Comparison of two different augmentation techniques

İki kemik arttırım yönteminin karşılaştırılması

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Abstract

Aim: This study aims to compare Guided Bone Regeneration (GBR) performed using autogenous block graft to particulate autograft with xenograft from physicians' and patients' perspectives.

Methods: 30 systemically healthy individuals participated in this study. GBR using block graft (GBR-BAX) was performed in 15 of the patients and GBR using particulate autograft with xenograft (GBR-PAX) was performed in the other 15 patients. Bone thickness was recorded preoperatively and in the 6th month postoperatively. Bleeding, hematoma, flap dehiscence, infection, and paresthesia were evaluated. Patients were requested to record pain intensity and swelling levels using the visual analog scale (VAS) on the 3rd, 7th, and 14th days after surgery. The swelling levels were also recorded by a clinician on the 3rd, 7th, and 14th days after surgery. The cost of the surgery, the time spent on preparing the patient for the surgery, the time spent during the surgery, and the fatigue levels of the physician resulting from surgery were also determined.

Results: Both GBR-BAX and GBR-PAX provided significant bone gain. Bleeding, hematoma, flap dehiscence, infection, and paresthesia levels found also similar. Both techniques caused similar pain, swelling, and discomfort on the 3rd, 7th, and 14th days. VAS results showed no differences in terms of pain and discomfort. GBR-BAX was found more time-consuming in both preparation and surgical period and tiring for the physician but was less costly compared to GBR-PAX.

Conclusion: Within the limitation of the present study, GBR with autogenous block graft and particulate autograft plus xenograft provided similar bone gain and caused similar complications, pain, and discomfort. In terms of efficacy, none of the two techniques was found superior to the other; however, block graft was more time-consuming, tiring, and costly.

Keywords: block graft; guided bone regeneration; pain; xenograft.

Öz

Amaç: Bu çalışmanın amacı, otojen blok greft veya partikül otogreft ve ksenograft ile uygulanan yönlendirilmiş kemik rejenerasyonu (YKR) uygulamalarını hekim ve hasta açısından karşılaştırmaktır.

Yöntemler: Bu çalışmaya sistemik olarak sağlıklı olan 30 birey katıldı. 15 hastaya blok greft ile (YKR-BOK) YKR ve 15 hastaya partiküler otogreft ve ksenogreft (YKR-POK) ile YKR uygulaması yapıldı. Kemik kalınlıkları ameliyat öncesi ve 6. ayda kaydedildi. Kanama, hematom, flep açılması, enfeksiyon ve uyuşma değerlendirildi. Hastalardan ameliyat sonrası 3., 7. ve 14. günlerde görsel analog skala ile ağrı ve şişlikleri kaydetmeleri istendi. Şişlik, ameliyattan sonraki 3., 7. ve 14. günlerde bir klinisyen tarafından kaydedildi. Maliyet, hasta hazırlık süresi, ameliyat süresi ve hekimin ameliyattan kaynaklanan yorgunluğu da belirlendi.

Bulgular: YKR-BOK ve YKR-POK uygulamaları önemli ölçüde kemik kazanımı sağladı. Her iki uygulama sonrası kanama, hematom, flep ayrılması, enfeksiyon, uyuşma seviyeleri de benzer bulundu. Her iki teknik de 3., 7. ve 14. günlerde benzer ağrı, şişlik ve rahatsızlığa neden oldu. Sonuçlar ağrı ve rahatsızlık açısından farklılık göstermedi. YKR-BOK'nin hem hazırlık hem de cerrahi dönemde daha fazla zaman alıcı ve hekim için yorucu olduğu ancak YKR-POK'e göre daha az maliyetli olduğu bulundu.

Sonuç: Bu çalışmanın sınırlamaları dahilinde, otojen blok greft veya partikül otogreft artı ksenograft ile benzer kemik kazanımı sağlandı ve teknikler benzer komplikasyonlara, ağrıya ve rahatsızlığa neden oldu. Etkinlik açısından iki teknikten biri diğerine üstün bulunmadı, ancak blok greft daha fazla zaman alıcı ve maliyetli bununla birlikte hekim açısından daha yorucuydu.

