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Clinical and radiological outcomes of osseodensification and crestal approach sinus kit for transcrestal sinus elevation – A randomized clinical trial

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ABSTRACT

Background: The aim of the present study was to evaluate the clinical and radiological effectiveness of transcrestal sinus elevation and simultaneous implant placement using osseodensification (OD) and crestal approach sinus (CAS) instruments.

Materials and Methods: This randomized controlled double-blinded clinical trial included 20 participants with edentulous spaces requiring 20 implants having residual bone height >5 mm in the posterior maxilla. Participants were randomly allocated into the CAS group and OD group. Indirect sinus elevation with simultaneous implant placement was performed in both groups. Implant stability (IS) was evaluated at baseline and 3 months. Crestal bone loss (CBL) was measured at 3, 6, and 12 months. Apical bone gain (ABG) was measured at 6 and 12 months. Surgical time and patient comfort using the Visual Analog Scale were assessed during the surgery. Unpaired *t*-test, ANOVA, and Friedman tests were used for inter- and intragroup comparisons. $P \leq 0.05$ was deemed statistically significant.

Results: Sinus elevation and simultaneous implant placement showed good clinical and radiological outcomes in both groups. Intergroup comparison showed a significantly greater primary and secondary IS (P = 0.005, 0.008) in the OD group. CBL was less in the OD group (P = 0.02 and 0.03 on mesial and distal sides) than in the CAS group at 6 months of evaluation. ABG was higher in the OD group (4.164 ± 0.293) than the CAS group (2.819 ± 0.415). The average surgical time taken was greater (87.00 ± 15.49 min) in the CAS group than in the OD group (69.00 ± 20.24 min).

Conclusion: Both CAS and OD groups showed significant improvement in all parameters. OD group showed greater benefits in terms of enhanced primary stability, less CBL, enhanced ABG, and lesser surgical time compared to the CAS group.

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INTRODUCTION

Dental implants are a potential modality for prosthetic replacement due to their high success rates and functional effectiveness in sites with adequate bone volume and density for implant biointegration.[1] The residual ridge resorbs most quickly in the first 6 months.[2] Due to the loss of alveolar bone, reduced bone density, and pneumatization of the maxillary sinus, restoring the posterior maxilla remains challenging.[3,4] To prepare the region for implant placement with pneumatized sinus in the posterior maxilla and resorbed alveolar ridge an increase in the bone volume by sinus elevation is required.[4,5] Transcrestal indirect sinus elevation (TISE) technique is effective when residual bone height (RBH) is >5 mm. In contrast, RBH <5 mm typically recommends a lateral approach for sinus floor elevation (SFE).[6] Osteotome-mediated SFE, a TISE technique first described by Summer in 1994, has proven to be a less invasive, less time-consuming procedure. It can increase the ridge height by 3–5 mm, enabling simultaneous placement of implants.[6,7] However, this method has some shortcomings, i.e., the use of explosive force that is challenging, leading to membrane perforation, inadvertent displacement of fractured fragments, and benign paroxysmal vertigo.[8] The intralift, hydraulic sinus lift, autologous core lift, and indirect sinus lift utilizing calciumphosphosilicate putty were eventually developed for safely elevating the sinus membrane.[2,9,10]

The Crestal Approach Sinus kit (CAS-KIT) was created specifically to elevate the maxillary sinus membrane transcrestally safely. The CAS-Drill is a vital part of the CAS-KIT because it improves the simplicity and safety of maxillary sinus surgery by raising the membrane using a special stopper system to stop over-drilling into the sinus cavity.[11]

A relatively new method for biomechanically preparing bone is osseodensification (OD). With a fluted densifying bur during the operation, rolling and sliding contact generates modest plastic deformation of bone, densifying the bone without heat elevation developed by Huwais *et al.*[12] It is carried out using burs (DensahTM) that have been specially constructed for the purpose. By compacting autografting, the OD burs aid in the preservation and condensation of the bone during osteotomy site preparation, enhancing its mechanical stability and thus accelerating the transition to the restorative phase.[13,14]

Evidence supporting the use of OD in TISE is extremely scant. In order to assess and compare the clinical and radiological outcomes of TISE and simultaneous implant placement using OD and CAS instrumentation, the current randomized, prospective, and clinical trial was designed. The null hypothesis of the study was "there will be no significant difference in clinical and radiological outcomes between the two methods (OD and CAS) for transcrestal sinus elevation and implant placement."

