ISSN: 0975 -8542

Journal of Global Pharma Technology

Available Online at: www.jgpt.co.in

RESEARCH ARTICLE

The Efficacy of Hydraulic Pressure Sinus Lift VS osteotome Lift via Crestal Approach Utilizing Sinus Endoscopy (Randomized Clinical Study)

Aseel Hamid Madab*, Thair A.L. Hassan

University of Baghdad, Iraq.

***Corresponding Author: Aseel Hamid Madab**

Abstract

Rehabilitation of posterior maxilla is compromised by deficient residual bone height. Sinus lift procedure can be performed by either lateral or crestal approach. Crestal approach had many advantages in comparison with the lateral approach. Hydraulic pressure devices for sinus membrane elevation have demonstrated a low risk of sinus membrane perforation as well as ease of application. Endoscopic surgery has change the philosophy and practice of modern implant surgery in all aspects, it give rise to minimally invasive surgery procedures based on the ability to visualize sinus membrane perforation and to operate in an optimum manner. Assessing and evaluating the efficacy of osung sinus lift kit and the presence of maxillary sinus membrane perforation with the use of endoscopy, were the aim of this present study, thirty patients in rolled in this study with mean age of 46.86 years divided into 2 groups: group A (Osung) the hydraulic pressure technique and group B (osteotome) the conventional osteotome technique. For each patient, orthopantomography and cone beam computed tomography were recommended, an endoscope used intraoperatively in each case to assess the presence of shniedrian membrane perforation, 51.9% (27 cases) were managed by osung procedure for sinus lift, while 48.1% (25 cases) were managed by osteotome sinus lift, the perforation of sinus membrane occurred in (7.7%) in both groups. The use of endoscope is simple and quick for direct visualization of the Schneider membrane, maxillary sinus floor elevation using Osung water lift system kit is a predictable procedure with a low perforation rate.

Keywords: *Crestal approach, Endoscopy, Hydraulic pressure, Shniederian membrane perforation.*

Introduction

Implant placement has become a widespread dental procedure to restore the edentulous jaw with functional defects. However, in many cases, insufficient vertical bone height of the residual ridge and poor bone quality give rise to difficulties in implant placement in the maxillary posterior area. This is partially due to the rapid progression of alveolar bone resorption and pneumatization of the maxillary sinus after tooth extraction. To overcome such anatomical and physiological problems, a sinus lift procedure, was developed.

For maxillary sinus membrane elevation, either the lateral approach or the crestal approach is used depending on the bone height of the residual ridge, Kim et al. 2013 [1].When the crestal approach, which is known as the osteotome technique, was introduced first in 1977 by Tatum and published in 1986, [2], Summers In 1994 modified this technique suggesting the use of a specific set of osteotomes for preparing the implant site and elevating the sinus floor [3]. The crestal approach had the limelight among clinicians due to its many advantages in comparison with the lateral approach. Nonetheless, the crestal approach has several drawbacks, in that the osteotome technique depends heavily on the skill of the clinician and causes ringing in the head of the patient due to malting and maxillary sinus membrane perforation during malting.

Moreover, the osteotome technique gives rise to complications such as headache and vertigo after the sinus lift procedure [3].Various surgical procedures and devices have been developed to overcome the

shortcomings of the osteotome technique. Among these surgical procedures and devices, devices using (hydraulic pressure) for sinus membrane elevation have demonstrated a low risk of sinus membrane perforation as well as ease of application [4]. Moreover, endoscopy has changed the philosophy and practice of modern surgery, all types of maxillofacial surgery are now commonly done endoscopically [5], the introduction of the endoscope into dental implant procedures, particularly transalveolar sinus lifts, has made advances in implantation techniques possible [6].The transalveolar sinus lift used to involve a blind drilling and insertion procedure [7], but a technique to raise the sinus membrane during the operation under endoscopic control was introduced in the late 1990s [7].