Anahtar Sözcükler: ağrı; blok greft; ksenogreft; yönlendirilmiş kemik rejenerasyonu

Received/*Geliş* : 09.11.2021
Accepted/*Kabul*: 16.02.2022

DOI: 10.21673/anadoluklin.1034650

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INTRODUCTION

Long-term partial or complete edentulousness causes anatomical, physiological and psychological effects and reduces the life quality of the patients (1,2). Physiological alterations such as changes in the salivary secretion, lack of appetite and taste sensation, and psychological changes such as low self-esteem, avoiding smiling and sadness might arise with edentulousness (3-6). Dental implants can easily reverse these adverse situations by restoring lost teeth (3,6,7). However, along with bone resorption in the edentulous area, anatomic structures such as the maxillary sinus, mandibular canal, and mental foramen become closer to the alveolar crest, and the risk of complications associated with implant surgeries increases (8-10). Many advanced surgical augmentation techniques are introduced at this point and provide the necessary bone harvesting (8,9,11-15). However, an ideal method for bone augmentation that has low risk and morbidity, is easy to apply, and well-tolerable by the patient and the physician was not determined yet.

Block graft (BG) procedure is a highly advanced, reliable, and predictable technique for increasing alveolar bone width in patients with inadequate bone volume for dental implant placement (16-20). Severe deficiency in the bone necessitates graft use in larger quantities. Studies report over 100% bone gain after autogenous BG procedure (16,17). The major advantages of the BG procedure are relatively larger amounts and the autogenous character of the grafts. In addition to advantages, there are some disadvantages of the technique such as second surgery for the donor site, resorption of the graft, mucosal dehiscence, donor site morbidity, and ecchymosis (16,18-21). To avoid disadvantages of BG such as second surgical area and donor site morbidity, researchers adapted the guided tissue regeneration method for bones and another autogenous bone technique, guided bone regeneration (GBR) has arisen (11,12,16,17,22). This method is briefly the formation of bone under a membrane used as a roof. The structure of the membrane is also important. In order to stay firm and not collapse, it should have a tight and robust structure that can protect its shape. One of the most commonly used membranes is polytetrafluoroethylene (PTFE) the efficacy in GBR was well-documented (17,23).

In order to find an optimal augmentation method, numerous researchers are involved in a large number of studies. Most of the studies compare the efficacy of different graft types and different membranes with autogenous block grafts (16,17,24-26). Recently, Santana et al. suggested that platelet-derived growth factor combined with a composite bone ceramic graft provided similar bone gain compared to autogenous block graft (25). In contrast, Gultekin et al. reported increased bone width at first but also found increased bone resorption after GBR procedure(16). de Freitas also suggested GBR with bone morphogenetic protein as a realistic alternative for BG with optimal wound healing (26). Nonetheless, no study reported a clear superiority of these techniques from one to another.

All bone augmentation techniques are highly advanced techniques that require experience, updated knowledge, and capability. Studies show the success, potential risks and complications, and prognosis of the techniques. However, no study evaluated GBR with BG plus xenograft or GBR with particulate autograft plus xenograft techniques from the point of view of the patients and the physician. Therefore, the present study aimed to evaluate these two techniques both from the perspective of physicians and patients evaluating the cost of the materials used, time for surgery preparation, time of surgery, postoperative fatigue of the operating physician, pain, discomfort, and swelling of the patient with VAS scale, bone gain with cone-beam computed tomography (CBCT) measurements and complications.

MATERIALS AND METHODS

The present study was prepared considering the STROBE checklist, a checklist of items that should be included in reports of observational studies.