MATERIALS AND METHODS

All participants were selected from the outpatient pool of the Department of Periodontics and Implantology at Vishnu Dental College, Bhimavaram. The study was approved and ethical clearance was obtained from the Institutional ethical committee with Ref No: IEC VDC/2021/PG01/PI/IVV/14 and approved under Clinical Trials Registry-India (CTRI/2021/07/034791). The study was conducted following the Helsinki Declaration as revised in 2013. Written informed consent was obtained from all the participants. The entire study period was from March 2021 to December 2022.

Selection criteria

Twenty participants between ages 25 and 50 years with maxillary posterior edentulous sites and RBH of 4–7 mm were included. Eighteen participants had single posterior edentulous sites. Two participants had two missing adjacent posterior teeth in the maxilla. However, in participants having multiple adjacent missing teeth a single posterior-most implant was included in the trial. Exclusion criteria were participants with active sinusitis/inflammation, undergoing radiation therapy, uncontrolled systemic diseases, severe clenching or grinding habits, poor oral hygiene maintenance, smokers, pregnant/nursing women, and those with tumors/pathologic growths in the sinus.

Randomization and allocation concealment

Clinical and radiological baseline examinations were performed on all the individuals. The CONSORT guidelines were followed for allocating patients [Figures 1, 2a and 3a]. The edentulous sites were randomly assigned to the CAS and OD groups. Computer-generated random numbering scheme enclosed in an opaque envelope was used for allocation concealment.

Study parameters

Clinical and radiological parameters i.e., implant stability (IS), crestal bone loss (CBL), apical bone

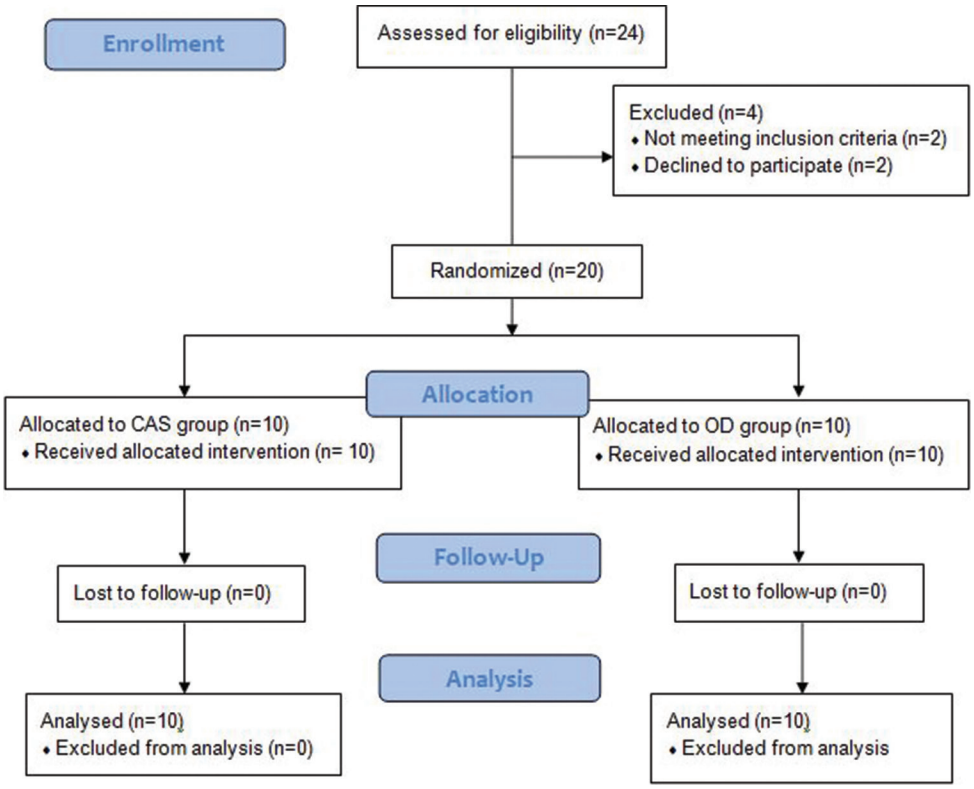

Figure 1: Consort flow chart.