Nahlieli et al. in 2011 [8] described the Modular Implant Endoscope, in working options, endoscopic observations, possibilities and highlighted its potential for the development of innovative endoscopic techniques for dental implant procedures. Kim et al. in 2008 [9] stated that the most common intraoperative complication seems to be *Schneiderian membrane* perforation, which occurs in it happens in 7-10% to 35%, while Pikos in 2008 [10] reported higher proportions of 10-50%.

Materials and Methods

This prospective observational randomized clinical study was conducted from December 2017 to December 2018 at the Department of Oral and Maxillofacial Surgery, College of Dentistry Teaching Hospital, University of Baghdad. This study was approved by the Ethical Committee of the College. A total of 30 patients aged 19-72 years (with mean age of 46.86), 5 males and 25 females who met the inclusion criteria were included in this study. Fifty two implants (52 cases) were placed simultaneously in 30 patients.

Cases were divided into two groups according to crestal approach sinus lift procedure utilized; Group A using hydraulic pressure (Osung) kit including 27 cases and Group B performed by Osteotome kit including 25 cases utilizing sinus endoscopy for both groups to assess the presence of any perforation. Furthermore, sinus augmentation with dental implant placement completed with the use of NucleOss dental implant and Osteon Ⅱ collagen (ß-tri calcium phosphate) as augmentation material and barrier membrane.

Eligibility Criteria:

- Good general health without any disease that compromising bone healing potential as heavy smoking, hyperparathyroidism, fibrous dysplasia, etc.
- Patient age range from 19-72 years of both genders.
- Partially or completely edentulous maxilla with delayed implant placement protocol.
- Adequate subantral bone height to ensure primary stability for the placement of implants between 3-7 mm (single stage surgery for sinus augmentation).

Exclusion Criteria:

- Any medical conditions that could interfere with normal healing or inability to withstand surgery including current pregnancy at the time of the surgical procedure.
- Presence of acute/chronic infection or local pathological conditions in the implant zone.
- Patients with clinical or radiological evidence of rhinosinusitis and/or anatomical elements that preclude SL mainly underwood septa of more than 4 mm and membrane thickening more than 6 mm.
- Patients required a sinus elevation that necessitates two-stage approach (SAD < 3 mm).
- Patients with previous history of vertigo (for group B).
- Parafunctional habits such as severe bruxism and clenching.

Patient's Preparation & Surgical Procedure:

Preoperative OPG was taken as a standard radiograph for documentation. CBCT (Carestream CS 8100 3D Health Inc., France) was essential for sinus lift procedure in order to provide a roadmap for assessment of the available alveolar bone height, width of the planned implant site, condition of the maxillary sinus, presence of antral septa, ostium patency, other pathologies, type and degree of sinus pneumatization, and the

thickness of *Schneiderian membrane*. The overall treatment plan was formulated accordingly. Surgery was done by using topical spray anesthesia of (Lidocaine 10%), anaesthetization of the planned surgical field with Lidocaine 2% (Septodent), three sided flap (extensive or limited flap design) was made initiating via paracrestal incision with palatal bias, full thickness mucoperiosteal flap reflection to expose crestal and buccal alveolar bone.

For group A (OCA KIT):

Procedures had been accomplished via the OCA-kit, after measuring the subantral distance accurately by means of CBCT, (Fig. 1).

Figure 1: OCA-kit with drills & stoppers (Osung, Co., Germany)

Starting with the use of pilot drill ⌀ 2.0 mm, which is the kit first drill set at 600-800 (rpm) and torque of 35 N/cm to precisely locate the preparation site, then turned to the first drill of cannon drills group which is ⌀ 2.4 mm with the stopper of 1 mm shorter than (SAD) performing drilling to the full stopper length. The next step is the use of the second cannon drill A.I ⌀ 2.8 mm which is a spring loaded drill with a stopper that is 1 mm more than the SAD, (Fig. 2).

