

Comparison of Implant Success Rate Between Direct And Indirect Sinus Lift Procedure

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¹⁻³Drafting the work or revising it critically for important intellectual content, Final approval of the version to be published

^{4,5,6}Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work,

Funding Source: None

Conflict of Interest: None

Received: June 14, 2022

Accepted: Nov 08, 2022

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ABSTRACT

Objective: To compare gain in bone height and post-operative complications with direct and indirect sinus lift procedure.

Methodology: This prospective clinical study was conducted at the department of Oral & Maxillofacial surgery, Madina Teaching Hospital Faisalabad, from February 2021 to February 2022. For patients in the 20-50 years age range either gender with maxillary posterior edentulous regions but with a low sinus and deficient alveolar ridge, implant retained prostheses would be a viable option.

Results: Results showed that pain and gingival inflammation resolved at 1st week postoperatively. These two parameters frequency was higher in patients with indirect method as compared to patients who were treated with direct method. Swelling was also settled in both treatment groups after 1st week postoperatively. However, frequency of swelling was higher in indirect method as compared to direct method but the difference was not statistically significant. There is significant change in bone height postoperatively in both treatment groups. But gain in mean bone height was significantly higher in patients treated with direct approach.

Conclusion: This study did not find a significant difference between direct versus indirect sinus lift procedures in terms of swelling, inflammation, and pain following surgery. Indirect sinus lifts, however, result in a significantly lower bone height gain than direct sinus lifts.

Key Words: Edentulism, Sinus lift procedures, Direct, Indirect, Bone height, Sinus surgery.

Cite this article as: Atiq T, Iqbal S, Rashid W, Ain QT, Asghar I, Javed T. Comparison of Implant Success Rate Between Direct And Indirect Sinus Lift Procedure. *Ann Pak Inst Med Sci.* 2022; 18(4):295-299. doi. 10.48036/apims.v18i4.761

Introduction

There are three dimensions to the maxillary sinus, the largest of the paranasal sinuses, with dimensions of 2.5 cm wide by 3.75 cm high and 3 cm deep.¹ A number of factors can contribute to alveolar bone resorption following tooth loss in the posterior maxilla, including physiological bone remodeling following tooth loss and sinus cavity pneumatization toward the alveolar crest.²

In addition to the surgeon's preferences and the patient's anatomy, a surgeon selects what type of maxillary sinus elevation and augmentation to use on a given patient. The amount of lift desired and the residual bone height of the patient are two anatomical factors to consider.³ In order for

dental implants to be placed successfully, a number of methods and techniques have been used. Indirect and direct techniques can be grouped into two broad categories. Gaining bone width with the direct method is considered to be the gold standard to date.⁴ Direct techniques involve considerably more complications than other methods.⁵

The use of osteotomes to elevate the sinus floor (indirect technique) and simultaneously place implants with or without bone graft material is usually indicated when residual vertical alveolar bone height exceeds 5 millimeters. It is recommended that lateral window grafting be used when the residual bone height is below 5

millimeters.⁶ In the case of extensive implantations, the lateral approach offers better control and better predictability.⁷ There are almost the same advantages and disadvantages associated with both techniques, despite their differences in indications. Treatment selection is based on the case selection and needs of the patient. Direct versus indirect methods are compared in this article.⁸

It is crucial to possess solid knowledge of sinus anatomy before performing direct or indirect sinus lift surgery, and to perform proper preoperative evaluation, diagnosis, surgical technique, and regular recalls and reviews throughout the process.

Methodology

This was a prospective clinical study conducted at the Department of oral and maxillofacial surgery, Madina Teaching Hospital Faisalabad over a period of one year from February 2021 to February 2022. For patients in the 20–50 age range of either gender with maxillary posterior edentulous regions but with a low sinus and deficient alveolar ridge, implant retained prostheses would be a viable option. Implant placement should be completed within six months of tooth extraction, and adjacent teeth should be restored if required. There may be a negative effect of treatment on patients who are suffering from severe metabolic diseases, lowered immune systems, hematologic disorders, maternal conditions, previous maxillofacial radiation, chemotherapy, bone disease, medication, or any other underlying illness that could affect treatment effectiveness.