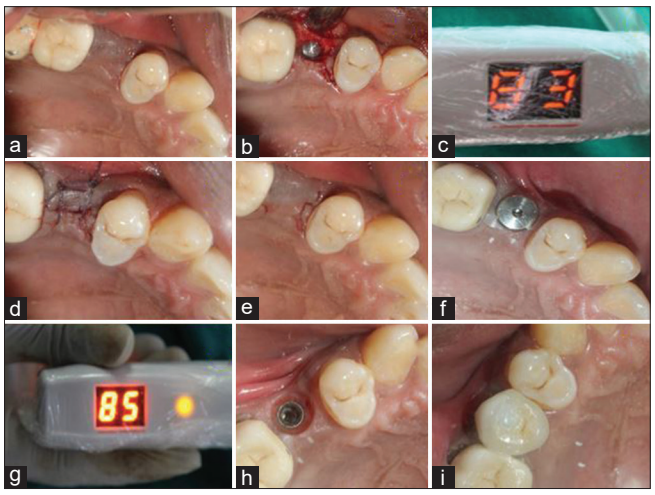

Figure 2: Crestal approach sinus Group, (a) Preoperative occlusal view of implant site, (b) Implant placement done irt 25, (c) implant stability quotient (ISQ) of 83 immediately after implant placement, (d) simple interrupted sutures placed, (e) 1 week postoperative evaluation of implant site and suture removal, (f) Slit incision with placement of healing abutment at 3 months, (g) ISQ of 85 at 3 months postimplant placement, (h) 3 weeks evaluation of implant site after placement of healing abutment, (i) Implant site restoration with screw retained.

gain (ABG), surgical time, and patient comfort, were recorded. A radiofrequency analyzer (RFA) (Penguin™) was used to test the clinical stability of implants both immediately and 3 months after implant placement. The apical implant thread and coronal bone-to-implant contact were used as reference points to measure CBL on the mesial and distal sides of the implant that were parallel to the axis of the implant. A decrease in the vertical distance between the reference points postoperatively indicates the loss of crestal bone.[1] ABG was measured from the coronal thread of the implant to the apical visible implant to bone contact on both sides parallel to the axis of the implant. A decrease in the distance between the reference point and the apical bone contact indicates ABG.[1] From the moment, local anesthesia was administered until the flap was approximated with the aid of sutures surgical time was recorded.[15] On an ordinal scale of 0–10, with 0 being the most unpleasant, and 10 the most tolerable, the patient's comfort was evaluated using a Visual Analog Scale (VAS) score.[15]

Sample size

G*power software version 3.1.9.7 (Heinrich-Heine-Universität Düsseldorf, Germany) was used to calculate the sample size. A total sample size of 14 was obtained with the power of the study set at 80% and an alpha value of 0.05 with an effect size of 1.74 taking into account ABG as the primary outcome variable based on previous studies. Considering the 20%

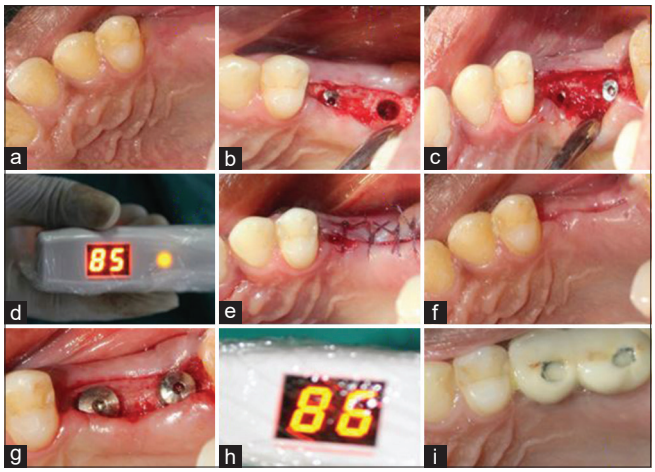

Figure 3: Osseodensification group: (a) Preoperative occlusal view of the implant site, (b) Flap elevation and osteotomy site, (c) Implant placement done irt 25,26, (d) implant stability quotient (ISQ) of 85 immediately after implant placement, (e) Simple interrupted sutures placed, (f) 1-week postoperative evaluation, (g) Flap elevation with insertion of healing abutments, (h) ISQ of 86 at 3 months postoperative, (i) Implant site restoration with screw-retained prosthesis.

dropout rate, the sample size was rounded to 20 (10 in each group).

Preoperative procedure

Periapical radiographs were acquired using the paralleling cone technique using acrylic stent. Using a metal grid with a 1-mm measurement box, the vertical bone height was calculated from the alveolar bone crest to the sinus floor lining.