Study Population

The study population consisted of the patients referred to Erciyes University Faculty of Dentistry Department of Periodontology between January 2017 and June 2018. All patients admitted to the clinic with a complaint of tooth loss and inadequate alveolar crest (crest width <4mm) and request for dental implant placement were examined. Intraoral examination of the pa-

tients was performed and panoramic films were taken. Alveolar bone width was analyzed by cone-beam computerized tomography (CBCT). Alternative treatment methods for increasing alveolar bone width were explained to each patient. Patients' choice of treatment was considered and patients who accepted either GBR with BG or GBR with particulate autograft plus xenograft procedures were enrolled in the present study. Therefore, two study groups GBR with BG plus xenograft (GBR-BAX) and GBR with particulate autograft plus xenograft (GBR-PAX) were created. The study protocol was reviewed and approved by the llocal ethics committee Erciyes University Clinical Researches Ethics Committee (approval number: 2018/101, date: 23.02.2018). Informed written consent was obtained from all patients.

Inclusion criteria were 1) 30 to 62 years of age 2) systemically healthy 3) no smoking 4) no use of medications for the previous 6 months 4) no pregnancy and lactation 5) no contraindications for periodontal surgery.

Exclusion criteria were the existence of systemic diseases, pregnancy/lactation, smoking, use of medication, and contraindication for periodontal surgery.

Clinical Procedures

All periodontal examinations were performed by one experienced examiner. Non-surgical periodontal treatment of the patients was performed within two weeks after initial examination by the same clinician and patients received oral hygiene instructions. Four weeks after non-surgical periodontal treatment, patients were appointed for surgical procedures.

All surgeries were performed by the same clinician who is experienced in periodontal and implant surgeries. All procedures were performed in the posterior region in either the right or left quadrant of the maxilla.

GBR with Block Graft Procedure (Figure 1)

0.2% chlorhexidine mouthwash was used for intraoral asepsis. The mouth and lower portion of the face were cleaned with 10% povidone-iodine. Infiltration anesthesia was performed in the relevant area. An incision was made and a full-thickness flap was elevated. A 10x7mm graft area was marked and the bone incision was made with piezo-electrical (EMS, Nyon, Switzerland) and rotational instruments. The block thickness was measured with a periodontal probe. After 4 mm thickness was obtained, the graft was harvested and placed in sterile saline solution. Bleeding in the donor area was taken under control with a hemostatic agent (Surgicel, Ethicon Comp., New Jersey, USA). Grafts were fixed with a 1.5 mm diameter osteosynthesis screw (Lorenz, Zimmer Biomet, Indiana, USA). The space between the block and crest was filled with autogenous bone grafts obtained with a scrapper. The sharp corners and edges of the block were rounded to prevent exposure and 0.2 cc xenograft was placed under a collagen membrane in order to prevent resorption of the block graft and collagen membrane was placed. For tension-free closure, the periost was separated from the flap and the flap was flexed with the dissection with a blind scissor. Flaps were closed without tension. The flap was sutured with a monofilament polyamide 4.0 suture (Medipac, Stavrochori – Kilkis, Greece). Patients were warned to avoid tooth brushing until two weeks after surgery in order to avoid physical trauma to the wound area.

GBR with particulate autograft plus xenograft procedure (Figure 2)

0.2% chlorhexidine mouthwash was used for intraoral asepsis. The mouth and lower portion of the face were cleaned with 10% povidone-iodine. Infiltration anesthesia was performed in the relevant area. An incision was made and a full-thickness flap was elevated. Decortication was performed in the relevant area. A non-resorbable polytetrafluoroethylene (PTFE, Medipac, Stavrochori – Kilkis, Greece) membrane was placed in the edentulous area to serve as a frame. Then the PTFE membrane was fixed with 3mm titanium pins (Sedanta, Pinfix, Istanbul, Turkey) in the palatal region. The region was filled with a mixture of autogenous graft obtained from the neighboring area of the same quadrant of maxilla (no need for a second surgery or wound) and xenografts (1cc, Tutobone, Integral, Ankara, Turkey). After the membrane was shaped, avoiding any collateral damage to neighboring teeth, the membrane was fixed into the vestibule area with 3mm titanium pins (Sedanta, Pinfix, Istanbul, Turkey). After immobilization of the bone particles under the membrane, a final fixation of the membrane was made. For tension-free closure, the periost was separated from the flap

Table 1: Age and gender of the study groups.

