RESEARCH

Is Membrane Usage Really Necessary for Sinus Lifting Operation in Lateral Window Technique

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ABSTRACT

Is Membrane Usage Really Necessary for Sinus Lifting Operation in Lateral Window Technique?

Background: Although the placement of a membrane after sinus floor augmentation promotes faster initialization of bone formation, there is evidence that these procedures may be successful and predictable without membrane barriers. The aim of this study was to investigate the presence of defects that might occur due to soft tissue invasion in the antrostomy area in two groups where membrane application was used or not used on the lateral window.

Methods: Comparisons of implant survival in the groups and the amounts of bone generation were also investigated. Forty patients were selected for the study, and they were randomized into two groups in which membrane application was used (study group) or not used (control group). Twelve months following the procedure, images of the region were taken with computerized dental volumetric tomography.

Results: The difference between the groups in terms of bone diameter was evaluated with an independent t test. No defect areas were found radiographically in the lateral window region in the groups. The mean bone diameter of the control group was 13.063 mm (±2.4 mm) and that of the study group was 14.10 mm (±5.8 mm). There was no significant difference between the groups in bone diameter. There were no losses in any of the implants that were placed in either group.

Conclusion: The use of a membrane to close the lateral window did not play any important role in the formation of bone defects.

KEYWORDS

Maxillary sinus, Membranes, Dental implants

ÖZ

Lateral Pencere Yöntemi Uygulanarak Gerçekleştirilen Maksiller Sinüs Yükseltme Prosedüründe Membran Kullanmasi Gerçekten Gerekli Midir?

Amaç: Sinüs tabanı yükseltme operasyonlarında, lateral pencere üzerine membran yerleştirilmesi kemik formasyonunu hızlı bir şekilde başlatsa da membran kullanılmadan gerçekleştirilen sinus yükseltme işlemlerinin de başarılı ve öngürülebilir sonuçlanacağı ile ilgili literatürde kanıtlar bulunmaktadır. Bu çalışmamızın amacı lateral pencere üzerine membran uygulanan ve uygulanmayan iki grupta antrostomi alanında yumuşak doku invazyonuna bağlı oluşabilecek defektlerin varlığını araştırarak gerçekten membran kullanımına gerek olup olmadığını kanıtlamaktır.

Gereç ve Yöntemler: Çalışma için 40 hasta seçildi. Membran uygulanan (çalışma grubu) ve membran uygulanmayan (kontrol grubu) olarak iki gruba randomize edildi. İşlemden 12 ay sonra Konik Işınlı Volümetrik Bilgisayarlı Tomografi kullanılarak bölgenin görüntüleri çekildi. Gruplarda implant sağkalımı ve kemik oluşum miktarları karşılaştırıldı.

Bulgular: Kemik çapı açısından gruplar arasındaki fark bağımsız t testi ile değerlendirildi. Gruplarda lateral pencere bölgesinde radyografik olarak defektli alan bulunmadı. Kontrol grubunun ortalama kemik çapı 13.063 mm (± 2.4 mm) ve çalışma grubunun kemik çapı 14.10 mm (± 5.8 mm) olarak ölçüldü. Kemik çapı açısından gruplar arasında anlamlı bir fark yoktu. Her iki gruba da yerleştirilen implantların hiçbirinde kayıp olmadı.

Sonuç: Lateral pencere açılarak gerçekleştirilen sinüs yükseltme işlemlerinde lateral pencere üzerine kapatmak için bir membran kullanılması, kemik defekti gelişmesinde önemli bir rol oynamamaktadır. Membran kullanılmadan da sinüs yükseltme işlemleri başarılı olabilmektedir.

ANAHTAR KELİMELER

Maksiller Sinüs , Membranlar, Dental Implant

Inadequate bone volume is a challenge to the placement of dental implants particularly in the posterior maxilla. The most commonly used surgical technique is the maxillary sinus grafting method1. This procedure consists of reaching the sinus, separating the Schneiderian membrane from the base of the sinus, placing a graft material into the sinus bone, and creating a space to support vertical bone growth.[4] Different graft materials, including allografts[7], xenografts[8], autogenous bone[9,10] or combinations of these materials[11,12], have been used successfully in sinus augmentation operations.

