Surgical Removal of Dental Implants Displaced into the Maxillary Sinus

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SUMMARY
The accidental displacement of roots, endodontic materials and dental implants into the maxillary sinus are relatively common complications in dental clinical practice. The purpose of this study is to present four cases of displaced dental implant into maxillary sinus, their treatment as well as the prevention of this condition. There are three different major approaches to remove materials displaced into the maxillary sinus: suction from the socket of an extracted tooth, the classical open surgery via the canine fossa and endoscopic approach. A relevant improvement of surgical techniques previous to, or in association with, the placement of implants in the posterior maxilla, has tremendously expanded the possibilities and indications for such treatments. To decrease the risk for developing side effects, it is recommended that sinus augmentation procedures should be performed before inserting implants in a resorbed upper jaw where sinus penetration is unavoidable. As implant displacement in the paranasal sinuses may be followed by infectious complications, an immediate or early removal of the displaced implants is indicated.

Keywords: dental implant; foreign body; maxillary sinus; migration

INTRODUCTION
The accidental displacement of roots, endodontic materials, and dental implants into the maxillary sinus is a relatively common complication in dental clinical practice [1]. Migration of implants into the maxillary sinuses (during surgery or after a period of function) has been reported [2–9]. Displacement of implants in the sphenoid [10] and ethmoid sinuses [11] has also been described in the literature.

As implant displacement in the paranasal sinuses may be followed by infectious complications [12–15], an immediate or early removal of the displaced implants is indicated. That procedure can be performed either through the implant site, or by creating a window in the anterior/lateral wall of the maxillary sinus (if the implant is displaced in the maxillary sinus) [3, 5, 16], or by means of an endoscopic nasal approach [6, 8, 9].

In this article we described four cases in which a dental implant, displaced into maxillary sinus, was removed by the posterior Caldwell-Luc approach. The integrity of the maxillary division of the trigeminal nerve was preserved in all patients and they had no complaints and testing showed no signs of nerve injury. There were no postoperative antrum-related complaints; the wounds healed completely, and there was no residual oroantral fistula.

CASE REPORT 1
A 31-year-old man visited his dental practitioner, and he received placement of two dental implants in the upper right molar region. After six months he returned to the dental office for the second stage. During the procedure of putting the healing screw, the implant was displaced and lost from view. A periapical radiography was made (Figure 1). The patient was referred to the Department of Oral and Maxillofacial Surgery. After thirty days a standard Caldwell-Luc surgical technique under local anesthesia was used to create a small osteotomy in the lateral antral wall in the region of the dislocated implant. The size of the opening was restricted but sufficient to allow passage of the implant. The implant and the cover screw were easily retrieved with a vascular forceps. A homogenous bone graft from a bone bank was performed after elevation of the Schneiderian membrane from the floor of the maxillary sinus, to a future placement of another dental implant (Figure 2).

Figure 1. Periapical radiography showing the dislocated dental implant in the maxillary sinus
Slika 1. Dentalni implantat u maksilarnom sinusu – periapikalni radiogram
CASE REPORT 2

A 81-year-old man was submitted to eight dental implants in the maxilla and another eight in the mandible, in order to obtain fixed superior and inferior metalloceramic prostheses. The implant was displaced and lost from view during the healing screw procedure (Figure 3). The implant was recovered after seven days by an oral and maxillofacial surgeon through a Caldwell-Luc approach (Figures 4 and 5).

CASE REPORT 3

A 47-year-old man had two dental implants inserted at the upper left maxillary region, after a good experience with other three dental implants. One implant was displaced and lost from view when he was eating, one week after the healing screw procedure (Figure 6). The implant was recovered through a Caldwell-Luc approach.

CASE REPORT 4

A 50-year-old woman had three dental implants inserted at the upper right maxillary region. She was using a total removable provisional prosthesis. After six months at the second stage, the dentist could not find the third implant. The implant possibly might be dislocated by the prosthesis (Figure 7). The implant was recovered through a Caldwell-Luc approach under local anesthesia.