Insufficient mouth opening, patients who smoked, chewed tobacco, or drank alcohol were excluded from the study. Radiographic evidence of maxillary sinus pathology, a history of sinusitis or maxillary sinus surgery were also excluded. There were 58 participants (29 in each group) who met the inclusion and exclusion criteria. We calculated sample size by taking the expected mean height gain and direct and indirect methods, with 80% confidence intervals and 80% test power as 5.34 ± 2.1^9 and 6.19 ± 0.48^9 respectively. Orthopantomograms were performed in accordance with Misch criteria for assessing maxillary sinuses.

Surgical procedure: Indirect sinus approach or direct sinus approach, implants are placed simultaneously following sinus elevations.

Indirect sinus approach: The implant site was marked with a pilot drill. The diameter of the drills was increased as the drilling progressed. A 2 mm height difference was

maintained between the floor of the sinuses and the top of the skull. An osteotome of the appropriate caliber was inserted, and successively larger diameter instruments were used for indirect sinus lift. An osseograft was then inserted after the PRF. Implants were placed immediately, cover screws and sutures were applied.⁽¹⁰⁾

Direct sinus Approach: Located behind the canine fossa, the buccal bone window opens into the maxillary sinus anterolaterally. Drills of increasing diameter were used with a pilot drill. Preparation of the osteotomy site was followed by placement of PRF and osseous graft, followed by the placement of implants in the prepared site and the placement of cover screws and sutures.⁽¹⁰⁾

In addition to following standard postoperative instructions, patients were advised to use an ice pack, consume a soft, high-nutrient diet, and rinse their mouths thoroughly with antiseptic mouthwash (chlorhexidine gluconate 0.2%). Intranasal pressure and vacuum were avoided by the patients by refraining from sneezing, blowing their noses, or doing anything else that would create high intranasal pressure. For a week, patients were asked not to use straws while drinking. In order to reduce the risk of wound dehiscence, it was instructed to not wear any prosthetics over the surgical site for at least one week after surgery. A postoperative follow-up was performed in both groups at 1st, 3rd, 6th, and 12th weeks, as well as at 1, 2, and 3 months after implant insertion for implant stability checking. These parameters were assessed postoperatively on the patient specifically pain, gingival inflammation status, swelling, stability, and any complications that may arise.

A version 25 of the Statistical Package for Social Science was used for data entry and analysis. Quantitative factors (age, Period of edentulousness, and bone height) were reported as Mean \pm SD, whereas qualitative variables (gender, pain (Yes/No), gingival inflammation, and edema) were presented as frequency and percentage. A chi square test was used to compare qualitative variables and a t-test was used to compare quantitative variables. In order to be considered statistically significant, the p-value had to be less than 0.05.

Results

The patients in the direct and indirect groups were 38.00 ± 5.83 and 39.76 ± 5.76 years old, respectively. Patients in both treatment groups are between the ages of 30 and 50. The direct group consisted of 6 patients (20.7%) and 23 patients (79.3%), while the indirect group consisted

of 12 patients (41.4%) and 18 patients (58.6%). There was a mean duration of edentulous in the direct group of 3.68 ± 2.13 years and a mean duration of edentulous in the indirect group of 5.30 ± 2.19 years.

Table I: Postoperative follow up in study Groups.

	Study Groups		p-value	
	Direct (n=29)	Indirect (n=29)		
Pain	1 st Day	12(41.4%)	18(62.1%)	0.115
	1 st Week	9(31%)	13(44.8%)	0.279
	3 rd Week	0(0%)	0(0%)	-
	6 th Week	0(0%)	0(0%)	-
	12 th Week	0(0%)	0(0%)	-
Gingival inflammation	1 st Day	27(93.1%)	27(93.1%)	-
	1 st Week	12(41.4%)	15(51.7%)	0.430
	3 rd Week	0(0%)	0(0%)	-
	6 th Week	0(0%)	0(0%)	-
	12 th Week	0(0%)	0(0%)	-
Swelling	1 st Day	6(20.7%)	8(27.6%)	0.539
	1 st Week	2(6.9%)	3(10.3%)	0.640
	3 rd Week	0(0%)	0(0%)	-
Preoperative bone height	5.76 \pm 1.06	4.19 \pm 1.38	-	
Postoperative bone height	12.21 \pm 0.77	9.05 \pm 1.69		
Change in bone height	6.44 \pm 1.24	4.85 \pm 0.87		
p-value (gain in Bone height)	<0.001	<0.001		