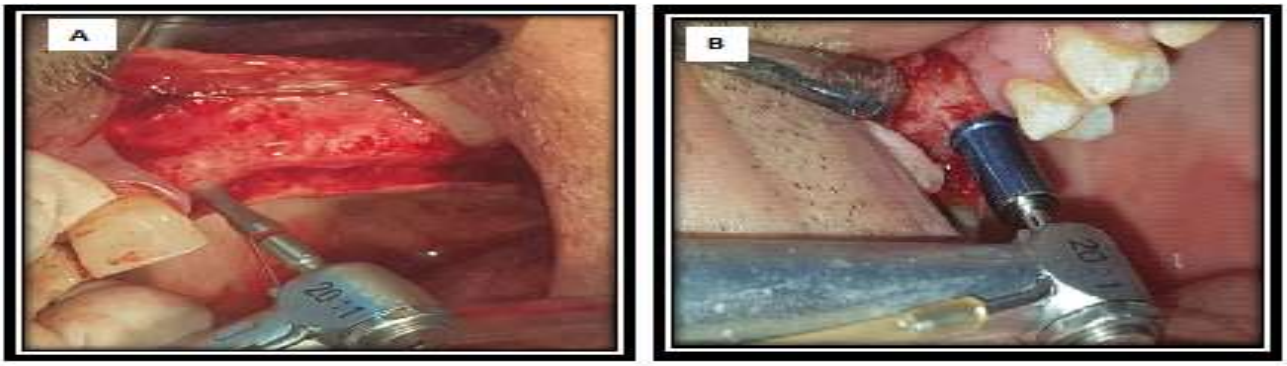

Figure 2: (A) OKA kit pilot drill, (B) Cannon drill (⌀ 3.2 mm) and stopper was initiated at osteotomy site verifying proposed implant site

Subsequently, turning to the final cannon drill A.I (⌀ 3.2 mm) with stopper of 1mm longer than SAD to continue the preparation until auto stop occurs, this means that the sinus inferior board has opened with no feeling of the spring action with the sensor gauge, (Fig.3).

Figure 3: (A) Illustrating the use of sensor gauge to insure sinus floor opening, (B) Showing final cannon drill A.I with stopper

For *Schniedrian membrane* elevation, the next step in the procedure was accomplished by Aqua taps proceeding by choosing (ø 3.5 mm) aqua tap, a stopper used with the same length of SAD is attached to the aqua tap then assembled to its engine adapter and applied to the engine hand piece that preset on slow speed (35 rpm, 35 N/cm), (Fig.4).

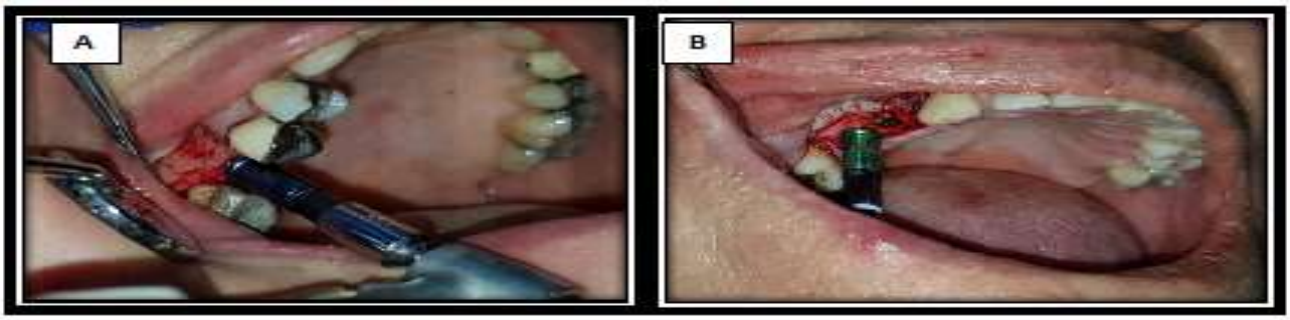

Figure 4: (A) & (B) Insertion of final aqua tap assembled with the specific stopper and adaptor in order to perform the aqua lift of the sinus membrane

Detaching the adapter along with the hand piece from the aqua tap and connecting the plastic tube to the bottom of the aqua tap while the second free end of the tube is connected to the plastic syringe filled with 5 cc normal saline which itself loaded and locked by aqua syringe. Injection technique is gradually done by boosting normal saline through the tube and the inner aqua tap canal toward the sinus membrane is done by pressing on the aqua syringe handle.