DISCUSSION

Alveolar bone is a specialized part of mandibular and maxillary bone that forms the primary support for teeth. It is composed of bundles of bone, which is built up in layers in a parallel orientation to the coronal-apical direction of...
the tooth. The anterior maxillary bone is less dense than mandibular bone but denser than maxillary posterior bone [17]. Alveolar ridge defects and deformities can be the results of trauma, periodontal disease, surgical treatment or congenital maldevelopment. Resorption after tooth loss has been shown to follow a certain pattern: the labial site of alveolar crest is primarily resorbed, which first reduces its width and later the height [18-19]. Alveolar bone is resorbed after tooth extraction or avulsion most rapidly during the first years. The loss is estimated to be 40-60% during the first three years and decreases to 0.25-0.5% annual loss thereafter [20]. The causes for resorption of alveolar bone have been assumed to be disuse atrophy, decreased blood supply, localized inflammation or prosthesis pressure [20].

For conventional implant treatment in the maxilla it is recommended that at least 10 mm implants should be used and a maximal number of implants installed even when an overdenture is planned [21, 22]. The edentulous posterior maxilla generally provides a limited amount of bone volume owing to atrophy of the alveolar ridge and pneumatization of the maxillary sinus and thin cortical bone of very low density [3, 23, 24, 25]. Consequently, dental implant placement in the posterior maxilla can be complicated. Because such implants are usually inserted marginally to the floor of the maxillary sinus, this approach has a high risk of seating the implant into the maxillary sinus.

In general, it has been reported that extension of the implants into the maxillary sinus does not play a significant role in the implant outcome [26, 27]. It is known that slight sinus membrane perforation due to implant placement usually heals spontaneously [24, 26-30]. Brånemark et al. [26] reported that parts of implants introduced into the nasal or sinus cavity covered by normal mucoperiosteum did not have any side effects in the cavities. To decrease the risk for developing side effects, sinus mucous membrane lifting is recommended before inserting implants in a resorbed upper jaw where sinus penetration is unavoidable.

In the study of Jung et al. [31] on dogs, when implants penetrated the mucosa of the sinus floor less than 2 mm, spontaneous covering of the implants with the sinus mucosa occurred. On the other hand, when implants penetrated the mucosa on the sinus floor more than 4 mm, the apical parts of the implants extending into the sinus cavity were not covered with the growing antral membrane. Therefore, one might expect that implants protruding into the sinus cavity could act as foreign bodies and become a source of inflammation and sinusitis. However, no signs of pathologic findings were observed in this study in any of the maxillary sinus cavities in either the 4-mm or 8-mm sinus-penetrating implant sides. Debris accumulated on the exposed surfaces of the implants extending into the sinus cavity that were not covered with the antral membrane. The antral membrane around the implants did not show any sign of inflammation. This observation may be explained by the direct attachment of the membrane to the implants, forming a barrier to the sinus cavity.

In another study of Jung et al. [32], more than half of the implants showed mucosal thickening around the parts of the implants exposed to the sinus cavity. Interestingly, no symptoms of maxillary sinusitis were induced by the mucosal thickening in the follow-up period (6 to 10 months). That was probably because the swelling of the mucosal lining was limited to the floor of the sinus.

It has been reported that implant extension into the nasal cavity can give rise to rhinosinusitis [33]. The most likely explanation for that complication, as reported by Raghoebar et al. [33], is that altered nasal airflow could induce irritation of the nasal mucosa. In addition, nasal clearance could be disturbed by implant blockage of the mucociliary pathway, giving rise to inflammation [34, 35, 36]. It is possible that implant extension into the maxillary sinus cavity may alter the normal function of the maxillary sinus in the same way as in the nasal cavity [32]. Timmenga et al. [28] reported that the occurrence of postoperative sinusitis after bone grafting of the sinus floor is limited to patients with a predisposition for sinusitis. This implies that implant exposure to the sinus cavity might contribute to the development of maxillary sinusitis in patients with a predisposition for sinusitis because it may provoke mucosal thickening, which is likely to affect the osteomeatal complex [32].