Surgical procedure

Local anesthesia, i.e., 2% lignocaine with 1:200,000 adrenaline was given. Full-thickness mucoperiosteal flap was elevated after a mid-crestal incision. Twenty milliliters blood was drawn from the patient's cephalic vein and transferred to 10 mL blood collection tubes and immediately spun for 12 min at a speed of 1500 rpm in a table-top centrifuge.[16] Advanced platelet-rich fibrin (A-PRF) was removed from the tubes and put in a sterile PRF box to form a membrane.

Crestal approach sinus group

The osteotomy was prepared with a point (guide) drill. An appropriate S-reamer drill was then selected, which is 1 mm shorter than the expected bone height for safety and increased sequentially in each phase using a 1-mm long stopper. Based on implant diameter and insertion depth in the sinus, the S-reamer's diameter was taken into account. Use the sinus membrane elevator drill to carefully elevate the sinus membrane. Continue to elevate the membrane until the desired height is achieved.

Osseodensification group

Initial preparation was done up to 2 mm deep using a pilot drill. After evaluating the radiographs, the OD osteotomy preparation was carried out using OD drills (Densah™). The smallest diameter drill (2.0) was chosen and used in an anticlockwise direction at 1200 rpm with bouncing irrigation until the sinus floor was reached. The sinus membrane was advanced in 1 mm increments using the succeeding larger diameter drills (3.3, 3.8 mm). After perforation of the inferior cortical wall was felt sinus elevation was done using the sinus membrane elevator drill until the desired sinus elevation was achieved. The RBH was determined using a depth gauge.

Sinus elevation and implant placement

The Valsalva maneuver was used to make sure the membrane was intact and the A-PRF membrane was inserted. 4.2 mm × 10 mm implants (ADIN, TouaregTM-S), with internal hex connections and spiral tap designs, were placed equicrestally in all the participants. In both groups, the apical-coronal position of the implant shoulder was standardized by placing the implants at the level of the crest of the alveolar bone [Figures 2b, c and 3b, c]. RFA was used to assess the stability of implants [Figures 2c and 3d]. Cover screws were attached, and flaps approximated with 4-0 resorbable sutures (VicrylTM). The surgical site was covered with a dressing [Figures 2d and 3e].

Postoperative care

Participants were asked not to brush in the surgical area. Analgesics (Diclofenac 50 mg twice daily for 3 days) and antibiotics (Amoxicillin + clavulunate 625 mg three times daily for 3 days) were administered. Patients were advised mouth rinsing with 0.2% chlorhexidine gluconate twice daily for 15 days. Patients were reassessed for healing after a week, and the sutures were removed [Figures 2e and 3f].

Second-stage surgery was done after a 3-month healing period allowing for implant osseointegration. The implant was exposed using a slit incision and the cover screw was removed. IS was analyzed using RFA [Figures 2g and 3h]. The healing abutment was then inserted and after obtaining adequate soft tissue physiologic contour (3 weeks), the transfer coping was fastened to the implant, and silicone putty was used to make closed tray impressions [Figure 2f and 3g]. Glass-ionomer

cement was used for fixing the prosthesis to the abutment [Figures 2i and 3i].

Postoperative analysis

Immediately following implant placement and 3 months later, IS was clinically evaluated [Figures 2h and 3h]. At 3, 6, and 12 months following implant placement, CBL was assessed. ABG was assessed 6 and 12 months after surgery [Figures 4 and 5].

Statistical analysis

The data were statistically analyzed using the Statistical Package for the Social Sciences (SPSS) 21.0 version (IBM, Armonk, New York, United States). Unpaired *t*-test, ANOVA, and Friedman tests were used to compare the means of all parameters within each group. By using an unpaired *t*-test, parameters were compared between groups. For all the analyses, $P \leq 0.05$ was deemed statistically significant.

RESULTS

Demographic variables

The age of the subjects ranged from 25 to 60 years, with a mean age of 52 in the CAS group and 47.50 in the OD group [Table 1]. The study groups comprised 11 males and 9 females, constituting 55% and 45% of the total participants [Table 2]. All implants were clinically and radiographically stable till the end of the study. A total of 7 implants were placed in the premolar region, and 13 implants were placed in the molar region [Table 2].

Implant stability

The mean implant stability quotient (ISQ) values increased from 72.20 ± 4.56 to 75.50 ± 3.65 in the CAS group at 3 months which was statistically not significant ($P = 0.09$). Similarly, in the OD group, the mean ISQ values increased from 77.60 ± 2.11 to 79.30 ± 2.94 at 3 months which was also not significant statistically ($P = 0.15$). Intergroup comparisons immediately following implant placement and 3 months were found to be significantly greater for the OD group ($P = 0.005$, $P = 0.008$) [Table 3].