Many clinicians use membranes to stabilize the grafting of

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antrostomy sides in the sinus cavity of the sinus material.[13] Membranes that prevent graft migration and soft tissue invasion[14-16] were proposed to allow the formation of more sinus bone regeneration.[17-19]

In the scientific literature, either bone regeneration or sinus lifting procedures, there are still discussions on the requirement for a barrier to be used simultaneously with the graft. In general, the guided bone regeneration procedures are used in periodontal and oral surgery, and membrane usages often are preferred by the clinicians. These appear to have significant benefits by supporting the highest volume of trabecular bone[20] and by producing bone growth without soft tissue intervention. However, while these come with positive benefits, it must be taken into consideration that infections, as well as additional cost and procedure time, may also arise.

Some authors have reported advantages which one is a more agreeable healing, and also the prevention of soft tissue invasion, with the use of Gore-Tex membranes with mineralized cancellous grafts together.[21] Anothers studies previously demonstrated that the placement of membranes increases vital bone formation and consequently provides a positive impact on the survival of the implant.[22] On the other hand, although the placement of a membrane after sinus floor augmentation promotes faster initialization of bone formation, there is evidence that these procedures may be successful and predictable without membrane barriers as well.[20,23]

The aim of this study was to investigate the presence of defects that might occur due to soft tissue invasion in the antrostomy area in two groups where membrane application was used and not used on the lateral window simultaneously with the sinus lifting process conducted with the lateral window technique and to compare the two groups. In addition, comparisons of implant survival in the groups and the amounts of bone generation were also investigated.

MATERIALS AND METHODS

Informed consent was received from all patients and it has been conducted in full accordance with the World Medical Association Declaration of Helsinki.

The inclusion criteria of patients in the study were considered as;

- The patients who do not use drugs as bisfosfanate which could affect the bone turnover.
- The patients who have sinus pneumatization which seems radiolucent in the initial radiologic examination.
- The residual bone at the posterior maxilla less than 4-5 mm where implant placement made without simultaneously.
- Cone Beam Computed Tomograpies (CBCT) were taken from patients who have alveolar bone examination for the implant supported prothesis treatments except the sinus lift procedure were conducted previously because the ethical concern related to evaluate this study using (CBCT).
- The sinus lift operations were perfomed without any complication as severe bleeding due to Posterior Maxillary Artery (PMA) or sinus membrane perforation.

The exclusion criteria of patients were decided as;

- The patients who have bone related systemic disease.
- The patients with residual bone presence of 4-5 mm where implant placement could be made simultaneously with the sinus lifting process.
- The patients have sinus septas when they have seen before the surgery in the radiologic examination,and also the operators runed into the sinus septas while they were conducting the sinus operation.
- The sinus perforation or PMA bleeding happened while the sinus operation were performing.

For this purpose, forty patients were selected for the multicenter study, and they were randomized into two groups in which membrane application was used (study group) or not used (control group). Additionally, two of authors, who have same titled operator could perform same operation almostly, operated the sinus lifting procedures at the all included patients and two of authors, who collected the data and observed the follow up process, didn't see the operations and the patients. A sinus lifting operation was performed using the lateral window technique for all patients under local anesthesia. A bone window of approximately 15 mm width and 10 mm height was created on the sinus sidewall in each patient with the help of diamond round burs. No bone was left in the middle of the window. Then, the sinus membrane was lifted with the help of the sinus lift curettes. In the control group, in addition to simultaneous implant (BioHorizons, Alabama-USA) and particulate bovine bone graft (Begooss, Bremen-Germany) application with sinus lifting with lateral window assistance, resorbable collagen membrane application was implemented on the lateral window; and in the study group, simultaneous implant and graft application with sinus lifting was again performed with the lateral window technique, but collagen membrane was not applied on the lateral window. The mucoperiosteal flap was closed with 3.0 resorbable sutures. The patients were given postoperative

closed with 3.0 resorbable sutures. The patients were given postoperative amoxicillin 1 g twice a day and an anti-inflammatory oral rinse for 1 week. Twelve months following the procedure, images of the region were taken from the patients with computerized dental volumetric tomography (CT). The presence of a defect area due to soft tissue invasion was investigated at the antrostomy site in these images (Figure 1). The newly formed bone diameter was measured from the widest part of the medial maxillary sinus area that was augmented from the boundaries that formed in the lateral bone window (Figure 2). The difference between the groups was evaluated statistically. Implant survival rates between groups were also evaluated. The difference between the groups in terms of bone diameter was evaluated with an independent t test. The methodology, results and conclusions were reviewed by an independent statistician.