Although it has been reported that oral implants migrated in the maxillary sinus may not determine any inflammatory/infectious reaction [4], generally foreign bodies in the paranasal sinuses should be removed because they may cause inflammation/sinusitis by interrupting mucociliary clearance [14, 15, 33]. There are three different major approaches to remove materials displaced into the maxillary sinus: suction from the socket of an extracted tooth, the classical open surgery via the canine fossa and endoscopic approach. Suction through the dental socket is the easiest procedure when a small root is displaced into the maxillary sinus during the course of extraction [37]. However, this blind procedure may lead to unsatisfactory results when the material is entrapped in the undercut of the sinus, and often leads to undesirable postoperative depression of the alveolar ridge due to the procedure of enlarging the socket for a suction tube. Another alternative procedure is the classical approach corresponding to the Caldwell-Luc procedure [37, 38]. However, this may lead to retraction of the soft tissues of the cheek and paraesthesia of the infraorbital nerve.
The Caldwell-Luc approach was the gold standard for access to the maxillary sinus for treatment of various problems, including retrieval of foreign bodies, until the development of functional endoscopic sinus surgery [38].

Parangelou [40] and Barrault [41] introduced the usefulness of endoscopic surgery, because sometimes problems in maxillary sinus did not necessitate cutting soft tissue and bone. Endoscopic removal is suggested to be a reliable procedure which provides superior visibility with a limited incision and respects the integrity of the sinus; consequently, the risk of infraorbital nerve damage is reduced [5, 6, 8, 9, 10, 41-48].

When planning endoscopic surgery for diseases in the maxillary sinus, the surgeon should choose one of two different approaches into the maxillary sinus; a transnasal approach through the inferior meata or a transoral approach via the canine fossa. The transnasal approach was described as inadequate to get access to dental materials dislocated to the bottom of the sinus because the acute angle from the inferior meata to the bottom of the sinus does not allow fibrescopic access to the object easily. Furthermore, even if the entrapment of the objects in the basket cage is achieved, it may not be easy to remove the object through the narrow and complicated pathway. On the other hand, although the transoral approach requires a small mucosal incision and an access-hole which is a little bigger than the diameter of the object, this approach provides easy access to the object located in the bottom of the sinus [5].

There are some disadvantages to this procedure. The first is that this procedure requires specific training and equipment. The next main disadvantage is that this procedure has a limitation of use when the object is large [5, 38]. Generally, the size of endoscopic retrieve basket is no larger than 20 mm [5]. In those cases, we can use a smaller Caldwell-Luc approach together with an endoscopic device, with decreased swelling, pain and bleeding. Over the long term, the resulting bone defect of the lateral antral wall will be smaller than with other methods, and there will be less expression of antral inflammation in the overlying soft tissues. Perhaps most important, this approach clearly decreases the inherent risk of damage to adjacent vital structures, particularly when retrieving a large, sharp foreign body from the maxillary antrum [38].

In the last few decades, a relevant improvement of surgical techniques previous to, or in association with, the placement of implants in the posterior maxilla, such as the use of short implants [49-53], placement of an intentional angulated implant to avoid the need for a sinus lift procedure [54] or sinus grafting procedures have tremendously expanded the possibilities and indications for such treatments [55-61].

Sinus augmentation procedures using a Caldwell-Luc approach have demonstrated a high success rate of alveolar bone regeneration beneath the sinus membrane [59]. It has been extensively utilized in the last 30 years to increase the dimensions of the posterior maxilla for implant placement (the study of Boyne and James [55] in 1980 was one of the first papers to describe the modern technique). This technique is based on the elevation of the Schneiderian membrane from the floor of the maxillary sinus and the introduction of a bone graft or a bone substitute. This procedure is technically demanding and involves many factors that might affect implant survival such as the type of graft used for augmentation, the surgical technique and the type of implants [62].

The indications for vertical ridge augmentation include situations where the remaining bone height is too small for proper anchorage of oral implants; unfavorable crown to implant ratios and unfavorable esthetic outcomes will result from the lack of remaining hard and soft tissues [63]. This can be done with the help of an e-PTFE membrane and particulated bone or with an en bloc augmentation with appositional bone grafts.

In the placement of an intentional angulated implant, the implants are positioned at a palatal axial inclination, between the inferior and medial wall of the maxillary sinus and the palatal cortex of the alveolar process. One advantage of this technique is that patients are more likely to accept overall treatment that avoids the need for a sinus lift. Besides, the 2-stage technique that is often employed lengthens treatment time by 6 to 12 months (the period needed for the bone graft to be incorporated). One disadvantage is that requires an angulated abutment and cemented crowns to correct the angulation of the implants [54].

