Journal of Craniomaxillofacial Research

Vol. 3, No. 4 Autumn 2016

Primary stability of implants inserted following sinus lift and bone graft in the posterior of the maxilla

Mehdi Sezavar [1], Mohammad Reza Soleimanpour [1], Fahimeh Koshki [1], Seyedeh Zahra Shakeri [1]

Mohammad Moharrami [2*]

1. Department of Oral and Maxillofacial surgery, Azad University of Medical sciences, Dental Branch, Tehran, Iran.

2. Craniomaxillofacial Research Center (CMFRC), Shariati Hospital, Department of Oral and Maxillofacial surgery, Tehran University of Medical Sciences, Tehran, Iran.

ARTICLE INFO

Article Type:
Original Article

Received: 31 May 2016
Revised: 2 Jul 2016
Accepted: 22 Aug 2016

**Corresponding author:*
Mohammad Moharrami
Craniomaxillofacial Research Center (CMFRC), Shariati Hospital, Tehran University of Medical Sciences, Tehran, Iran.

Tel: +98-21-82415415
Fax: +98-21-82415400
Email: Dr.m.moharrami@Gmail.com

ABSTRACT

Introduction: This study aimed to compare the primary stability of implants inserted conventionally with those inserted following sinus lift plus bone graft.

Materials and Methods: The data consisted of periotest scores from 12 patients (7 women, 5 men, mean age of 47.8±10.4) and 24 implants. Each patient had 1 implant which was inserted conventionally and another using sinus lift (lateral window) and bone graft, therefore, each patient rolled as control as well as case group for him/herself. Eight patients had surgery on the right side and other 4 on the left side. After 4 months of surgery, primary stability was measured by periotest at 3 points. Radiographs also were served to evaluate success rate of each technique. The patients were collected from a private clinic during 8 months. Mann-Whitney U test was served for analysis; P-value less than 0.05 was considered as statistically significant.

Results: The difference between diameters and lengths of implants between case and control group was insignificant ($p>0.05$). The mean score of periotest for case and control group was -2.73±1.52 and -4.31 ±1.99 respectively. Although the primary stability was higher in the control group and Mann-Whitney U analysis showed a significant difference ($p<0.05$), but as both scores were negative, primary stability was acceptable in the case group as well.

Conclusion: Despite the lower primary stability of implants inserted in regions with a sinus lift and graft, the technique is acceptable and clinically efficient.

Key words: Implant, Sinus lift, Graft, Primary stability.

Introduction

Implant surgery is predictable and reliable treatment method for prosthetic reconstruction of the edentulous areas of the jaw but sometimes insufficient amounts of bone, because of atrophy followed by teeth loss or due to the presence of the maxillary sinus, makes it hard to place implants in the posterior of the maxilla and pre-surgical procedures are needed [1]. The insufficient vertical space can be increased by sinus pneumatization, flat floor of the palate, resorption of the residual ridge [2]. It is suggested that at least 10 mm of vertical bone height is needed for the predictable success of dental implants [3]. Also, the size of the implant is crucial due to the lower bone density of posterior of maxilla; the bone width is often lost as well [2]. Sinus lift and bone graft are developed as surgical techniques for this deficiency [4]. There are 4 types of maxillary bones according to Mish classification [5].

SA-1: For regular implant placement, this technique is used when at least 12 mm of vertical bone is available *SA-2*: Elevation of sinus with close technique and placement of the implant, 10-12 mm of vertical bone height and sufficient width is needed for this technique *SA-3:* Sinus augmentation with placement of implant synchronyor dilatory, 5-10 mm of vertical bone height exists.

SA-4: Sinus augmentation with dilatory placement of the implant. The residual vertical bone is less than 5 mm. According to this classification, there are different approaches and techniques available due to each condition. But here is the question, is there any differences between these techniques based on integration of bone-implant; nowadays implant loosening due to weak osseointegration is one the obstacles in surgeries [6].

According to previous studies, success rate of sinus lift followed by implant placement is highly described. In most cases survival rate of implants reaches 90.0% after 3-5 years period [7]. There are few studies that considered success rate of sinus lift and bone graft simultaneously and studies which considered both are few and mainly experimented primates. Most studies evaluated integration between bone and graft and formation of new bone [8-11]. In recent studies which took place in different clinics with different techniques-bone-implant integrations results were mainly acceptable; in the study by Conde, it is shown that normal maxillary sinus augmentation is acceptable and there was not any failure in sample studies [12]. Khachtryan and Hakobyan reported there was not any failure after 5 years follow-up of patients treated with maxillary sinus augmentation [13]. In the study by Cricchio, sinus bone formation and implant survival ratewas evaluated during 1-6 years period after sinus membrane elevation without any bone augmentation; the result showed 98.7% success rate [8].

