouts proliferated toward the graft by the third day, and were demonstrated at the graft periphery. Revascularization was more intense in the area near the perforation of the recipient bed. Those findings may explain the integration the thin bone wedges in the retention grooves at the recipient bed, and this may happened due to the wide openings of the blood vessels when preparing the grooves at the recipient bed. Upon the histologic examinations from the bone wedges that were performed 4 months after the augmentation: Osteocytes were visible inside the wedge and indicates its vitality. In addition, the presence of osteoclasts and osteoblasts at the periphery of the wedge is an indicator of the graft remodeling.

In FWT, the cortical bone wedge also has several functions; first, the thin nature of the wedge(0.5-1 mm) make it more readily to be penetrated by the vascular sprouts that emerge from the grooves at the recipient bed, so the revascularization of the graft may be earlier and more intensive than a thick block. Second, the bone wedge acts as space maintainer for the new bone volume, and this achieved by the multiple bone compartments that created between the bone wedges. Third the bone wedges while they are inserted in the grooves, they tent the membrane, support the particulate bone filler, and inhibit deformation of the augmentation materials. Insertion of several bone wedges at the recipient site creates a site with increased number of bone walls that may accelerate the regeneration of the treated sites. The wedge – groove unit increases the bone to bone contact surface and can lead to the end point of fast wedge to groove integration. Successful grafting depends directly on close contact between the graft and vascularization tissue, and in fixation of the graft to the recipient bed [35, 39]. Those two principles are found in the wedge-groove unit.

FWT has several advantages which includes:

1. Two harvested bone blocks for multisite augmentation in both jaws.
2. No need for fixation materials (Screws, miniplates or titanium mesh).
3. No need for extra-oral donor sites.
4. Reducing complications and expenses.

The use of free fat graft is usually used with this technique for double layer and tension free closure of the recipient site [45].

Conclusions

Fares wedge technique biological rational is to create multiple autogenic bone compartments that filled with allogenic bone particles. This combination can augment multiple sites with intraoral autogeneous bone blocks, and reduces the need for extraoral donor site. The wedge- groove unit may enhance revascularization of the bone graft and improves the graft survival.

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Conflict of Interest

Declare that there is no financial interest or any conflict of interest.

Bibliography

1. Chiapasco M., *et al*. "Bone augmentation procedures in implant dentistry". *International Journal of Oral & Maxillofacial Implants* 24 (2009) Suppl: 237-259.

2. Esposito M., *et al*. "The efficacy of various bone augmentation procedures for dental implants: A Cochrane systematic review of randomized controlled clinical trials". *International Journal of Oral & Maxillofacial Implants* 21.5 (2006): 696-710.

3. Rabelo GD., *et al*. "Retrospective study of bone grafting procedures before implants placement". *International Journal of Implant Dentistry* 19.4 (2010): 342-50.

4. Haggerty CJ., *et al*. "Simple bone augmentation for alveolar ridge defects". *Oral and Maxillofacial Surgery Clinics of North America* 27.2 (2015): 203-226.

5. Boyne PJ and Herdford AS. "An algorithm for reconstruction of alveolar defects before implant placement". *Oral and Maxillofacial Surgery Clinics of North America* 13 (2001): 533-541.

6. Jensen SS and Terheyden H. "Bone augmentation procedures in localized defects in the alveolar ridge: clinical results with different bone grafts and bone-substitute materials". *International Journal of Oral & Maxillofacial Implants* 24 (2009) suppl: 218-236.

7. Stoelinga PJW., et al. "Interpositional bone graft augmentation of atrophic mandible". *International Journal of Oral & Maxillofacial Surgery* 36.1 (1978): 30-32.

8. Jensen OT., *et al*. "Anterior maxillary alveolar distraction osteogenesis: a prospective 5-year clinical study". *International Journal of Oral & Maxillofacial Implants* 17.1 (2002): 52-68.

9. Jensen OT. "Alveolar segmental "sandwich" osteotomies for posterior edentulous mandibular sites for dental implants". *International Journal of Oral & Maxillofacial Implants* 64.3 (2006): 471-475.

10. Urbani G., *et al*. "Distraction osteogenesis to achieve mandibular vertical bone regeneration: a case reort". *International Journal of Oral & Maxillofacial Implants* 11 (1996): 387-394.

11. Beirne OR. "Comparison of complications after bone removal from lateral and medial plates of the anterior ilium for mandibular augmentation". *International Journal of Oral & Maxillofacial Implants* 15.3 (1986): 269.

12. Cricchio G and Lundgren S. "Donor site morbidity in two different approaches to anterior iliac crest bone harvesting". *Clinical Implant Dentistry and Related Research* 5.3 (2003): 161.

13. Kline Jr RM and Wolfe SA. "Complications associated with the harvesting of cranial bone grafts". *Plastic and Reconstructive Surgery* 95.1 (1995): 5-20.

14. Frodel Jr JL., *et al*. "Calvarial bone graft harvest. Techniques, considerations, and morbidity". *Archives of Otolaryngology - Head and Neck Surgery* 119.1 (1993): 17-23.

15. Restoy-Lozano A., *et al*. "Calvarial bone grafting for three-dimensional reconstruction of severe maxillary defects: a case series". *International Journal of Oral & Maxillofacial Implants* 30.4 (2015): 880-890.

16. Chen YC., *et al*. "Donor site morbidity after harvesting of proximal tibia bone". Head Neck 28.6 (2006): 496-500.

17. Nkenke E., *et al.* "Morbidity of harvesting of bone grafts from the iliac crest for preprosthetic augmentation procedures: A prospective study". *International Journal of Oral & Maxillofacial Implants* 33.2 (2005): 157-163.