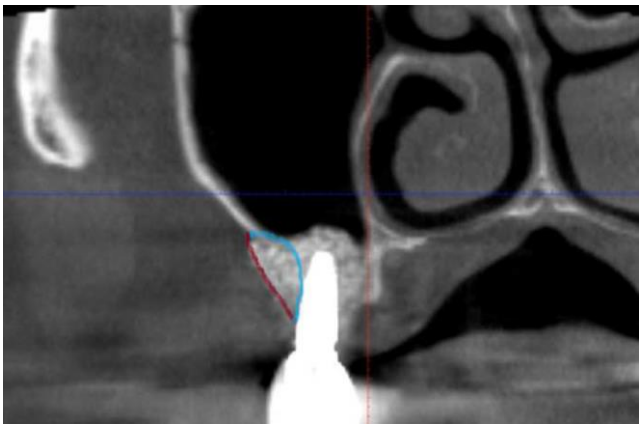

Figure 1

The presence of a defect area due to soft tissue invasion was investigated at the antrostomy site in these images (Figure 1). The blue line demonstrates the defect area that is investigated, and the red line demonstrates the nondefect area.

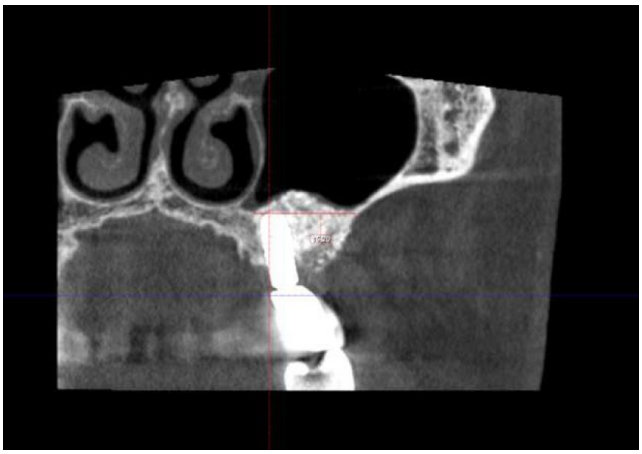

Figure 2

The newly formed bone diameter was measured from the widest part of the medial maxillary sinus area that was augmented from the boundaries that formed in the lateral bone window.

RESULTS

Forty patients participated in this study. Twenty of these patients constituted the study group, and 20 of them were the control group. As a result of the study, 1 patient from the study group could not be operated on due to a rupture of the sinus membrane during the sinus lifting procedure and was excluded from the study. Additionally, in the control group, 2 patients were excluded from the study as a result of a rupture of the sinus membrane. Three patients could not be included in the control group. As a result, the control group consisted of 15 patients, and the study group consisted of 19 patients. In the control group, 22 implants were placed in 15 patients, while 26 implants were placed in 19 patients in the study group.

As a result of the study, no defect areas were found radiographically in the lateral window region in either the study or the control group. The mean bone diameter of the control group was 13.06 ± 2.4 mm and that of the study group was 14.10 ± 5.8 mm. There was no significant difference between the groups in the measurement of the newly formed bone diameter in the widest portion of the medial region of the maxillary sinus area, which was augmented from the bone boundary forming at the lateral bone window (Table 1). In the experimental group and the control group, there were no losses in any of the implants that were placed.

Table 1.