On the 1st postoperative day, 41.4% of patients who underwent direct sinus lift procedures and 62.1% of those who underwent indirect sinus lift procedures complained of pain. On the visual analogue scale, 31% of patients who received direct sinus lifts in the first week after surgery experienced pain, compared to 44.8% who received indirect sinus lifts. There was a higher rate of pain reported in the indirect sinus lift group. Both treatment groups reported no postoperative pain at the 3rd week (Direct: 0% vs. indirect: 0%), the 6th week (Direct: 0% vs. Indirect: 0%) and the 12th week (Direct: 0% vs. indirect: 0%). In the direct group, 93.1% of patients and in the indirect group, 93.3% had gingival inflammation at the first day, during the first week, 41.4% of patients in the direct group and 50% of patients in the indirect group had gingival inflammation, and in both groups the inflammation settled by the third week. Neither treatment group showed significant differences in gingival inflammation over time, but gingival inflammation did decrease over time. At 1st day (Direct: 20.7% vs. Indirect: 27.6%, p-value=0.539) and 1st week (Direct: 6.9% vs. Indirect: 10.3%, p-value=0.640) no significant difference was seen for swelling between groups. At the end of the 3rd week, both groups experienced a reduction in swelling.

Among direct and in direct groups preoperatively, the mean bone height was 5.76 ± 1.06 mm and 4.19 ± 1.38 mm, respectively. Postoperatively mean bone height in direct and indirect group was 12.21 ± 0.77 and 9.05 ± 1.69 respectively. In both groups, significant bone height gains were observed. When used indirect technique for bone height gain, the mean value was 4.85 ± 0.87 while using direct technique, the mean value was 6.44 ± 1.24 .

Discussion

An edentulous maxillary jaw with inadequate bone height presents major challenges for implant placement. Dental implant sites require sufficient bone height and volume to be restored by bone augmentation methods.¹¹ Implant placement can be tricky most of the time, especially in the posterior maxillary region. However, by evaluating the problem and using the various techniques available, a successful outcome can be achieved most of the time.

Saraperaz-martenz in 2015 had done a systematic review and concluded sinus lift procedure as a valid surgical procedure to gain crestal height of 5–9 mm.¹² The indirect sinus lift procedure presents the advantage of being less invasive and consuming less time compared to a direct sinus lift.¹³

In this study, we compared the direct method with the indirect method of the sinus lift procedure. Results showed that pain and gingival inflammation resolved at 1st week postoperatively. These two parameters frequency was higher in patients with indirect method as compared to patients who were treated with direct method. Swelling was also settled in both treatment groups after 1st week postoperatively. However, frequency of swelling was higher in the indirect method than in the direct method, but the difference was not statistically significant. There is a significant change in bone height postoperatively in both treatment groups. However, mean bone height gain was significantly higher in patients treated directly.

Post-operative pain and swelling is slightly more in the direct group during the initial post-operative week, which gradually diminished.¹⁴ In this study no significant difference was seen for pain and swelling between the direct and indirect method. However, pain and swelling was slightly higher in indirect group which is not in line with the findings of US Pal.

S M. Balaji (Direct: 6.19 mm vs. Indirect: 5.34 mm) and U. S. Pal (Direct: 8.5 mm vs. Indirect: 4.4 mm) have reported significantly higher gain in bone height with direct method of sinus lift procedure.^{9, 14} The study by

Pulkit Khandelwal found that after 3 months, the mean gain in bone height was $8.31 + 1.63$ mm (ranging from 5.8 - 12.06 mm).¹⁵ A 10 mm increase in bone height was reported by Zitzmann and Scharer.¹⁶ The lateral window approach was found to increase vertical bone height by over 9 millimeters by Al-Dajani.¹⁷

Bortoluzzi MC in his study showed that one-stage direct sinus floor augmentation technique should be the treatment of choice when the height of residual bone is less than 5 mm in the posterior maxilla. This procedure can provide a significant increase in bone height (8.31 ± 1.63 mm) with implant success rate of 96.3%.¹⁸