Crestal bone loss

Intragroup comparison of mean CBL on the mesial and distal sides in the CAS group from 3 to 12 months was highly statistically significant ($P = 0.001$) with a mean difference of 0.45 mm. The mean CBL observed in the OD group was 0.11 ± 0.18, 0.40 ± 0.23 and 0.68 ± 0.37 on the mesial side and 0.13 ± 0.17 mm, 0.49 ± 0.21 mm, 0.75 ± 0.20 mm on the distal side at 3, 6, and 12 months, respectively, which is significant ($P < 0.001$) [Table 3 and Figures 6a-c, 7a-c].

Intergroup comparison of CBL on the mesial side at 3 and 6 months between the CAS group and OD group showed a significant difference ($P = 0.02$, 0.02), with the CAS group showing more CBL. At 12 months, the mean difference was insignificant ($P = 0.47$). Similarly, intergroup comparison of CBL on the distal side at 3 and 6 months between the CAS group and OD group also showed statistically significant variation ($P = 0.05$, 0.03, respectively) with greater

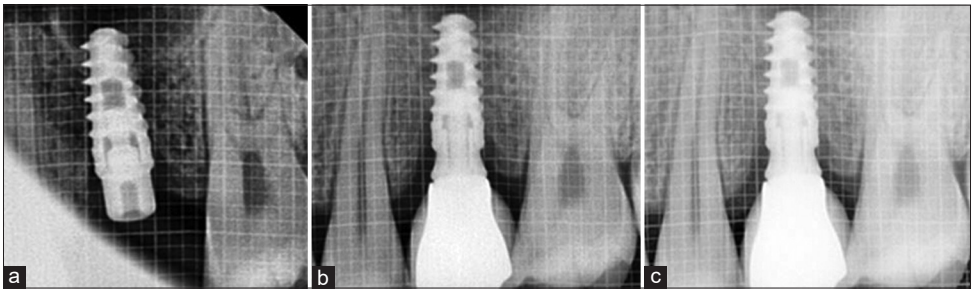

Figure 4: Crestal approach sinus group radiographs at (a) 3 months, (b) 6 months and (c) 12 months after implant placement.

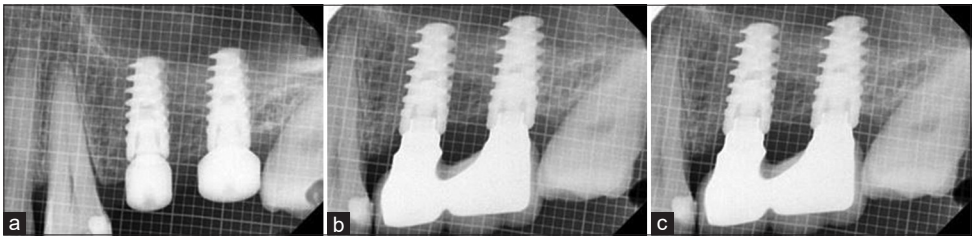

Figure 5: Osseodensification group radiographs at (a) 3 months, (b) 6 months and (c) 12 months after implant placement.

CBL in the CAS group. At 12 months, the mean values were statistically insignificant ($P = 0.24$) [Table 4].

Apical bone gain

The mean RBH in the CAS group on the mesial side was 6.99 mm, and on the distal side, 6.09 mm. Intragroup comparison in the CAS group showed statistically significant ($P < 0.001$) ABG at the end of 12 months [Table 3 and Figures 6d-f, 7d-f]. The mean RBH in the OD group on mesial and distal sides were 6.45 and 6.11 mm respectively. Intragroup comparison of ABG in the OD group showed a mean increase with statistical significance ($P < 0.001$) [Table 3].

Intergroup comparisons of ABG between the CAS and OD groups from baseline to 6 months and baseline to 12 months showed a statistically significant mean increase from baseline, with the OD group showing considerably greater ABG than the CAS group.($P = 0.003$, $P < 0.001$ respectively) [Table 4].