Nowadays 1.4 million implants are used world wide, so quality and success rate in this quantity is deserved to be further studied [14]. Due to importance of osseointegration in success of implants' primary stability and followed by it, the success of prosthesis and considering the fact that sinus lift and bone graft is common technique among maxillofacial surgeons, In this study we evaluated success rate of implant placement after sinus lift and bone augmentationand compared it with normal condition that no pre-surgical procedureswere needed to determine if this technique is acceptable for clinical procedures or not.

Method and Material

Cone-beam computed tomography (CBCT) images were taken from implant candidates for selecting 12 patients who participated in this study. The including criteria for selecting the patients were:

1) Patients who needed implants both using the conventional surgery and sinus lift and graft 2) Plaque index less than 20% [15]. Also, patients must have been able to follow schedule of the study and attend follow-up sessions 3) Class III or IV bone quality [16] 4) Edentulous period of at least 1 year;

Exclusion criteria were as follow:

1) Use of long-term antibiotics more than 2 weeks 2) history of malignancy, radiotherapy or chemotherapy 3) pregnancy 4) smoking 5) presence of mucocutaneous diseases; severe acute or chronic sinus pathology (sarcoidosis, osteomas, or carcinomas etc).

All the surgeries accomplished by one maxillofacial surgeon and in one clinic, this approach tends to decrease biases in comparison with the multi-central procedure. The total sample of the study consisted of 12 patients who needed implants both with and without sinus lift and graft, therefore, we inserted 24 implants. Each patient was control as well as the case for her/himself (Figure 2). All patients were treated with same surgical technique: sinus lift were done by lateral window technique in case group; The total 24 implants were placed by 1-stage procedure, whether they needed sinus lift with augmentation or not; the remaining bone height (RBH) was 3-5 mm in the case group. In this study, we used CenoBone (1000-2000 μm particles) Kish tissue regeneration corporation augmentation grafts. Patients were prescribed to take 0.2 % chlorhexidine mouthwash twice daily and continue taking antibiotics for 7 seven days after surgery.

After 4 months of surgery, osseointegration was assessed using periotest in both groups in 3 points and mean score was reported as osseointegration value, the score could vary between -8 to 0, which shows acceptable primary stability and the more negative the score is better the osseointegration (Figure 2). Also, the periapical radiographs were used to ensure successfulness of surgeries.

Ethical Consideration

The protocol was approved by the ethics committee of Azad dental university of medical science. Informed

consent was obtained from all patients. The study followed Helsinki Declaration guidelines. All patients referred to the clinic were treated whether or not they had participated in the study.

Data Analyze

The data were analyzed with SPSS software, version 22 using Mann-Whitney U test. P-value less than 0.05 was considered as statistically significant.

Results

The samples consisted of 24 implants in 12 patients. The patients consisted of 5 women (41.7 %) and 7 men (58.3%). The mean age of patients was 47.8±10.4 with the range of 33 to 64 years old. The implants were inserted in the posterior of the maxilla; 8 on the right side and 4 on the left side. Diameter and length of implants based on case and control groupis shown in table 1. According to this table, the slight differences between sizes in 2 groups was not significant (p>0.05). So the results taken from periotest between 2 groups werecomparable.

Except two patients (7, 12) the periotest scores were lower in implants without sinus lift and graft, though they were negative in all samples. Overall there was 1.5 point difference between 2 groups which was significant (p=0.02) according to Mann-Whitney U analysis which indicates different primary stability in two group (Table 2).

Discussion

In a systemic review by pjetursson et al [17], the survival rate of implants placed following sinus floor elevation was described successful with acceptable clinical outcomes. Both preclinical [18] and clinical studies [9, 11, 19] have suggested that the elevation of the maxillary sinus membrane at the time of implant insertion without any graft is a successful technique for bone reformation and implant survival.

In this study the primary stability and osseointegration of implants inserted using sinus lift and bone graft technique were evaluated and compared with control group without any pre-surgical procedure in each patient; choosing case and control group from one patient to omit confounding factors and reaching reliable results was our study's main difference from others, though, it was difficult tofind patients with these exclusivities according to our including and excluding criteria. All surgeries were performed by one surgeon to reduce any further bias. The implants were inserted from the first premolar to the second molar in D_3 and D_4 bone types.