After sinus membrane lifting is done by the OCA-kit, the prepared socket is completed by the Nucleoss dental surgical kit drills to the desired implant dimensions.

For Group B

Utilizing NucleOss surgical kit, starting with pilot drill to the predetermined height (1 mm below sinus floor) followed by sequential drilling maneuver, proceeding with larger drills until reaching the requested final drill diameter, then a greenstick fracture of sinus floor with ø 3.4 mm osteotome or ø 3.8 mm with gentle and controlled firm tapping by surgical mallet while asking the assistant to support patient's head.

Careful attention paid in this step as tactile sense and voice resonance (of prime importance) will be changed indicating entrance into sinus membrane space as further tapping would perforate sinus membrane. Checking the patency of *schneiderian membrane* for the presence of any perforation is the next step in the procedure for both groups and it is implemented by means of endoscope, (Fig. 5).

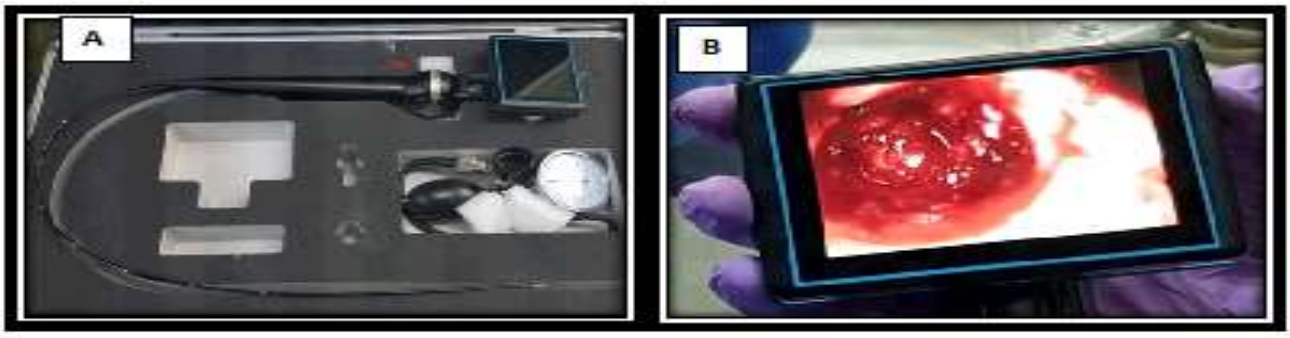

Figure 5: (A) Endoscopic parts assembled together, (B) Endoscopic monitor turned on displaying implant bed and membrane with clarity

After the reverberation of the fluid into the oral cavity, drying up the socket hole with cotton swab in order not pervert the lens and affect its resolution, endoscopic lens introduced into the socket or at the edge of the drill hole (implant load) (parascope) was utilized depending on SAD, for observing and illustrating the membrane, asking the patient to take deep respiration to watch the membrane movement upon inspiration if there is any perforation to be detected or, however the perforation may be obvious once viewed by the endoscope, capturing photos and registering videos for documentation, (Fig. 6).