Surgery time and patient comfort

The average surgical time taken was 87.00 ± 15.49 min in the CAS group and 69.00 ± 20.24 min in the OD group with significantly less time in the OD group ($P = 0.03$) [Table 5]. Patients in both the

Table 1: Distribution of age in the study groups

Groups	Age, mean±SD	Mean difference	*P*
CAS group	52.00±9.96	4.50	0.33
OD group	47.50±10.22		

Unpaired *t*-test. SD: Standard deviation; CAS: Crestal approach sinus; OD: Osseodensification

Table 2: Distribution of males and females and implant sites in the study groups

Groups	Gender	
	Male	Female
CAS group	7 (70)	3 (30)
OD group	4 (40)	6 (60)
Total	11	9
Groups	**Distribution**	
	Premolars	Molars
CAS group	4	6
OD group	3	7
Total	7	13

CAS: Crestal approach sinus; OD: Osseodensification

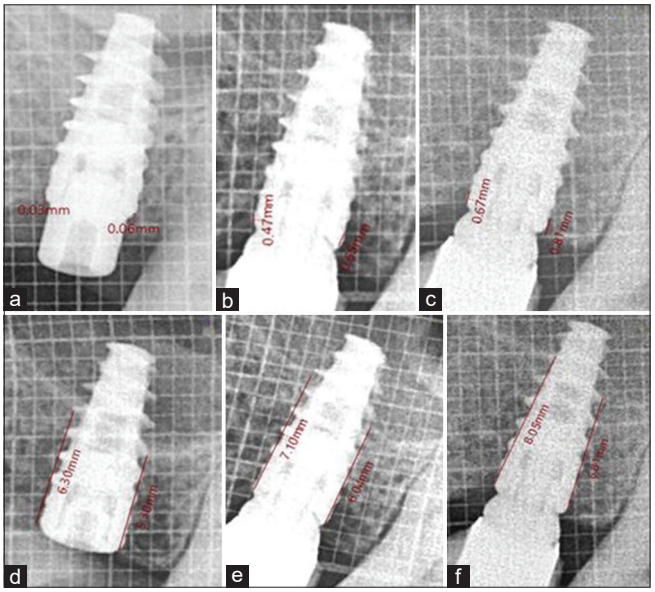

Figure 6: Crestal approach sinus Group-Crestal bone loss at (a) 3 months, (b) 6 months (c) 12 months, Apical bone gain at (d) 3 months, (e) 6 months (f) 12 months.

Table 3: Intragroup comparison of implant stability, crestal bone loss, and apical bone gain

Parameter	CAS group, mean±SD	*P*	OD group, mean±SD	*P*
ISQ				
Immediately after placement	72.20±4.56	0.09	77.60±2.11	0.15
3 months	75.50±3.65		79.30±2.94	
CBL				
Mesial (mm)				
3 months	0.32±0.17	<0.001**	0.11±0.18	<0.001**
6 months	0.62±0.13		0.40±0.23	
12 months	0.77±0.11		0.68±0.37	
Distal (mm)				
3 months	0.31±0.21	<0.001**	0.13±0.17	<0.001**
6 months	0.66±0.11		0.49±0.21	
12 months	0.85±0.14		0.75±0.20	
ABG				
Baseline-6 months	1.449±0.109	<0.001**	2.144±0.643	<0.001**
Baseline-12 months	2.819±0.415		4.164±0.293	

**Highly significant, ANOVA test. ABG: Apical bone gain, CBL: Crestal bone loss, ISQ: Implant stability quotient, SD: Standard deviation, CAS: Crestal approach sinus; OD: Osseodensification

study groups felt comfortable during the procedure, with a mean of 8.6 ± 0.51 in the CAS group and 8.5 ± 0.52 in the OD group, which is not statistically significant ($P = 0.67$) [Table 5].

DISCUSSION

The TISE in both CAS and OD groups was uneventful with no peri-operative or postoperative complications reported. After 1 year of follow-up, both groups showed good survival rates. In TISE without augmentation, the important determinant of implant success is achieving good primary stability. On intergroup comparison, the mean ISQ values are greater for the OD group immediately after implant placement than CAS group. The significantly better primary stability in the OD group is in accordance with the studies done by Elghobashy *et al*.[16] and Arafat and Elbaz[13] where the authors compared TISE using OD with osteotome sinus elevation. The mean ISQ values obtained by Elghobashy *et al*.[16] and Arafat and Elbaz[13] were 66.17, and 65.15, respectively, which were lesser than the present study. In the current study, implants of the standard dimension of 4.2 mm × 10 mm were used, whereas Elghobashy *et al*. used implants of varying lengths, i.e., 8–10 mm, based on the available RBH.[16,17] Furthermore, in our study, PRF was used as a grafting material before the insertion of implants in contrast to the other two studies, which were done without any graft material. The use of PRF in the current study could have contributed to the higher ISQ values in both groups, as stated by Öncü and Alaaddinoğlu.[18] Conventional osteotomy or other sinus elevation instruments use subtractive techniques to remove the autologous bone from the implant site. In contrast, OD results in bone compaction and, an increase in the implant-bone interface leading to improved primary stability and reduced micromovements, thus reducing the chances of implant failure.[19-21]

