

Post-surgical complications of symphyseal block graft with and without soft tissue grafting

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ABSTRACT

الأهداف: دراسة ما إذا كان لعملية زراعة اللثة قبل زراعة العظم من منطقة الذقن أثر في تقليل مشاكل ما بعد زراعة العظم من منطقة الذقن.

الطريقة: أجري هذا البحث بكلية طب الأسنان بجامعة الملك عبدالعزيز، جدة، المملكة العربية السعودية خلال الفترة من أكتوبر 2010م حتى يناير 2013م على 14 حالة تم تحويلها لزراعة الأسنان وتحتاج إلى زراعة عظم من منطقة الذقن، تم تقسيم هذه الحالات إلى مجموعتين، اشتملت المجموعة الأولى على 7 حالات في 6 مرضى تم لهم عمل زراعة العظم من منطقة الذقن، بينما اشتملت المجموعة الثانية على 7 حالات في 6 مرضى تم لهم عمل زراعة اللثة بطريقة النفق الحديثة، وبعد 6-8 أسابيع تم عملية زراعة العظم من منطقة الذقن.

النتائج: حصل انحسار للثة وانكشاف للعظم في حالتان من المجموعة الأولى. الأولى كان انكشاف العظم 3x4 مم مما أدى إلى ذوبان العظم بنسبة 45%. بينما الحالة الثانية انكشف العظم 4x5 مم تبعه التهاب في العظم أدى إلى ذوبان العظم بنسبة 75%، باقي الحالات التأمت بدون مضاعفات وبدون بسيط يتراوح من 0-15%. كان هناك زيادة في سماكة اللثة 1-2 مم بعد زراعة اللثة في المجموعة الثانية. جميع الحالات التأمت بدون مضاعفات وبدون ذوبان في العظم أو ذوبان بسيط يتراوح من 0-15%، وتم عمل زراعة الأسنان والتراكيبات لجميع الحالات بدون مشاكل.

خاتمة: تم حدوث مشاكل أكثر في الحالات التي لم يتم عمل زراعة لثة لها. تبين هذه الدراسة المبدئية أهمية زراعة اللثة قبل زراعة العظم من منطقة الذقن، خصوصاً في الحالات التي تحوي لثة رقيقة.

Objectives: To determine whether soft tissue augmentation prior to block grafting will minimize post-block grafting soft tissue complications.

Methods: This longitudinal controlled pilot study was conducted at the Faculty of Dentistry, King Abdulaziz University, Jeddah, Kingdom of Saudi Arabia from October 2010 to January 2013. Fourteen

sites requiring block grafting were divided into 2 groups: Group A - 7 sites in 6 patients were subjected to monocortical block graft (control); and Group B - 7 sites in 6 patients were subjected to soft tissue graft through new tunnel technique, followed by monocortical block graft (test).

Results: In Group A, 2 patients had wound dehiscence and graft exposure. The first that had an exposure of 3x4 mm resulted in 45% resorption of the graft. The second had an exposure of 4x5 mm followed by infection, which resulted in 75% resorption of the graft. In the other 5 cases, sites healed with no complications and minimal resorption (0-15%). In Group B - there were generalized 1-2 mm increases in the thickness of soft tissue following soft tissue graft. Recipient sites healed with no complications or infection following block grafting. Block graft resorption ranged from 0-15%.

Conclusion: More complications were seen in those patients who did not receive soft tissue augmentation, thus demonstrating the importance of soft tissue preparation prior to block grafting, especially in patients having thin soft tissue.

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Dental implants have become the ideal option for replacing missing teeth. Their proper placement and restoration is dependent on the presence of enough bone volume at extraction site.¹ Bone grafting is often necessary for ideal aesthetics and functioning of dental implants. The defect size and topography is the most important factor in selecting a ridge augmentation technique.² Mandibular and maxillary ridge defects can be classified as horizontal, vertical, or a combination of vertical and horizontal bone loss.³ Several augmentation techniques for alveolar ridge defects have been described in the literature, including bone spreading, bone grafting, and guided bone regeneration,⁴ and many materials have been used with these techniques including autografts,^{4,6} allografts,⁷ xenografts,^{8,9} and alloplasts.⁹ Until now, the use of autogenous bone grafts is considered the gold standard for bone augmentation procedures.^{5,6}