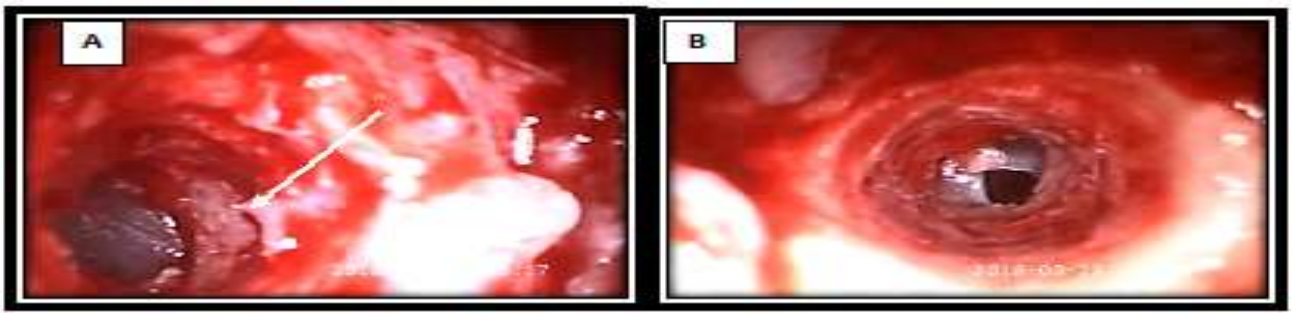

Figure 6: (A) Intact Schneider membrane with grayish bluish hue, (B) Perforated *schneiderian membrane* clearly viewed by an endoscope

In both groups barrier membrane placed, non-autogenous bone graft material (osteon II) injected incrementally by the syringe and loaded with bone carriers of OCA-kit and introduced into the SMS with the aid of bone condenser or osteotome, the predetermined DI size installed in its position, finally, wound closure is achieved with 3/0 black silk non absorbable suture (simple interrupted technique). The patients were given medications including cefixime trihydrate 400 mg tab orally once/day for 5 days, metronidazole 500 mg tab orally three times/day for 7 days, phenylephrine 0.5% nasal drops 2-3 drops every 6 hours for 4 days, Panadol extra (Caffiene 65 mg+ Paracetamol 500 mg) tabs on need.

Results

Thirty consecutive patients (52 cases) with mean age of 46.86 years undergone transalveolar sinus lift surgery and received 52 sinusal implants. In this study, 51.9% of cases (27) were managed by osung procedure for sinus lift and 48.1% of cases (25) were managed by osteotome procedure, (Table 1).

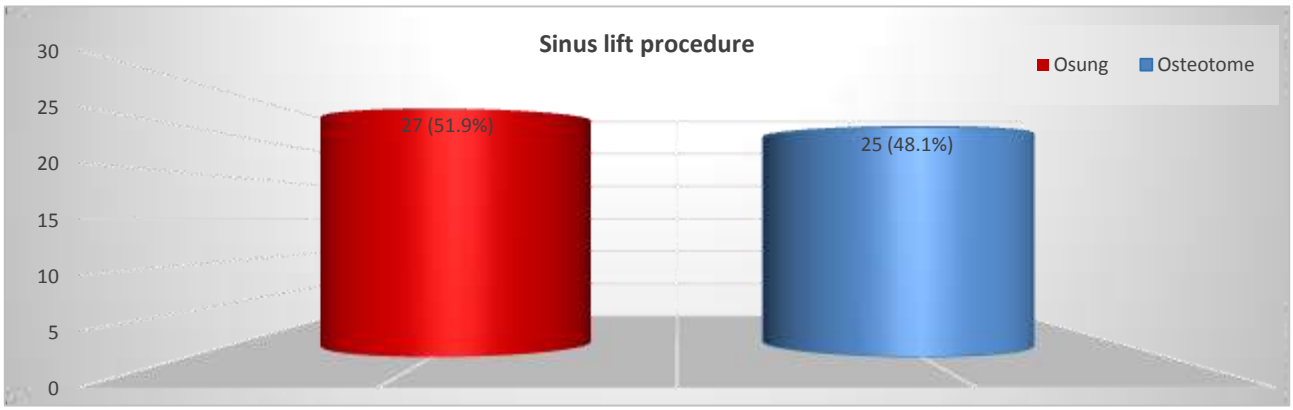

Table 1: Distribution of study patients by type of sinus lifts procedure

Regarding the perforation of sinus membrane, it occurred 7,7% in both groups 3,7% of cases managed by osung procedure, while it occurred in 12 % of cases managed by osteotome procedure, but this difference was statistically not significant (P= 0.22), Table 2.