Based on our results after 4 months of implant surgery, the case group with the need of sinus lift and graft had periotest score of -2.73±1.52 which is acceptable for primary stability and osseointegration but less than the control group with the score of -4.31±1.99. The radiographs used for follow-ups showed no bone resorption, so, no sign of failure was seen in either of groups. As the results indicated, sinus lift plus graft is an acceptable technique for inserting implants in the posterior region of the maxilla with low RBH but in comparison with regular implant technique it provides less primary stability.

In as tudy by Ricket et al, two different bone graft materials were used, bio Oss mixture with the autogenous bone and bio Oss mixture with autogenous stem cells, although the osseointegration of stem cell mixture was higher but implant primary stability was acceptable in both groups. like present study, their result showed the technique is trustful for implant surgery, however, they inserted the implants after 3 months of surgery but we simultaneously inserted the implants. Unlike presentstudy, they did not use the conventional implant surgery as the control group and compared two different graft materials with each other [10].

Ciricoo et al released their long-term clinical and radiographic follow-ups of implant surgeries in the space gained by sinus elevation without any graft; Resonance frequency analysis (RFA) and radiography after 6 months of surgery showed the formation of 5.3±2.1 mm of new bone and acceptable primary stability with a survival rate of 98.70 %. These findings suggested that sinus lift can reach enough primary stability solely if the graft is not needed [8].

Ulrike Kuchler showed 83% of implants placed using simultaneous sinus floor elevation reached threshold Implant Stability Quotient (ISQ) ≥ 70 after 8 weeks, which allows predictable and reliable early loading; the early failure rate was only 0.9% [20].

Palma et al found that that there are no significant differences between osseointegration of implants inserted using sinus lift in maxilla with or without graft based on histological evaluation after six months of surgery which is in contrast with our results. This is maybe due to the fact that they studied primates and used autogenous bone augmentation, also, they used

histological and RFA to evaluate osseointegration [18].

Due to nature of our human study it was not possible to do histological analysis, and periotets was used to determine the primary stability, though,most studies used RFA technique for measuring primary stability; it is shown that RFA is effective but hard to use in clinical studies, periotes thas almost the same accuracy and also is cheaper, more convenient and easier to use in clinic. Scores in periotest are in the range of 0 to -8 which shows acceptable integration and the more negative the score is the integration will be better. Also, the results suggested that osseointegration is better in the control group without sinus lift and bone graft but clinical findings suggested that there is not any problem in thecase group and after loading the implants there was not any failure.

CBCT and periapical radiographs were used before surgery for determining the exact dimension of sinus and RBH for inserting implants properly, and the same method after 4 months of surgery was used to evaluate new bone formation and success rate of each technique. The obstacles of this study were to find patients adaptable to our study criteria with the need of implants both with and without sinus lift and graft.

Conclusion

Primary stability and success rate of implants in the posterior of the maxilla in patients with need of sinus lift and graft is acceptable, though, it shows less stability than conventional implant surgery with sufficient RBH.

Conflict of Interest

The authors declare no conflict of interest.

Funding

The study had no financial resources and support.

Table 1. Diameter and length of Implants in case and control group.

Patients	*Diameter of Implants*	*Length of Implants*
	(*Mean±SD*)	(*Mean±SD*)
With sinus lift and bone graft (*N=12*)	*4.110.37±*	*11.920.40±*
Without bone graft (*N=12*)	*4.530.43±*	*11.670.55±*
P-value	*0.6*	*0.8*

Table 2. Periotest scores for each implant in case and control group.

Patient	*Periotest Score*	
	With sinus lift and graft	*Without sinus lift and graft*
1	*-1.30*	*-7.02*
2	*-3.17*	*-6.73*
3	*-3.40*	*-4.84*
4	*-1.03*	*-3.04*
5	*-0.60*	*-1.89*
6	*-1.98*	*-2.94*
7	*-4.69*	*-1.99*
8	*-5.54*	*-6.44*
9	*-1.34*	*-5.45*
10	*-2.97*	*-5.18*
11	*-3.72*	*-4.92*
12	*-3.13*	*-1.28*
Total (*mean±sd*)	*-2.731.52±*	*-4.311.99±*
P-value	*0.02*	

References

[1] Wehrbein H, Diedrich P. [Progressive pneumatization of the basal maxillary sinus after extraction and space closure]. Fortschr Kieferorthop. 1992;53(2):77-83.