Summers [64] has described a less invasive method of elevating the sinus floor by the osteotome technique, the so-called crestal approach. The crestal approach entails exposure of the alveolar ridge, followed by compression of bone with cylindrical instruments referred as osteotomes. Sequentially larger diameter osteotomes are used to displace the floor of the sinus in an apical direction. Bone graft material is then introduced into the floor of the sinus through the osteotomy site. Summers’ original bone graft material was composed of autogenous bone in combination with hydroxyapatite. Similar to conventional sinus lift surgery, this technique can be performed at the time of implant placement if there is a minimum of 3 to 4 mm of alveolar height.

This technique with osteotomes can also be done with alveolar widening. Osteotomes and chisels produce a greenstick fracture leaving the remaining periostuem attached to the bone. This periosteally pedicled buccal cortex is repositioned and a new implant bed is created without even drilling. The major benefit of crestal widening is that the thin alveolar bone can be utilized for implantation without grafting and the implants placed simultaneously with the bone expansion procedure. The bone can be flexed to some extent due to its elasticity [65]. The direction of forces by chisels should be aimed palatally to decrease the damage exerted on the fragile buccal plate. One of the problems is generally to assure precise positioning of implants according to prosthetic needs. Since the expansion is achieved by transposition of the buccal plate even more buccally, the implants may have a tendency to be inclined too much in the same direction [63].

The use of short implants may also be an alternative. A treatment option of short dental implants is of benefit to both the patient and the surgeon. For the patient, there...
is the avoidance of the surgical procedures of autogenous bone grafting and nerve transposition. Beside these additional procedures there are also negative sequelae of donor site morbidity for the bone graft and sensory alterations of the mental nerve for nerve transposition procedures. There is also a significant cost savings via obviation of the procedures and the benefits of decreased treatment time and less discomfort. For the surgeon, there is the benefit of placing a smaller implant in the confined space of the mouth and the ability to offer implant therapy to a patient population that had previously been denied [66].

Implants with length less than 10 mm have been associated with higher failure rates [67]. Other studies have claimed similar results when either shorter or longer implants were used [68-73]. It is well documented that the majority of the stress concentration is distributed at the level of the first few threads to the crestal cortical bone when an implant is loaded [74]. It has been suggested that the use of longer implants to provide a larger surface area for stress distribution may not necessarily be appropriate or advantage [75]. Once the minimum implant height is established for initial stability, width is more important than the additional length [74].

CONCLUSION

To decrease the risk for developing side effects, sinus augmentation procedure is recommended before inserting implants in a resorbed upper jaw where sinus penetration is unavoidable. Solution of each case requires customization and often combination of those techniques. As implant displacement in the paranasal sinuses may be followed by infectious complications, an immediate or early removal of the displaced implants is indicated. The first choice of treatment for removing the dental materials displaced into the maxillary sinus should be the technique that the surgeon is accustomed, in order to reduce complications. The Caldwell-Luc may be an “old-fashioned” technique, but it is a simple approach for those that do not have the endoscopic equipment and the specific training to manage it. But the best technique still is the prevention.

REFERENCES


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Uklanjanje implantata iz gornjoviličnog sinusus hirurškim putem

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KRATAK SADRŽAJ

Kako je dospevanje implantata u gornjovilični sinus vrlo često praćeno infekcijom [12-15], indikovano je njegovo rano uklanjanje iz sinususa. Da bi se uklonio, implantatu se može primijeniti da kroz hiruršku ranu ili pravljivom otvoru kroz prednju, odnosno bočnu stranu gornje vilice (ako je implantat u gornjoj vilici) [3, 5, 16] ili endoskopskim pristupom kroz nos [6, 8, 9].

U radu su predstavljena četiri slučaja gde su implantati dopeli u gornjovilični sinus i potom uklonjeni Koldvel-Likovim (Caldwell-Luc) pristupom sa zadnje strane gornje vilice. Integritet maksilarni grane trigeminalnog živca ni u jednom slučaju nije bio oštećen, a nijedan pacijent nije imao bilo kakve simptome koji bi ukazivali na njegovu povredu. Takođe, nije bilo postoperacionih tegoba vezanih za sam sinus, rana je dobro zarašla i nije bilo zaostale oroantralne fistule.