Autogenous bone grafting can be harvested from extraoral,¹⁰ or intraoral⁴⁻⁶ donor sites. Many studies have confirmed that intraorally harvested intramembranous bone grafts have minimal resorption,^{2,4,11} enhanced revascularization, and better incorporation at the recipient site than do extra orally harvested endochondral bone grafts.^{12,13} It can be used in block or particulate forms. Preservation of adequate soft tissue coverage is a very important factor in the success of bone grafts in general and block grafts in particular. Dehiscence of the mucosa and early exposure of the grafted bone are the most common etiological factors that may lead to graft failure.^{4,6,14,15} The causes of soft tissue dehiscence around the block graft has not been investigated. One of the possible etiological factors is the presence of thin soft tissue coverage around the block. The acellular dermal matrix (ADM) allograft seems to be a good substitute for the connective tissue graft (CTG), having been used successfully for soft tissue augmentation and recession coverage for many years.^{16,17} AlGhamdi et al⁴ have used ADM successfully for soft tissue augmentation before block grafting procedures, according to 2 case reports. This study aims to determine whether soft tissue grafting prior to block grafting will minimize post-block grafting soft tissue complications.

Methods. This longitudinal controlled pilot study was conducted at the Faculty of Dentistry, King Abdulaziz University, Jeddah, Kingdom of Saudi Arabia (KSA) from October 2010 to January 2013. The design was reviewed and approved by the Ethics Committee of the Faculty of Dentistry, King Abdulaziz University, Jeddah, KSA. The study was conducted according to principles of Helsinki Declaration. An

informed consent was obtained from all individuals. It was mandatory for all study participants to have read and signed the consent form before being included in the present study. Fourteen sites from 12 patients referred for dental implant treatment and requiring monocortical block grafting due to severe horizontal ridge deficiency participated in this study. Patients were advised of their role in the study, possible post-surgical complications, and advantages and disadvantages of the surgical procedures. They signed an informed consent to participate in the study. Their selection was based on the number of sites - not the number of patients (for example, patients with 2 distant sites needing a block graft were considered to have 2 sites). After clinical examination and radiographic evaluation, the sites were assigned randomly to one of the 2 groups. Group A - 7 sites in 6 patients were monocortical-block grafted from the mandibular symphysis (control). Group B - 7 sites in 6 patients were soft tissue grafted using an ADM graft with new tunnel technique for soft tissue preparation, followed by monocortical block graft from the mandibular symphysis (test). All included patients were 18 years or older, systemically healthy, and having at least one site with a severe class I ridge defect.³ Patients who had any of the following: diabetes; osteoporosis; any diseases related to bone metabolism; smoking habit; moderate-to-severe vertical ridge defects;³ poor oral hygiene; and active periodontal disease were excluded from the study.

Study protocol. Group A. Preparation of recipient site with perforation of the bone, harvesting monocortical block graft from the mandibular symphysis, fixation of the graft to the recipient site, covering the block with a mixture of bovine bone (Bio-Oss, OsteoHealth, Shirley, NY) and calcium sulfate (ratio, 4:1) then double layer of collagen bioabsorbable membrane, closer of the wound, and evaluation of the graft healing was carried out according to the technique described previously.⁴

Block graft exposure and implant placement. Five to 6 months after block graft surgery, the grafts were exposed, the fixation screws were removed, and the implants were placed according to the surgical guide. Results were evaluated after 2, 4, and 12 weeks. Prosthetic treatment was performed 4 months after implant placement, and the patients were observed for 2-6 months following prosthetic treatment.

Group B. In this group, all patients were scheduled to receive soft tissue augmentation for the recipient site using an ADM graft prior to monocortical block graft.

Soft tissue graft. A soft tissue graft was carried out by the new tunnel technique described previously⁴ as follows: the recipient sites were anesthetized utilizing

local infiltration with 2% lidocaine containing 1:100,000 epinephrine. Two vertical incisions were made at least one tooth wider mesiodistal than the area of the defect, starting just apical to the mucogingival junction, and continuing apically at 5-7 mm. A partial-thickness dissection was extended horizontally, connecting the 2 vertical incisions, then coronally to undermine the tissue covering the defect area. The ADM was hydrated, as suggested by the manufacturer, in 2 saline washes, then the mesial part of the graft was sutured with a single knot, passing the needle underneath the tunnel created. The sutures were pulled from the mesial aspect of the tunnel and pushed from the distal direction so that the graft could slide under the tunnel. The graft was positioned over the defect using 3-5 suspension sutures. The vertical incisions were closed with interrupted sutures. All patients were given nonsteroidal anti-inflammatory drugs (NSAIDS) to manage postoperative pain, and chlorhexidine mouthwash for one week post-surgery. No antibiotics were given at this stage. After 10-14 days, the patients came for suture removal, and the healing was evaluated at 6, and 8 weeks.