	GBR-AX	GBR-BG	p values
Age			
Mean± SD	49.5±7.7	46.5±10.4	p>0.05
Min-max	37-62	30-61	
Gender n (%)			
Female	8 (53.3%)	7 (46.7%)	p>0.05
Male	7 (46.7%)	8 (53.3%)	

GBR-AX: Guided bone regeneration with autograft+xenograft group, GBR-BG: Guided bone regeneration with block graft group. Chi-square test and Mann Whitney U test were used. p<0.05 was considered statistically significant.

Table 2: Alveolar bone width and complications in the study groups.

	GBR-AX	GBR-BG	p values
Baseline bone thickness	3.04±0.32	3.12±0.38	p>0.05
6th-month bone thickness	6.51±1.74	6.46±1.1	p>0.05
Bleeding	0	1(%6.7)	p>0.05
Hematoma	1(%6.7)	0	p>0.05
Flap dehiscence	2(13.3%)	1(%6.7)	p>0.05
Infection	2(13.3%)	1(%6.7)	p>0.05
Numbness	0	0	-

GBR-AX: Guided bone regeneration with autograft+xenograft group, GBR-BG: Guided bone regeneration with block graft group. Chi-square test and independent t test were used. p<0.05 was considered statistically significant.

and the flap was flexed with the dissection with a blind scissor. The flaps were closed without tension. The flap was sutured with a polyamide 4.0 suture (Medipac, Stavrochori – Kilkis, Greece). Patients were warned to avoid tooth brushing until two weeks after surgery in order to avoid physical trauma to the wound area.

All patients, regardless of the surgical procedure, were prescribed an antibiotic (amoxicillin-clavulanic acid, 1000 mg ×2, Augmentin, Glaxo Smith Kline, Brentford, UK), analgesic (Dexketoprofen Trometamol, 25 mg x2, Arveles, Ufsa, Istanbul, Turkey) and antiseptic (0.12% chlorhexidine, oral gavage x2, Klorhex, Drogsan, Ankara, Turkey) for 5 days after surgery.

A soft diet was suggested and post-operational care was instructed to all patients. Sutures were removed after 14 days.

CBCT Measurements

CBCT with a slice thickness of 0.1 mm was taken from all patients before and after surgical procedures (Figure 3) (NNT imaging, Verona, Italy, NewTom software, CA, USA). All CBCT measurements were performed by a calibrated examiner. The reproducibility of the measurements was tested before the onset of the study. 10 CBCT imaging randomly selected from the study population, 5 from the GBR-BAX group and 5 from the GBR-PAX group, were evaluated for examiner calibration. Repeat measurements were recorded one week after. Measurements of the study were performed when no difference was found between the repeated measurements and the measurements showed a 99% consistency, (an r-value of 0.99 between the two measures).

Evaluation of the postoperative pain and swelling

Postoperative pain was assessed on the 3rd, 7th, and 14th days after surgery with a visual analog scale (VAS). On the scale, the left end of the graphic represented the absence of pain (score 0) and the right end represented the most severe pain (score 10).

The swelling was assessed both by the patients themselves and by a physician. Patients were recorded swelling via the VAS scale. On the scale, the left end of the graphic represented the absence of swelling (score 0) and the right end represented the most severe swelling (score 10).

Table 3: Pain and researcher-evaluated swelling scores of the study groups.