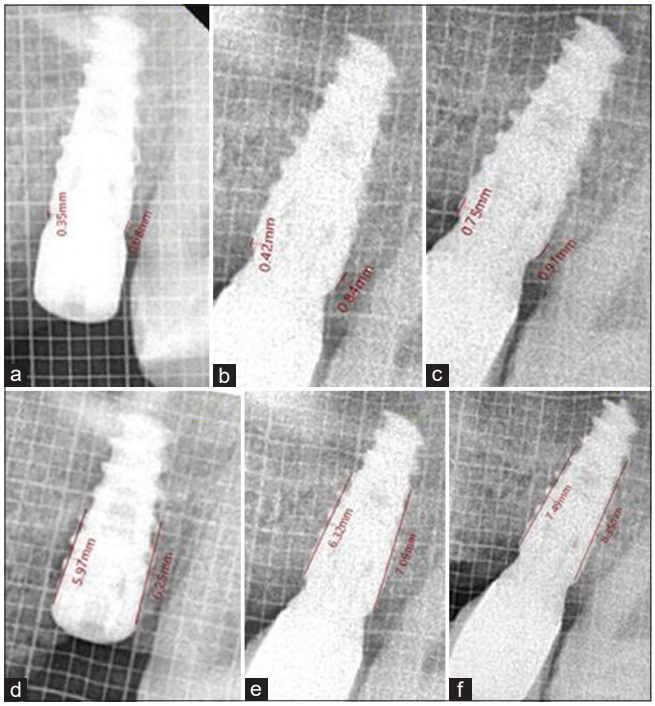

Figure 7: Osseodensification Group-Crestal bone loss at (a) 3 months, (b) 6 months, and (c) 12 months, Apical bone gain at (d) 3 months, (e) 6 months, and (f) 12 months.

At 3 months postoperatively, in both groups, mean ISQ values increased indicating an improvement in the bone-to-implant contact. The mean secondary stability values were considerably greater for the OD group. The results are in accordance with Arafat and Elbaz, (75.92 ± 2.94) and Hamdi and Hemd (71.8 ± 5.5), who have reported greater

Table 4: Intergroup comparison of implant stability, crestal bone loss, and apical bone gain

Parameter	Time interval	CAS group, mean±SD	OD group, mean±SD	*P*
ISQ	Immediately after placement	72.20±4.46	77.3±2.26	0.005*
	3 months	75.50±3.65	79.70±2.54	0.008**
CBL				
Mesial	3 months	0.32±0.17 mm	0.11±0.18 mm	0.02*
	6 months	0.62±0.13 mm	0.40±0.23 mm	0.02*
	12 months	0.77±0.11 mm	0.68±0.37 mm	0.47
Distal	3 months	0.31±0.21 mm	0.13±0.17 mm	0.05
	6 months	0.66±0.11 mm	0.49±0.21 mm	0.03*
	12 months	0.85±0.14 mm	0.75±0.20 mm	0.24
ABG				
Bseline-6 months		1.449±0.109 mm	2.144±0.643 mm	0.003**
Baseline-12 months		2.819±0.415 mm	4.164±0.293 mm	<0.001**

*Statistically significant; **Highly significant, ANOVA test. SD: Standard deviation; CAS: Crestal approach sinus; OD: Osseodensification; ABG: Apical bone gain; CBL: Crestal bone loss; ISQ: Implant stability quotient

Table 5: Intergroup comparison of surgical time and patient comfort

Parameter	CAS group, mean±SD	OD group, mean±SD	*P*
Surgical time	87.00±15.49 min	69.00±20.24 min	0.03*
Patient comfort	8.6±0.51	8.5±0.52	0.67

*Statistically significant, unpaired *t*-test. SD: Standard deviation; CAS: Crestal approach sinus; OD: Osseodensification

secondary stability in the OD group.[13,22] Along with the intact, well-organized trabecular pattern surrounding the implant, the spring-back effect and elastic recoil of the bone on the implant and bone surface increased its initial stability and improved secondary stability.[23] The bone particles in the walls of the osteotomy and in between the threads of the implant body could act as a bone growth initiator, which enhances secondary stability.[24] However, the intragroup comparison showed no significant improvement in the OD group in the present study which is similar to the values of Hamdi and Hemd, who showed no statistical improvement in the OD group from baseline.[22]