Monocortical block graft. After 2-3 months of healing following the soft tissue graft, the patients were scheduled for a block graft from the mandibular symphysis. The same protocol used in group A was followed in all steps.⁴

Statistical analysis. Data were analyzed using the Statistical Package for Social Sciences version 16.0 for Windows (SPSS Inc., Chicago, IL, USA). For Baseline data, Student t-test was used to compare the mean age between the groups, whereas Fisher's exact test was used to compare the gender distribution. To compare the bone resorption percentage of block grafts after 6 months of healing, the Mann-Whitney U test was used. The level of statistical significance was considered when the *p*-value was <0.05.

Results. Patients' information (Table 1 and Table 2).

Group A. Six patients participated in this group (2 males and 4 females) with an average age of 44.3 ± 17.59 years. Each patient had one block graft surgery, except one patient who had 2 distant block graft surgeries (in the area of teeth 12 and 22).

Group B. Six patients participated in this group (one male and 5 females) with average age 40.17 ± 14.68 years. Each patient had one block graft surgery, except one patient who had 2 distant block graft surgeries (in the area of teeth 12 and 22).

Comparisons between groups (Table 3). No statistically significant differences in mean age ($p=0.665$) or gender distribution ($p=0.500$) were found between the 2 groups.

After soft tissue graft (group B) (Tables 1 and 2). In group B, all patients had a soft tissue graft; the soft tissue healed without complication, pain, or infection. There were generally 1-2 mm increase in thickness of the soft tissue covering the defect 8 weeks after allograft surgery.

After monocortical block graft (Tables 1 and 2). Donor site. In both groups, the donor sites healed with no complications. No recession or incision dehiscence was observed. No permanent sensory disturbances of the skin or teeth were noted, although there was a transient alteration in sensation in the chin and lower lip in both groups, which had disappeared by 8 weeks post-block graft surgery.

Recipient site. Group A. Two patients from this group had wound dehiscence and graft exposure. The first patient had a 3×4 mm exposure in the fourth week post-surgery (Figure 1). The exposure did not lead to infection or any other complication, but at the time of block exposure (after 6 months), resorption of 45% of the graft was noticed. The second patient had an exposure of 4×5 mm in the fourth post-surgical week (Figure 2). Infection developed in the seventh week (Figures 3), which was treated with local and systemic antibiotics (amoxicillin 500 mg + metronidazole 500 mg for one week). At the time of exposure (6 months), resorption of 75% of the graft was found. The available bone was not adequate for implant placement, and the area had to be regrafted. The patient refused another block graft surgery and elected to receive guided bone regeneration. We grafted the defect with a mixture of bovine bone and calcium sulfate (ratio, 4:1) and covered it with a resorbable barrier. In the other 5 patients, the recipient sites healed with no complications. At the time of graft exposure, the fixation screws could be visualized through the soft tissue in all cases (but no dehiscence), which indicated thin soft tissue coverage. No or minimal graft resorption was noticed in these cases (0-15%). The quality of the augmented bone was excellent, and the block graft was completely integrated with the recipient bed. In all cases, sufficient bone was found for implant placement except in the case of more extensive exposure and infection, where regrafting was performed.

Group B. In all cases, the recipient site healed with no complications or infection. None of these sites had any dehiscence. At the time of block graft exposure,

Table 1 - Description of cases in Group A patients (without soft tissue graft) included in a study conducted at the Faculty of Dentistry, King Abdulaziz University, Jeddah, Kingdom of Saudi Arabia.

Case no.	Age	Gender	Location of defect (tooth #)	Type of tissue	Number of blocks	Block graft size (mm)*	Dehiscence of soft tissue	Infection of graft	(%) of block graft resorption
1	22	F	12	Thin	1	10 × 6 × 5	No	No	(15)
2			22	Thin	1	11 × 5 × 5	No	No	(15)
3	32	F	46 & 47	Thin	1	7 × 13 × 5	No	No	(5)
4	62	M	11	Thick	1	11 × 9 × 4	No	No	(5)
5	40	F	34-36	Thin	1	5 × 16 × 4	No	No	(10)
6	42	M	12-22	Thin	2	6 × 15 × 5 [†] 6 × 10 × 5 [‡]	Yes	No	(45) (15)
7	68	F	13-15	Thin	1	7 × 17 × 5	Yes	Yes	(75)

*Height × width × thickness, [†]First block size, [‡]Second block size**Table 2** - Description of cases in Group B patients (with soft tissue graft) included in a study conducted at the Faculty of Dentistry, King Abdulaziz University, Jeddah, Kingdom of Saudi Arabia.