The survival rate of dental implants placed using different techniques for elevating the maxillary sinus floor was found in a recently published systematic review and meta-analysis. A systematic review and meta-analysis found no statistically significant difference between implant placement using a direct or indirect sinus lift approach. Accordingly, each direct and indirect procedure is selected according to its indications.¹⁹ The technique selected depends on the anatomy of the sinus floor and lateral wall of the sinus, as well as the residual bone height. In cases where bone height is less than 5 mm, a lateral window approach will be used, and for heights greater than 5 mm, a crestal approach will be used. Between the two methods, RBH is the deciding factor.¹⁹

When extensive implantations are needed, the lateral approach offers better control of the Schneiderian membrane.^{20, 21} Kher *et al.* found an implant survival rate of 96.67% during a mean follow-up of 15.74 months post-loading.²² A recently published prospective study from India evaluate the success of one-stage direct (lateral) sinus lift procedure in severely atrophic posterior maxilla. As per the findings of this study, the success rate of implant stability was 96.3% during the study period.¹⁵

Maxillary sinus augmentation surgery can be performed using either direct or indirect techniques, and when used in the right circumstances, they provide good long-term results. An edentulous region requiring augmentation will be treated using either the direct or indirect approach for the maxillary sinus lift procedure.²³

Dental implant surgeons aim to perform simple, safe, cost-effective, and highly predictable procedures that are minimally invasive and highly predictable. Treatment duration and costs are often increased by advanced and extensive surgical techniques without an absolute prediction of the outcome. As compared to invasive

procedures, minimally invasive techniques such as direct (DSAT) and indirect (ISAT) minimally invasive sinus augmentation technique (SAT) are cost-effective, less risky, and provide predictable results.

Conclusion

This study did not find a significant difference between direct versus indirect sinus lift procedures in terms of swelling, inflammation, and pain following surgery. Indirect sinus lifts, however, result in a significantly lower bone height gain than direct sinus lifts.

References

1. Pjetursson BE, Lang NP. Sinus floor elevation utilizing the transalveolar approach. *Periodontology* 2000.2014;66(1):59-71.
<https://doi.org/10.1111/prd.12043>
2. Levi I, Halperin-Sternfeld M, Horwitz J, Zigdon-Giladi H, Machtei EE. Dimensional changes of the maxillary sinus following tooth extraction in the posterior maxilla with and without socket preservation. *Clin Implant Dent Relat Res.* 2017;19(5):952-8.
<https://doi.org/10.1111/cid.12521>
3. Bathla SC, Fry RR, Majumdar K. Maxillary sinus augmentation. *J Indian Soc Periodontol.* 2018;22(6):468-73.
https://doi.org/10.4103/jisp.jisp_236_18
4. Simon BI, Greenfield JL. Alternative to the gold standard for sinus augmentation: Osteotome sinus elevation. *Quintessence Int.* 2011;42(10).
5. Irinakis T, Dabuleanu V, Aldahlawi S. Complications during maxillary sinus augmentation associated with interfering septa: a new classification of septa. *Open Dent.J.*2017;11:140.
<https://doi.org/10.2174/1874210601711010140>
6. Starch-Jensen T, Jensen JD. Maxillary sinus floor augmentation: a review of selected treatment modalities. *J. Oral Maxillofac. Surg.* 2017;8(3).
<https://doi.org/10.5037/jomr.2017.8303>
7. Danesh-Sani SA, Loomer PM, Wallace SS. A comprehensive clinical review of maxillary sinus floor elevation: anatomy, techniques, biomaterials and complications. *Br J Oral Maxillofac Surg.* 2016;54(7):724-30.
<https://doi.org/10.1016/j.bjoms.2016.05.008>
8. Shenoy SB, Talwar A, Thomas B, Ramesh A, Raghavendra A. Direct vs Indirect Sinus Elevation: A Literature Review. *MJDS.* 2020;5(2):15-21.
9. Balaji S. Direct v/s Indirect sinus lift in maxillary dental implants. *Ann. Maxillofac. Surg.*