	GBR-AX	GBR-BG	p values
Pain 3rd day Mean± SD Min-max	 7.2±1.37 5-10	 6.96±0.83 5-8	 p>0.05
Pain 7th day Mean± SD Min-max	 5.33±1.44 2-8	 5.23±1.29 2-8	 p>0.05
Pain 14th day Mean± SD Min-max	 1.13±1.95 0-5	 0.96±1.5 0-4	 p>0.05
Swelling 3rd day (Patient report) Mean± SD Min-max	 7.13±1.35 6-10	 6.86±1.24 5-9	 p>0.05
Swelling 3rd day (Researcher assessment) Mean± SD Min-max	 5.0±1.25* 2-7	 4.66±0.97* 3-6	 p>0.05
Swelling 7th day (Patient report) Mean± SD Min-max	 4.86±1.76 1-8	 5.33±0.81 4-6	 p>0.05
Swelling 7th day (Researcher assessment) Mean± SD Min-max	 2.80±1.14* 1-5	 3.0±1.19* 2-6	 p>0.05
Swelling 14th day (Patient report) Mean± SD Min-max	 2.53±1.18 1-5	 2.53±0.63 2-5	 p>0.05
Swelling 14th day (Researcher assessment) Mean± SD Min-max	 0.60±0.91* 0-3	 0.53±1.06* 0-4	 p>0.05

*p<0.05 vs patients self-reported swelling scores. Chi-square test, independent t test and Mann Whitney U test were used. GBR-AX: Guided bone regeneration with autograft+xenograft group, GBR-BG: Guided bone regeneration with block graft group. min: minimum, max. maximum, SD: standard deviation.

For the swelling evaluation, to obtain objective results, a 15sc video footage was recorded for each patient. Then the recordings were watched by an unbiased clinician who was unaware of the study and a swelling score was determined for each patient.

Any complication such as bleeding, hematoma, flap dehiscence, infection, and numbness presence was recorded as score '1', and absence was recorded as score '0'.

Operational parameters

All materials used for surgical operations were obtained from the inventory of the periodontology clinic and recorded by the staff immediately after the operation.

The time for preparation of the patient and time for surgery was recorded by the staff of the periodontology clinic.

Table 4: Comparison of time for patient preparations, time for surgery and fatigue of the operating physician in study groups.

	GBR-BG	GBR-AX	
Time for preparation of the patient (min, recorded by the nurse) Mean±SD	7.6±3.24	5.53±2.11	P<0.05
Time for surgery (min, recorded by the nurse) Mean±SD	92±24	78±14	P<0.05
Fatigue of the physician after surgery (VAS scale) Mean±SD	7.2±2.0	5.4±1.2	P<0.05

Chi-square test, independent t test and Mann Whitney U test were used. GBR-AX: Guided bone regeneration with autograft+xenograft group, GBR-BG: Guided bone regeneration with block graft group. SD: standard deviation, VAS: visual analog scale.

A VAS scale was filled by the nurse immediately after the operation by asking the physician. On the scale, the left end of the graphic represented the absence of fatigue (score 0) and the right end represented the most severe fatigue (score 10).

Statistical Analysis

A power analysis was performed based on a previous study with a similar study design (27, 28). 30 patients provided 85% power. The Kolmogorov-Smirnov test was used to test the normality of the data. Descriptive statistics were done for gender and age. Data were presented as mean±SD or percentage as appropriate. Results and statistical analysis were elaborated with the Statistical Package for the Social Sciences package program version 20.0 (SPSS Inc., Chicago, IL, USA). One Sample KS test was used as the normality test. For parametric tests, independent t-test and chi-square test were used and for non-parametric tests, Mann Whitney U was used. $p<0.05$ was considered statistically significant.

RESULTS

30 Patients (15 Females and 15 Males) were included in the present study. The mean age of the GBR-BAX group was 46.50 (ranging from 30 to 61) (Table 1) and the mean age of the GBR-PAX group was 49.50 (ranging from 37 to 62). No statistical difference was observed regarding demographic data between groups ($p>0.05$).

All patients complied with all post-operative appointments.