Table 2: Comparison between SL procedures by perforation of sinus membrane

Perforation of sinus membrane	SL Procedure		Total 52 (%)	P- value
	Group A (Osung) 27	Group B (Osteotome) 25		
yes	1 (3.7)	3 (12.0)	4 (7.7)	0.22
no	26 (96.3)	22 (88.0)	48 (92.3)	

About the association between perforation of sinus membrane as a complication and general characteristics of study patients, it has been noticed that there was no statistical significant association ($P \geq 0.05$) between perforation of sinus membrane with both age and gender (Table 3).

Table 3: Association between perforation of sinus membrane and general characteristics

Variable	Perforation of sinus membrane		Total 30 (%)	P- Value
	yes 4 (%)	no 26 (%)		
Age (Years)				
≤ 29	0 (0)	4 (100.0)	4 (13.3)	0.867
30 - 44	z1 (14.3)	6 (85.7)	7 (23.3)	
45 - 59	2 (15.4)	11 (84.6)	13 (43.4)	
≥ 60	1 (16.7)	5 (83.3)	6 (20.0)	
Gender				
Male	0 (0.0)	5 (100.0)	5 (16.7)	0.462
Female	4 (16.0)	21 (84.0)	25 (83.3)	

Discussion

In this research the distribution of study patients by type of sinus lift procedure utilized 51.9% (27 cases) were managed by osung procedure and 48.1% (25 cases) by the standard osteotome technique. For Osung technique, it has been noticed that the procedure is less invasive than osteotome SL with the use of intelligent drills.

The kit is quite easy to be used with sequential drilling procedure and large No. of stoppers with the final drill is quite safe in which the drilling procedure is concentrated on the peripheries (sides) of the implant bed (socket hole) with flat top surface providing a safe fracture and elevation of the sinus floor.

One important point to note is that the operator worked according to the kit instructions in the first case with the use of depth gauge to check for completion of sinus floor elevation, however, the case of perforation occurred in the 1st case with the use of osung SL, there were 2 possibilities:

- Imperfect use of the flexible (compressible) depth gauge (lack of safety).
- The use of the final drill (Cannon drill ⌀ 3.2 mm) with 2 mm difference from the previous drill (Cannon drill ⌀ 2.8 mm) which may induce this complication.

As a result of that, the operator decided to use the stoppers gradually for every 1 mm, and hence no perforation occurred in the remaining 14 cases, with the use of hard depth gauge rather than and flexible one. For sinus membrane hydraulic elevation, it was better with the use of aqua taps with osung kit since it can reach as near as possible to the membrane to ensure adequate elevation (owing to the presence of 3 holes in the apical end of the aqua tap) with the use of OCA-syringe, and this is supported by Chen & Cha in 2005 [11] who stated that the elevation of the *Schneiderian membrane* using the water infiltration system can be explained by Pascal's principle which states 'a change in the pressure of an enclosed incompressible fluid is conveyed undiminished to every part of the fluid and to the surfaces of its container'.

The use of an equal liquid pressure in every point of the *Schneiderian membrane* can reduce the stress applied to the membrane's surface which results in less risk of perforation. Regarding perforation of sinus membrane, Pikos in 2008 [10] stated that *Schneiderian membrane* perforation has been reported as the most common complication of sinus lift augmentation, with a prevalence from 10-55%, also Zheng et al [6].

Said that perforation is the most common intraoperative complication and it has been reported in (7-35%). In the present study, perforation of sinus membrane occurred in 12% of cases managed by osteotome procedure, while it occurred in 3.7% of cases dealt with osung SL, the total percentage was (7.7 %), however, this difference was statistically not significant (P= 0.22), and this is may be due to that the whole procedures were performed by an expert surgeon who had performed about 200 SL surgeries.