The difference between the groups in terms of bone diameter was evaluated with an independent t test

Groups	N	Mean	Std. Deviation
With Membrane	19	14,1342	2,24277
Without Membrane	15	13,0633	1,67383
		t=1,540, df=32	p=0,133 p>0,05

DISCUSSION

Numerous systematic reviews have shown that the augmentation of the sinus base is one of the most reliable procedures in preprosthetic surgery.[24-27] However, there are important discussions regarding the use of membranes together with the sinus lifting process in terms of benefits for implant survival and treatment success. As we have concluded in our study, some researchers found no difference in implant survival rates between membrane-coated and noncoated groups.[28] Others reported higher implant survival rates when antrostomy sites were membrane-coated.[29-31] However, no clinical trials have shown any significant p values that indicate benefits from the usage of membranes. Published evidence indicating protective effects that membranes might offer came from Wallace[31] and Pjetursson[27] in the form of meta-analyses conducted by them in systematic reviews.

In previous studies, significantly less soft tissue formation was observed in the sinuses covered with membranes.[32-35] In this study, on the other hand, no soft tissue invasion progressing towards the bone grafts in the antrostomy regions without the use of membrane was observed in any of the patients on the CT images. Again, in a histological study by Barone et al., no significant difference was observed in terms of soft tissue infiltration between the two groups.[37]

Although the coverage area of the antrostomy site with membranes can prevent soft tissue infiltration and improve bone regeneration near the sinus window, most posterior maxillary implants are placed at the palatal position away from the antrostomy defect. This may be the reason why implant biopsies and survival rates are not affected by the use of membranes.[37] For all the reasons mentioned above, and additional costs and stages of redundancy, including placing and dismantling, to save on the duration and cost of the operation, the use of membranes should be reviewed again.

Misch observed first that the lateral wall of the sinus had the tendency to induce bone formation when the membrane was removed.[38] Other studies confirmed these results, showing the potential of highest bone formation on the lateral regions of the sinus. Finally, both in primates[39,40] and in humans[41,42], there was some evidence of bone formation towards the inside from the base of sinus and the lateral sidewalls. The application of membrane on the sidewall of the sinus during the lifting process could reduce the osteogenic potential in this area.

However, some authors have evaluated the results of a sinus base elevation that did not involve the use of barrier membranes, and they have concluded that unfavorable recovery was achieved in the lateral wall area.43 These studies reported that the main complications of the nonusage of a membrane were the displacement of graft particles and/or the proliferation of connective tissue into the sinus cavity. They reported that the presence of soft tissue in the area prevented the formation of bone. It was reported that the absence of vital bone in the region, depending on the amount of existing bone for osteointegration, might have a negative impact on the survival of implants. Unlike these findings, in our study, no invasion of soft tissue into the region and no resultant defect area were observed. In the study, periosteal continuity was preserved as a result of careful incision and periosteal elevation. The conclusion we drew from the study indicated that the periosteum, which was preserved without compromising its continuity, acted as a natural membrane in the lateral antrostomy area and prevented soft tissue invasion.

The results of another study showed that the use of membrane could somewhat increase the amount of vital bone during a 6-month period compared to the regions that were not covered and histologically evaluated. On the other hand, the use of membranes appeared to reduce the proliferation of connective tissue. In the present study, soft tissue invasion was not viewed histologically, the presence of defects was investigated macroscopically with CT scans, and bone area formation between the groups was researched.

Newly formed bone diameters were evaluated to describe new bone formation values. It would be more accurate to calculate the new bone volume instead of diameter measurement. However, graft volumes used in sinus lifting and implant numbers were different in each case. Therefore, bone volume measurements are also misleading. It was thought that possible defects at the antrostomy sites would decrease the bone diameters, and bone diameters were used to describe newly formed bone values. As a result, in our study, no difference between groups was found in terms of the amount of bone generation and the occurrence of defects.

CONCLUSION

The results of this study allowed us to conclude that the use of a membrane to close the lateral window did not play any important role in the formation of bone defects and did not affect the growth of the bone area to any great extent. However, we hold the opinion that if periosteal elevation was performed with the preservation of its continuity during the operation, it would act as a natural membrane. This would enable the avoidance of an increase in cost and duration resulting from membrane usage while also engaging the osteogenic capacity of the buccal periosteum on the lateral membrane within the process.

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