Baseline alveolar bone thickness values were similar in the groups ($p>0.05$). Both GBR-BAX and GBR-PAX provided similar bone gain and postoperative alveolar bone thickness at the 6th month was also similar ($p>0.05$). Alveolar bone values of baseline and 6th month were shown in Table 2.

Regarding complications mean scores of the GBR-PAX and GBR-BAX groups were, mean bleeding scores 0 vs 1, mean hematoma scores 1 vs 0, mean flap dehiscence scores 2 vs 1, mean infection scores 2 vs 1 and mean numbness scores 0 vs 0, respectively (Table 2).

No patients complained about a serious complication or any discomfort. In line with postoperative instructions given to the patients, no analgesics were used after operations. In terms of pain and discomfort, VAS scale results showed similar values between groups. All patients reported medium to high pain levels on the postoperative 3rd day (7.2 for GBR-PAX and 6.90 for GBR-BAX), however, pain decreased with time and most of the patients reported no pain on the 14th day. There were no significant differences regarding pain levels ($p>0.05$) on postoperative 3rd, 7^{th,} and 14th days (Table 3).

As for the swelling, patients reported higher swelling scores, however; levels recorded by a physician were lower than those of the patients on the 3rd, 7^{th,} and 14th days ($p<0.01$). The swelling scores recorded both by the patients themselves and by the researchers, exhibited no difference between study groups ($p>0.05$) and swelling values decreased on 14th day (Table 3).

Operational parameters (Table 4)

The cost of the materials used for the procedure was higher in the GBR-PAX group compared to the GBR-BAX group ($p<0.05$). Time for preparation of

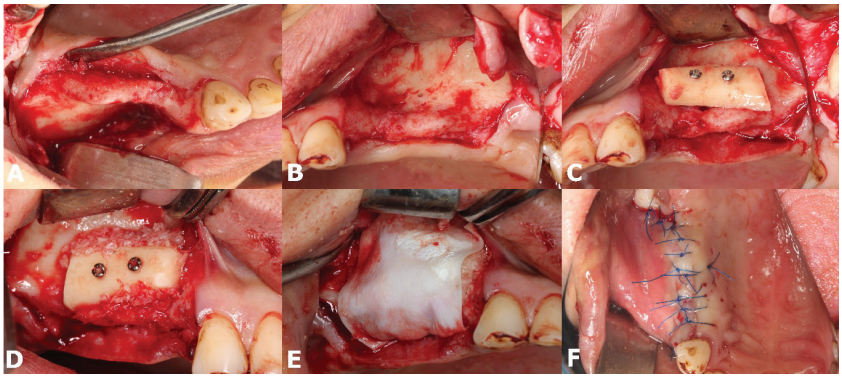

Figure 1. Representative clinical photographs of guided bone regeneration with autogenous block graft procedure
A: Baseline photograph, B, C, D, E, and F photographs of operational phases

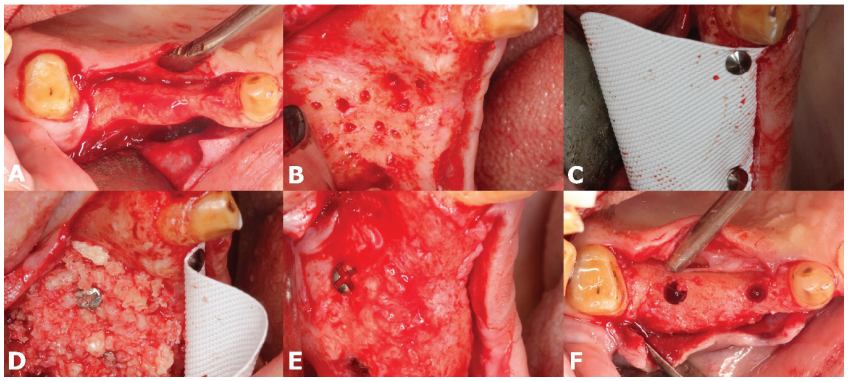

Figure 2. Representative clinical photographs of guided bone regeneration with particulate autograft+xenograft procedure
A: Baseline photograph, B, C, D, and E photographs of operational phases, F: 6th month photograph immediately before implant placement.

the patient and time for surgery was higher in the GBR-BAX group than those of the GBR-PAX group ($p<0.05$). Parallel to the time of surgery, fatigue of the operating physician was also higher in the GBR-BAX group compared to the GBR-PAX group ($p<0.05$).