- 2013;3(2):148.
<https://doi.org/10.4103/2231-0746.119228>
10. Daniel D, Rao SG. Evaluation of increase in bone height following maxillary sinus augmentation using direct and indirect technique. *Journal of Dental Implants*.2012;2(1):26.
<https://doi.org/10.4103/0974-6781.96563>
 11. Saba Afreen D, Kaur T, Rani P. Clinical Performance of Different Bone Substitutes in Direct and Indirect Sinus Lift Procedures for Implant Placement: A Review. *Ann. Romanian Soc. Cell Biol*. 2021:758-62.
 12. Pérez-Martínez S, Martorell-Calatayud L, Peñarrocha-Oltra D, García-Mira B, Peñarrocha-Diago M. Indirect sinus lift without bone graft material: Systematic review and meta-analysis. *Int. J. Clin. Dent*. 2015;7(2):e316.
<https://doi.org/10.4317/jced.51716>
 13. Neamat AH, Ali SM, Boskani SW, Mahmud PK. An indirect sinus floor elevation by using piezoelectric surgery with platelet-rich fibrin for sinus augmentation: A short surgical practice. *Int J Case Rep Images*. 2017;8(6):380-4.
<https://doi.org/10.5348/ijcri-201752-CR-10791>
 14. Pal U, Sharma NK, Singh R, Mahammad S, Mehrotra D, Singh N, et al. Direct vs. indirect sinus lift procedure: A comparison. *Natl J Maxillofac Surg*. 2012;3(1):31.
<https://doi.org/10.4103/0975-5950.102148>
 15. Khandelwal P, Dhupar V, Akkara F, Hajira N. Direct maxillary sinus floor augmentation and simultaneous implant placement for rehabilitation of the severely resorbed posterior maxilla: A prospective clinical study. *Indian Journal of Dental Research*.2020;31(3):449.
https://doi.org/10.4103/ijdr.IJDR_848_18
 16. Zitzmann NU, Schärer P. Sinus elevation procedures in the resorbed posterior maxilla: Comparison of the crestal and lateral approaches. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*.1998;85(1):8-17.
[https://doi.org/10.1016/S1079-2104\(98\)90391-2](https://doi.org/10.1016/S1079-2104(98)90391-2)
 17. Al-Dajani M. Recent trends in sinus lift surgery and their clinical implications. *Clin Implant Dent Relat Res*.2016;18(1):204-12.
<https://doi.org/10.1111/cid.12275>
 18. Bortoluzzi MC, Manfro R, Fabris V, Cecconello R, Derech EDA. Comparative study of immediately inserted dental implants in sinus lift: 24 months of follow-up. *Ann. Maxillofac. Surg*. 2014;4(1):30.
<https://doi.org/10.4103/2231-0746.133071>
 19. Shah D, Chauhan C, Shah R. Survival rate of dental implant placed using various maxillary sinus floor elevation techniques: A systematic review and meta-analysis. *J. Indian Prosthodont. Soc*.2022;22(3):215.
https://doi.org/10.4103/jips.jips_283_22
 20. Göçmen G, Özkan Y. Maxillary sinus augmentation for dental implants. *Paranasal Sinuses*. 2017.
<https://doi.org/10.5772/intechopen.69063>
 21. Wallace SS, Tarnow DP, Froum SJ, Cho S-C, Zadeh HH, Stoupe J, et al. Maxillary sinus elevation by lateral window approach: evolution of technology and technique. *J. Evid. Based Dent. Pract*.2012;12(3):161-71.
[https://doi.org/10.1016/S1532-3382\(12\)70030-1](https://doi.org/10.1016/S1532-3382(12)70030-1)
 22. Kher U, Mazor Z, Stanitsas P, Kotsakis GA. Implants placed simultaneously with lateral window sinus augmentation using a putty alloplastic bone substitute for increased primary implant stability: a retrospective study. *Implant Dentistry*. 2014;23(4):496-501.
<https://doi.org/10.1097/ID.000000000000117>
 23. Carrao V, DeMatteis I. Maxillary sinus bone augmentation techniques. *Oral Maxillofac Surg Clin*. 2015;27(2):245-53.
<https://doi.org/10.1016/j.coms.2015.01.001>