Case no.	Age	Gender	Location of defect (tooth #)	Type of tissue	Number of blocks	Block graft size (mm)*	Dehiscence of soft tissue	Infection of graft	(%) of block graft resorption
1	19	F	12	Thin	1	10 × 7 × 6	No	No	(15)
2			22	Thin	1	11 × 7 × 5	No	No	(10)
3	44	F	35 & 36	Thin	1	6 × 14 × 6	No	No	(10)
4	32	F	41	Thin	1	9 × 7 × 5	No	No	(5)
5	58	F	31-41	Thin	1	7 × 12 × 5	No	No	(0)
6	34	F	32-43	Thin	2	5 × 9 × 5 [†] 6 × 12 × 5 [‡]	Yes	No	(0) (0)
7	54	M	31-41	Thin	1	8 × 18 × 5	No	No	(0)

*Height × width × thickness, [†]First block size, [‡]Second block size**Table 3** - Comparison of age, gender distribution and percentage of block graft resorption between the 2 groups included in a study conducted at the Faculty of Dentistry, King Abdulaziz University, Jeddah, Kingdom of Saudi Arabia.

Variables	Group A	Group B	P-value
<i>Age, years</i>			
Mean ± SD	44.33 ± 17.59	40.17 ± 14.68	0.665*
Median	41.00	39.00	
<i>Gender, n</i>			
Female	4	5	0.500*
Male	2	1	
<i>Block graft resorption (%)</i>			
Mean ± SD	23.12 ± 24.49	5.00 ± 5.98	
Median	15.00	2.50	0.021 [†]

*No statistically significant differences were found between the 2 groups. [†]The median was significantly different between the 2 groups.

the soft tissue thickness was maintained over the graft and the fixation screws could not be visualized through the soft tissue in any case, indicating thick soft tissue coverage. No or minimal graft resorption was noticed in all cases (0-15%).

Comparisons between groups (Table 3). When the percentage of block graft resorption was compared between groups, the median of bone resorption for

group A was 15, whereas it was only 2.5 for group B. This was statistically significantly different between the 2 groups ($p=0.021$).

After implant placement. In both groups, the surgical sites healed without complications or infection after implant placement. At the time of prosthetic loading (4 months postimplant surgery), the implants were completely surrounded by bone. The cases were followed for 2-6 months after prosthetic loading. During this short evaluation period, the soft tissue was stable and healing was uneventful. The aesthetic outcome was acceptable for all patients.

Discussion. Intraoral block grafts have been used successfully for the past several decades.^{5,6} The mandibular symphysis is the preferred donor site in cases where larger and thicker intraoral blocks are needed. Paresthesia of the lower lip and wound dehiscence are the main reported post-surgical complications at the donor site with this procedure. In the current study, we used the sulcular incision, which was proven in the literature to be associated with less pain and discomfort. No dehiscence was reported with this type of incision, compared with the vestibular incision, wherein wound

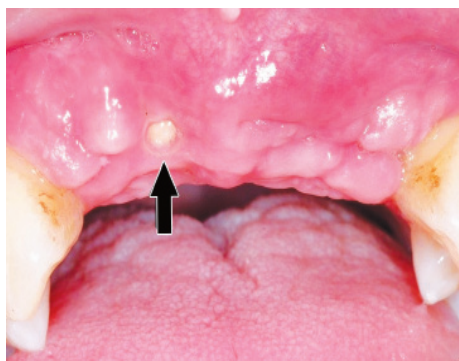


Figure 1 - Soft tissue dehiscence (arrow) 4 weeks post-block graft surgery (Group A). The tissue looks healthy around the dehiscence area.

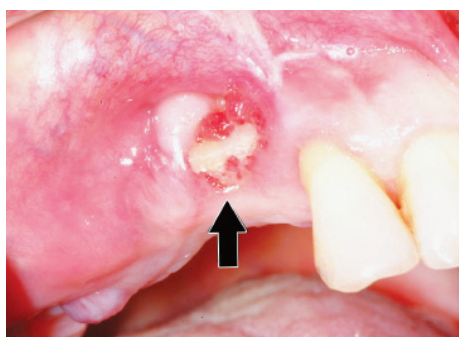


Figure 2 - Soft tissue dehiscence (arrow) 4 weeks post-block graft surgery (Group A). The tissue looks inflamed around the dehiscence area.