The use of an endoscope helps the sinus lift to overcome the shortcomings of the blind technique and achieve a safe and effective procedure [5, 8]. The main advantage is that it is introduced through the same surgical field with no need for another approach through the nasal cavity being less invasive, quick and flexible.

The endoscopic examination in this study revealed 4 cases of sinus membrane perforation (7.7%), with the remaining cases were intact (92.3%), these figures represent the lowest when compared with the repeated literature [10] (10-55%) and with Zheng et al [6] (7-35%), this is in spite of that the later

studies didn't utilize endoscopy for registration of the complication that MS it may be even more with the use of such precise diagnostic tool.

Conclusion

The use of endoscope is simple, easy, and quick for direct visualization of the Schneider membrane, also facilitated proper application of barrier membrane and non-autogenous bone graft material. The results from this study demonstrated that maxillary sinus floor elevation using osung water lift system kit via the crestal approach is a predictable procedure with a low perforation rate as compared with osteotome technique and demonstrated the lowest percentage of sinus membrane perforation in regards with previous studies in the literature [12, 13].

References

1. Kim YK, Cho YS, Yun PY (2013) Assessment of dentists' subjective satisfaction with a newly developed device for maxillary sinus membrane elevation by the crestal approach. Journal of periodontal & implant science, 1: 43(6):308-14.
2. Tatum JH (1986) Maxillary and sinus implant reconstructions. Dental Clinics of North America, 30(2):207-29.
3. Summers RB (1994) A new concept in maxillary implant surgery: the osteotome technique. Compendium (Newtown, Pa.). 15(2): 152-4.
4. Davarpanah M, Martinez H, Tecucianu JF, Hage G, Lazzara R (2001) The modified osteotome technique. International Journal of Periodontics & Restorative Dentistry, 1: 21(6).
5. Pedroletti F, Johnson BS, McCain JP (2010) Endoscopic techniques in oral and maxillofacial surgery. Oral and Maxillofacial Surgery Clinics, 1: 22(1):169-82.
6. Zheng J, Zhang S, Lu E, Yang C, Zhang W, Zhao J (2014) Endoscopic lift of the maxillary sinus floor in beagles. British Journal of Oral and Maxillofacial Surgery, 1: 52(9):845-9.
7. Wiltfang J, Schultze-Mosgau S, Merten HA, Kessler P, Ludwig A, Engelke W (2000) Endoscopic and ultrasonographic evaluation of the maxillary sinus after combined sinus floor augmentation and implant insertion. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology, 1: 89(3): 288-91.
8. Nahlieli O, Moshonov J, Zagury A, Michaeli E, Casap N (2011) Endoscopic approach to dental implantology. Journal of Oral and Maxillofacial Surgery, 1: 69(1):186-91
9. Kim YK, Choe GY, Yun PY (2008) Management of perforated sinus membrane using absorbable haemostat and fibrin adhesive for sinus lift procedure. Asian Journal of Oral and Maxillofacial Surgery, 1: 20(3):129-34.
10. Pikos MA (2008) Maxillary sinus membrane repair: update on technique for large and complete perforations. Implant dentistry, 1: 17(1):24-31.
11. Chen L, Cha J (2005) An 8-year retrospective study: 1,100 patients receiving 1,557 implants using the minimally invasive hydraulic sinus condensing technique. Journal of Periodontology, 1: 76(3):482-91.
12. Kim DY, Itoh Y, Kang TH (2012) Evaluation of the Effectiveness of a Water Lift System in the Sinus Membrane-Lifting Operation as a Sinus Surgical Instrument. Clinical implant dentistry and related research, 14(4):585-94.
13. Grunenberg M, Gerlach KL (1990) Clinical, radiographic and endoscopic evaluation of the maxillary sinus after maxillary osteotomy. Deutsche Zeitschrift fur Mund-, Kiefer-und Gesichts-Chirurgie, 14 (3): 202-5.