18. Khoury F. "Augmentation of the sinus floor with mandibular bone blocks and simultaneous implantation". A 6-year clinical investigation. *International Journal of Oral & Maxillofacial Implants* 14.4 (1999): 557-564.

19. Misch CM. "Ridge augmentation using mandibular ramus bone grafts for the placement of dental implants: presentation of a technique". *Pract Periodontics Aesthet Dent* 8.2 (1996): 127-135.

20. Mish CM. "Comparison of intraoral donor site for inlay grafting prior to implant placement". *International Journal of Oral & Maxillofacial Implants* 12.6 (1997): 767-776.

21. Schwartz-Arad D., *et al*. "Surgical success of intraoral autogenous block onlay bone grafting for alveolar ridge augmentation". *International Journal of Implant Dentistry* 14.2 (2005): 131-138.

22. Garg AK, *et al*. "Autogenous mandibular bone grafts in the treatment of the resorbed maxillary anterior alveolar ridge rational and approach". *International Journal of Implant Dentistry* 7.3 (1998): 169-176.

23. Silva FM., *et al*. "Complications of intraoral donor site for bone grafting prior to implant placement". *International Journal of Implant Dentistry* 15.4 (2006): 420-426.

24. Joshi A. "An investigation of post-operative morbidity following chin graft surgery". *British Dental Journal* 195.4 (2004): 215-218.

25. Clavero J and Lundgren S. "Ramus or chin grafts for maxillary sinus inlay and local onlay augmentation: Comparison of donor site morbidity and complications". *Clinical Implant Dentistry and Related Research* 5.3 (2003): 154-160.

26. Nkenke E., *et al*. "Morbidity of harvesting of retromolar bone grafts: A prospective study". *Clinical Oral Implants Research* 13.5 (2002): 514.

27. Nkenke E., *et al*. "Mobidity of harvesting of chin grafts: A prospective study". *Clinical Oral Implants Research* 12.5 (2001): 495.

28. Widmark G., *et al*. "Rehabilitation of patients with severely resorbed maxillae by means of implants with or without bone grafts. A one year follow up study". *International Journal of Oral & Maxillofacial Implants* 13.4 (1998):474-82.

29. Cammack GV., *et al*. "Histologic evaluation of mineralized and demineralized freez-dried bone allograft for ridge and sinus augmentations". *International journal of periodontics & restorative dentistry* 25.3 (2005): 231-237.

30. Simon M, *et al*. "Vertical ridge augmentation by expanded-polytetrafluoroethylene membrane and a combination of intraoral autogenous bone graft and deproteinized anorganic bovine bone (bio Oss)". *Clinical Oral Implants Research* 18.5 (2007): 620-629.

31. Koll A., *et al*. "Current trends and future perspective of bone substitute.materials-from space holdersmaterials to innovative biomaterials". *Journal of Craniomaxillofacial Surgery* 40.8 (2012): 708-718.

32. Gomes KU., *et al*. "Use of allogenic bone graft in maxillary reconstruction for installation of dental implants". *International Journal of Oral and Maxillofacial Surgery* 66.11 (2008): 2335-8.

33. Le B., *et al*. "Cortical tenting grafting technique in severely atrophic alveolar ridge for implant site preparation". *International Journal of Implant Dentistry* 17.1 (2008): 40-50.

34. Khojasteh A., *et al*. "Localized bone augmentation with cortical bone blocks tended over different particulate bone substitutes: a retrospective study". *International Journal of Oral & Maxillofacial Implants* 27 (2012): 1481-1493.

35. Burchardt H and Enneking WF. "Transplantation of bone". *Surgical Clinics of North America* 58 (1978): 403-427.

36. Nathanson A. "The early vascularization of an autogenous bone inlay into an artificial defect in the rabbit mandibular". *Acta Oto-Laryngologica* 85(1-2) (1978): 135-148.

37. Hammack BL and Enneking WF. "Comparative vascularization of autogenous and homogenous-bone transplants". *Journal of Bone & Joint Surgery America* 42-a (1960): 811-817.

38. De Marco AC., *et al*. "Revascularization of autogenous block grafts with or without an e-PTFE membrane". *International Journal of Oral & Maxillofacial Implants* 20.6 (2005): 867-874.

39. Scardina GA., *et al*. "Microcirculation in the healing of surgical wounds in the oral cavity". *International Journal of Oral and Maxillofacial Surgery* 42.1 (2013): 31-5.

40. LaTenta GS., *et al*. "The role of rigid fixation in bone graft augmentation of the craniofacial skeleton". *Plastic and Reconstructive Surgery* 84.4 (1989): 587-588.

41. Pikos MA. "Mandibular block autografts for alveolar ridge augmentation". *Atlas of the Oral and Maxillofacial Surgery Clinics of North America* 13.2 (2005): 91-107.

42. Schwarts AD and Levin L. "Multitier of harvesting technique for bone augmentation using intraoral autogeneous bone blocks". *International Journal of Implant Dentistry* 16.1 (2007): 5-12.

43. Proussaefs P and Lozada J. "The use of intraorally harvested autogenous block grafts for vertical alveolar ridge augmentation: A human study". *International journal of periodontics & restorative dentistry* 25.4 (2005): 351-363.

44. De Carvalho PS., *et al*. "Influence of bed preparation on the incorporation of autogeneous bone grafts: A study in dogs". *International Journal of Oral & Maxillofacial Implants* 15.4 (2000): 65-570.

45. Kablan F and Laster Z. "T e use of free fat tissue transfer from the buccal fat pad to obtain and maintain primary closure and to improve soft tissue thickness at bone-augmented sites: Technique presentation and report of case series". *International Journal of Oral & Maxillofacial Implants* 29.2 (2014): e220-e231.

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