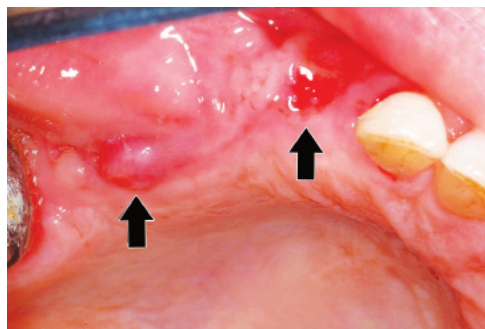


Figure 3 - Infection developed around the block graft in the seventh week post-block grafting with pus discharge from the area of dehiscence.

dehiscence and scar formation have been reported to occur in approximately 11% of the cases.¹⁸ Paresthesia of the lower lip occurred in all patients in the current study. It was transient, and completely disappeared by 8 weeks post-surgery without any intervention. Lip paresthesia is a common complication of this surgery, as previously reported.^{4,6,13,19} Permanent paresthesia was prevented by careful incision and osteotomy when

harvesting the block from the donor site. To prevent injury to the mental nerve, the vertical incisions at the donor site were made mesial to the canines and straight when a small block graft was needed, and distal to the mental foramen and divergent distally when a large block graft or multiple blocks were needed. The superior horizontal osteotomy was made a minimum distance of 5 mm from the apices of the mandibular incisors and canines, and the distal vertical osteotomy was made at least 5 mm mesial to the mental foramen.

Maintenance of soft tissue closure is an important factor in the success of bone grafting. Wound dehiscence and premature exposure of the bone graft are the most common causes of graft failure.^{4,6,14,15} With block grafting procedures, the presence and maintenance of adequate soft tissue coverage for the block is more important due to the great increase in ridge width and height.^{4-6,20,21} Minimum soft tissue thickness of 1.5 mm is advocated to provide additional protection and coverage to augmented bone.²² In cases of thin mucosa, the maintenance of soft tissue coverage is more difficult due to the inability of the tissue to overcome the continuous pressure from the block; penetration can easily occur from sharp edges of the block or fixation screw. Soft tissue preparation and grafting are mandatory steps in cases of thin mucosa prior to monocortical block grafting. The use of ADM allograft seems to be a good substitute for the CTG for soft tissue augmentation.^{16,17} The main advantages of using ADM over CTG are ultimate supply and availability. The use of ADM using the new tunnel technique offers the advantage of increasing the soft tissue thickness before block grafting, and it may minimize or eliminate the early or late post-surgical soft tissue complications associated with block grafting. This technique is simple and predictable. No pain or complications were noted after the soft tissue surgery. The average time for the procedure was 30-45 minutes.⁴

In this pilot study, none of the cases with soft tissue augmentation using ADM had early or late soft tissue complications following block grafting, although 2 patients without soft tissue augmentation presented with soft tissue dehiscence 4 weeks after block graft surgery. Both the cases were in the maxilla. One of the patients developed a substantial infection that led to 75% resorption of the block graft, while the second presented with approximately 45% resorption. With the exception of the 2 above-mentioned cases, both groups had excellent healing with no or minimal graft resorption. The low percentage of resorption reported in this study might be due to the use of a double layer

of collagen barrier. Investigators have reported that block graft resorption without a barrier membrane occurs approximately 7 times as often as with one.^{15,23} Moreover, the use of a double layer of collagen membrane was reported to improve stability, minimize resorption, and increase bone density.^{24,25} Integration of the block graft in this study was excellent in both groups, perhaps because of careful decortication and perforation of the recipient bed as reported previously.²⁶ A high implant success rate has been reported when dental implants were placed in block grafts.²⁷⁻³⁰ A similar finding was reported in the current study with no difference between the 2 groups in the short follow-up time following implant placement. A longer-term follow-up period is recommended to evaluate soft tissue stability and long-term complications (if any) in both groups.

The major shortcoming of this study was having all surgical procedures and evaluation completed by the authors. This made blind evaluation impossible. Further research with larger sample size and longer evaluation period is needed to confirm the outcome of this study.

In conclusion, more complications were seen in those patients who did not receive soft tissue augmentation, thus demonstrating the importance of soft tissue preparation prior to block grafting. In cases having a thin soft tissue biotype, it is important to prepare the soft tissue prior to bone grafting to minimize or prevent dehiscence of the soft tissue and graft exposure, which may result in failure of the procedure. The current pilot study opens the door for further randomized, controlled clinical trials with a larger sample size and longer evaluation period.

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Ethical Consent

All manuscripts reporting the results of experimental investigations involving human subjects should include a statement confirming that informed consent was obtained from each subject or subject's guardian, after receiving approval of the experimental protocol by a local human ethics committee, or institutional review board. When reporting experiments on animals, authors should indicate whether the institutional and national guide for the care and use of laboratory animals was followed.