[2] Rios HF, Avila G, Galindo P, Bratu E, Wang H-L. The influence of remaining alveolar bone upon lateral window sinus augmentation implant survival. Implant Dent. 2009;18(5):402-12.

[3] Chiapasco M, Zaniboni M, Rimondini L. Dental implants placed in grafted maxillary sinuses: a retrospective analysis of clinical outcome according to the initial clinical situation and a proposal of defect classification. Clin Oral Implants Res. 2008;19(4):416-28.

[4] Beretta M, Cicciu M, Bramanti E, Maiorana C. Schneider membrane elevation in presence of sinus septa: Anatomic features and surgical management. International journal of dentistry. 2012;2012.

[5] Misch CE. Bone density. Implants and Restorative Dentistry. 2001:79.

[6] Osseointegration in skeletal reconstruction and rehabilitation: a review. J Rehabil Res Dev. 2001;38(2):175-82.

[7] Bornstein MM, Chappuis V, Von Arx T, Buser D. Performance of dental implants after staged sinus floor elevation procedures: 5-year results of a prospective study in partially edentulous patients. Clin Oral Implants Res. 2008;19(10):1034-43.

[8] Cricchio G, Sennerby L, Lundgren S. Sinus bone formation and implant survival after sinus membrane elevation and implant placement: a 1-to 6-year follow-up study. Clin Oral Implants Res. 2011;22(10):1200-12.

[9] Hatano N, Sennerby L, Lundgren S. Maxillary Sinus Augmentation Using Sinus Membrane Elevation and Peripheral Venous Blood for Implant-Supported Rehabilitation of the Atrophic Posterior Maxilla: Case Series. Clin Implant Dent Relat Res. 2007;9(3):150-5

[10] Rickert D, Sauerbier S, Nagursky H, Menne D, Vissink A, Raghoebar G. Maxillary sinus floor elevation with bovine bone mineral combined with either autogenous bone or autogenous stem cells: a prospective randomized clinical trial. Clin Oral Implants Res. 2011;22(3):251-8.

[11] Thor A, Sennerby L, Hirsch JM, Rasmusson L. Bone formation at the maxillary sinus floor following simultaneous elevation of the mucosal lining and implant installation without graft material: an evaluation of 20 patients treated with 44 Astra Tech implants. J Oral Maxillofac Surg. 2007;65(7):64-72.

[12] Martínez-Conde R, Eguia A, Uribarri A, López-Vicente J, Aguirre JM. Multiple window access antrostomy in maxillary sinus grafting. Presentation of a clinical serie of 10 cases and literature review. 1989.

[13] Hakobyan G, Khachatryan A. Maxillary sinus augmentation using vertical bone condensing. EUROMEDICA. 2010:65.

[14] Gahleitner A, Hofschneider U, Tepper G, Pretterklieber M, Schick S, Zauza K, et al. Lingual Vascular Canals of the Mandible: Evaluation with Dental CT 1. Radiology. 2001;220(1):186-9.

[15] O'Leary TJ, Drake RB, Naylor JE. The plaque control record. J Periodontol. 1972;43(1):38-.

[16] Lekholm U, Zarb G. Tissue-Integrated Prostheses Osseointegration in Clinical Dentistry/Eds PI Branemark et al. Chicago; 1985.

[17] Pjetursson BE, Tan WC, Zwahlen M, Lang NP. A systematic review of the success of sinus floor elevation and survival of implants inserted in combination with sinus floor elevation. J Clin Periodontol. 2008;35(s8):216-40.

[18] Palma VC, Magro-Filho O, Oliveria D, Américo J, Lundgren S, Salata LA, et al. Bone reformation and implant integration following maxillary sinus membrane elevation: an experimental study in primates. Clin Implant Dent Relat Res. 2006;8(1):11-24.

[19] Ellegaard B, Kølsen-petersen J, Baelum V. Implant therapy involving maxillary sinus lift in periodontally compromised patients. Clin Oral Implants Res. 1997;8(4):305-15.

[20] Kuchler U, Chappuis V, Bornstein MM, Siewczyk M, Gruber R, Maestre L, et al. Development of Implant Stability Quotient values of implants placed with simultaneous sinus floor elevation–results of

a prospective study with 109 implants. Clin Oral Implants Res. 2016.

Please cite this paper as:
Sezavar M, Soleimanpour M, Koshki F, Shakeri Z, Moharrami M; Primary stability of implants inserted following sinus lift and bone graft in the posterior of the maxilla. J Craniomax Res 2016; 3(4): 258-263