Rawat *et al*. reported a mean CBL of 0.43 mm at 3 months which increased to 0.60 mm at the end of 6 months, where they performed indirect sinus elevation using the osteotome technique and densahburs.[1] However, the results of the present study suggest comparatively less CBL in both groups; it might be because of the simplified surgical technique with subcrestal implant placement and the use of specialized drills in both groups. In a similar study by Mamidi *et al*., an indirect sinus lift procedure was performed using a CAS kit, and PIEZO drills stated a mean CBL of 0.52, 0.57, and 0.72 mm on the mesial side and 0.38, 0.44 and 0.78 mm on the distal side at 3, 6, 12 months respectively.[25] The results of the present study suggest that with the specialized drills, the amount of CBL could be reduced, favouring the OD group. Arafat and Elbaz, in a study, observed marginal bone loss after sinus elevation using osteotome and OD and observed greater CBL in the OD group (0.98 mm) compared to the osteotome group (0.93) with no statistical significance.[13] The present study showed a lesser bone loss in the OD group which could be due to the preservation of the bone bulk, compaction of cancellous bone caused by viscoelastic and plastic deformation as well as the autografting of bone fragments along the osteotomy.[23]

The present study showed the most significant ABG in the OD group which is in accordance with a study by Arafat and Elbaz, where he reported an ABG of 2.79 mm in the osteotome group and 3.33 mm in the OD group.[13] The rationale for using graft substitutes in conjunction with sinus elevation is to keep the sinus membrane as high as possible, improve IS, and act as a space maintainer. Endo-sinus bone formation was seen in both groups due to the inherent osteogenic potential of the sinus membrane and surrounding bony walls. The increased bone formation without using bone grafts can be attributed to the osteogenic potential of the sinus membrane, which has innate osteogenic cells and the apex of the implant acting as a tenting screw to hold the membrane in its elevated position.[5] The presence of collagen and bone bulk, along with autografted bone chips in the osteotomy walls and apical regions, act as nuclei for increased quantity and dense bone formation.[23] In sinus elevation procedures, the sinus membrane has inherent osteogenic potential and makes a significant contribution to bone regeneration.[5] The implant survival rate and new bone formation in nongrafted sinuses are comparable to grafted sinuses.[26] In TISE, more implant protrusion into the sinus raises the probability of sinus membrane perforation, especially in procedures without grafting materials. In the current study, though no bone grafts were used A-PRF was used as a membrane to cover and protect the sinus membrane simply and efficiently which also acts as a space maintainer and provides an adequate scaffold for bone regeneration.

Surgical time was less for the OD group (69.00 ± 20.24) compared to the CAS group (87.00 ± 15.49), which is statistically significant. A study by Ibrahim *et al*., reported a similar reduction in surgical time for the implants placed using Densah burs which is in accordance with the present study.[27] A study by Elsaid *et al*., showed lesser surgical time in the OD group.[28]

The mean patient comfort (VAS) scores obtained in the present study were 8.6, and 8.5 in the CAS and OD groups, respectively. In a study by Ibrahim *et al*., a considerable difference in patient comfort was seen in favor of the densah group.[27] In the present study, similar levels of patient comfort were observed in both groups, as both procedures were minimally invasive.

The current study showed that TISE and simultaneous implant placement using both the CAS and OD techniques are reliable, with good survival rates and can be used for implant placement in the atrophic

posterior maxilla. However, the OD group showed slightly improved clinical and radiographic outcomes, which need to be assessed further with long-term trials to evaluate the success of implants placed.

Limitations and prospects

In the present study, mean RBH in both groups was ≥6 mm. Further studies with less RBH could better evaluate the efficacy of the drills. Although good survival rates and clinical outcomes were obtained, a larger sample size and more extended follow-up periods are required to assess the definitive results of both interventions.

CONCLUSION

Both CAS kit and OD burs are effective in the safe elevation of the sinus membrane transcrestally with minimal or no complications. The results of the present study favor the OD group in terms of greater implant primary, secondary stability, and minimal CBL. ABG with reduced operating time compared to the CAS group. However, in both groups, patients were comfortable during the entire procedure.

Clinical relevance

TISE using the OD technique can be an effective and reliable alternative to conventional osteotomy preparation.

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Conflicts of interest

The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or non-financial in this article.

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