DISCUSSION AND CONCLUSION

The present study compared the most common two methods of alveolar bone augmentation as autogenous block graft and guided bone regeneration with autograft plus xenograft with PTFE membranes in terms of patient comfort and complications. Present results suggested that both autogenous block graft and GBR with autograft-xenograft and PTFE membranes are well-tolerated by the patients, provided similar bone gain, and caused similar complications.

For a long time, autogenous block grafts were considered the most optimal method for increasing alveolar width (9,13,17,19,24,27,28). The effectiveness of an autogenous block graft in bone gain is indispensable. However, donor site morbidity is a major drawback for both intraoral and extra-oral harvested autogenous block graft (20,21,27,29). Another disadvantage of autogenous BG is the fast resorption time and relatively less osteoconductive capacity compared to other graft materials or substitutes such as xenograft (18,20,30-32). This also implies particulate autografts. Faster resorption might cause decreased remaining bone width after the augmentation procedure. In order to overcome this situation, alternative approaches such as combining xenografts with autogenous grafts were evaluated and a great success rate for this approach was suggested in the literature (31,33,34).

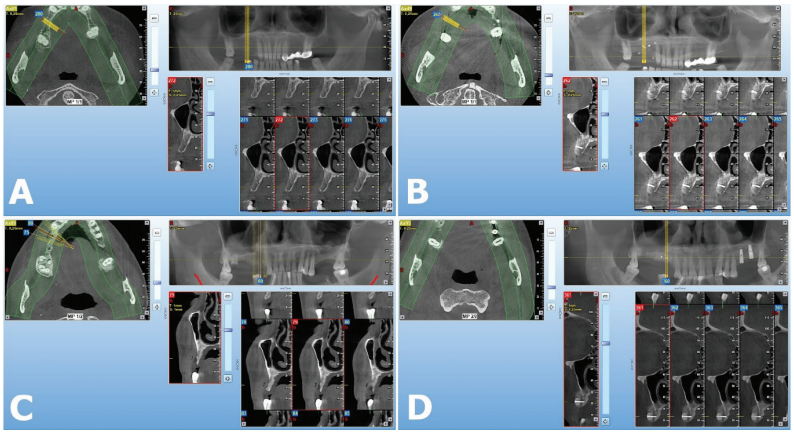

Figure 3. Representative CBCT images of the groups
A: Representative pre-operative CBCT image of guided bone regeneration with autogenous block graft group **B:** Representative post-operative CBCT image of guided bone regeneration with autogenous block graft group **C:** Representative pre-operative CBCT image of particulate autograft+xenograft surgery **D:** Representative post-operative CBCT image of particulate autograft+xenograft surgery

Recently, Ersanlı et al. demonstrated that autogenous bone block provided over 4 mm bone gain in the severely atrophic maxilla (28). The autogenous bone block might be more resistant to bone resorption compared to particulate autogenous graft (20) (18, 30). Meloni et al. reported that the autograft and xenograft combination provided a high implant survival rate and bone augmentation in severe atrophic alveolar bone (34). Monje et al. also demonstrated a great increase in the alveolar bone crest with the use of an autogenous block graft and xenograft combination (33). Supporting their study, Galindo-Moreno et al. found that autograft+xenograft application had higher cellularity and biological activity compared to the autograft+allograft combination (35). However, a most recent systematic review pointed out that implant success and survival were similar and no clinically significant difference was observed among the used materials regardless of the type of graft or material (36). As present results demonstrated, there was no difference in bone gain and remaining bone width after either GBR-BAX or GBR-PAX procedures. We used autografts in both GBR-BAX and GBR-PAX procedures and covered grafts with collagen membrane in GBR-BAX group and PTFE membrane in GBR-PAX group. Therefore, similar bone gain and similar results might be plausible due to the similar osteogenic and osteoinductive capacity of autografts.

All grafting procedures were performed in the posterior region of the maxilla. Resorption of the harvested graft was suggested to be faster in the maxilla compared to the mandible (18,30). Nonetheless, no significant resorption and decrease in the alveolar width were observed in the present study. Implants were placed in the 6th month with a second surgery. PTFE membrane used in GBR-PAX group is a non-resorbable membrane that requires to be removed as a major disadvantage of non-resorbable membranes (17,23). However, in the present study, membranes were removed before the implant placement, so that no surgery to remove the membrane was performed and the drawback of the PTFE membrane has been overcome.

In regards to complications after surgeries, all patients reported similar levels of pain and swelling. The researcher's evaluation of swelling was also indifferent between groups. In addition, bleeding, hematoma, flap dehiscence, infection, and numbness scores were also found to be similar and low compared to the literature (20,21,29). The possibility of complications can be reduced by the experience and careful work of the physician.

Bone augmentation surgeries are highly invasive procedures that might frighten patients with the possibility of severe pain. Less painful procedures may be the reason for the preference for patients. On the other hand, assessment of pain is important, as pain

may be associated with postoperative complications such as infection(21,29). Even so, the subjective character makes it difficult to observe and pain is a difficult phenomenon to assess because it is easily affected by physical and physiologic features (37,38). There are various methods for tain measurement, and VAS is a reliable method for measuring pain and is commonly used to evaluate postoperative pain after dental surgeries (21,28,29,31,36-39). VAS evaluations of groups showed no significant difference in pain. Both techniques were well-tolerated by the patients.

As a new perspective in this study relative to other studies in the literature, we evaluated the procedures in regard to the cost, time, and fatigue of the clinician. BG is a demanding major surgery in terms of risks and complications (20,21,28,29). The higher the risk of surgery, the greater the stress on the physician. Therefore, we evaluated the postoperative fatigue of the operating physician after GBR with either block or particulate graft procedures. Even though more materials such as xenograft and pin were not used, GBR-BAX was found to be a more demanding, tiring, and time-consuming procedure for both staff and physicians compared to GBR-PAX procedure. Due to the requirement for more materials, the cost of the operations was higher in GBR-PAX group than those of the GBR-BAX group.

The present results should be interpreted considering the limitations of the present study which are; the small number of participants, involvement of only two bone augmentation techniques, and lastly involvement of only autograft plus xenograft procedures.

Within the limitation of this study, GBR with either autogenous block graft or particulate autograft plus xenograft provided similar bone gain and caused similar complications, pain, and discomfort. In terms of efficacy, none of the two techniques was found superior to the other; however, block graft was more time-consuming, tiring, and less costly. Much work has been done and is still being done on implant surgery, bone augmentation techniques, and materials; so this situation is about to turn into the pollution of data. Too much information was covered in previous studies, but even more, is waiting to be found. The community created by all these publications and researchers is very tempting, shiny, and crowded but misleading and exhausting. For this reason, it is quite an inconvenient process to draw the right information from the right research in such an environment and interpret it correctly. In this study, we tried to reveal the relatively undervalued sides of the two methods currently used. And hopefully, the present article could help clinicians to choose the best method for themselves and their patients.

Acknowledgments

We sincerely thank the Erciyes University Faculty of Dentistry Department of Periodontology staff and research assistants for their assistance in preparing the present study.

Conflict-of-interest and financial disclosure

The author declares that she has no conflict of interest to disclose. The author also declares that she did not receive any financial support for the study.

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