PRAKAZ PRVOG SLUČAJA

PRAKAZ DRUGOG SLUČAJA
Pacijentu starom 81 godinu ugrađeno je po osam zubnih implantata u gornjoj i donjoj vilici zbog protetičke rehabilitacije metalokeraškim mostovima. Implantat je pomerjen i izgubljen iz vida tokom postavljanja gornjeg dela (Slika 3). Nakon sedam dana Koldvel-Likovim pristupom implantat je vraćen na svoje mesto (Slike 4 i 5).

PRAKAZ TREĆEG SLUČAJA
Pacijentu starom 47 godina ugrađena su dva zubna implantata u regiji gornje vilice s leve strane posle uspešno postavljenost tri implantata. Jedan implantat je nestao iz vida tokom uzimanja hrane, a drugi dan posle postavljanja gornjeg dela implantata (Slika 6). Koldvel-Likovim pristupom implantat je vraćen na svoje mesto.

PRAKAZ ĆETVRTOG SLUČAJA
Pacijentkinji staroj 50 godina ugrađena su tri zubna implantata u regiji gornje vilice sa desne strane. Ona je koristila pokretnu protečnu vilicu. Šest meseci posle toga, u drugoj fazi, stomatolog nije mogao naći treći implantat. Implantat je najverovatnije bio pomerjen protekom (Slika 7). Koldvel-Likovim pristupom u lokalnoj anesteziji implantat je vraćen na svoje mesto.

DISKUZIJA
Alveolarna kost je poseban deo kosti donje i gornje vilice koji daje potporu zuba. Ona je sastavljena od snopova koji su organizovani u paraleline sveže krunično-apikalne orijentacije. Kost prednje dela gornje vilice je manje gustine od kosti donje vilice, a veće gustine od zadnjeg dela gornjovilične kosti [17]. Nedostaci i deformitete alveolarnog grebena mogu biti rezultat povrede, parodontalnog oboljenja, hirurškog lečenja ili kongenitalnog poremećaja u razvoju. Resorpacija nakon gubitka zuba dešava se na tipičan način: prvo se resorbuje spoljašnji deo alveolarnog grebena, što ima uticaja na svega na njegovu
širinu, a kasnije i na visinu [18, 19]. Alveolarna kost se resorbuje posle vađenja ili izbijanja zuba mnogo brže prvih godina. Procjenjeni gubitak je 40-60% tokom tri godine, a kasnije se smanjuje na 0,25-0,5% godišnje [20]. Smatra se da je uzrok re- sorpcije alveolarse kosti atrofija zbog neupotrebe, smanjenog dotoka krvi, lokalizovanog zapaljenja ili pritiska proteze [20].

U standardnoj terapii implantatima u regiji gornje vilice preporučuju se implantati duži od 10 mm, kao i maksimalan broj implantata u slučaju terapije supradentalnim protezama [21, 22]. Zadnji deo gornje vilice uglavnom ima ograničenu količinu kosti zbog atrofije alveolarnog grebena i postojanja gornjoviličnog sinus i tanke kortikalne kosti male gustine [3, 23, 24, 25]. Posledično, postavljanje implantata u zadnji deo gornje vilice može biti komplikovano. S obzirom na to da su se oni obično postavljaju blizu poda gornjoviličnog sinus, ovakav pristup vrlo lako može dovesti do postavljanja implantata u sinus.

Upošteno gledano, čak i ako je implant postavljen u gornjovilični sinus, to nema značaja na ishod lečenja [26, 27]. Poznato je da sitne perforacije sluzokožu sinus koje nastaju tokom postavljanja implantata spontano ozdravljuju [24, 26-30]. Branemark (Bränemark) i saradnici [26] su zapazili da su de-lovi implantata koji produr u nosu ili sinusu sluzinu obično pokriven normalnim mukoperiostom i ne izazivaju neželjene efekte u šupljinama. Da bi smanjili rizik od nastanka neželjenih efekata, preporučljivo je da se uradi podizanje sinus sluzokože pre postavljanja implantata u slučajevima resorbovane gornje vilice, gde je prodir u sinus neizbežan.

Dung (Jung) i saradnici [31] su urađivaju na psam impulsive da, kada implanti postavljaju u sinus sluzokoža sinus manje od 2 mm, nastaje spontano pokrivanje implantata sluzokožom. S druge strane, kada implanti postavljaju više od 4 mm, apikalni deo implantata se ne pokriva sluzokožom sinus. Zbog toga se može očekivati da će implanti u gornjoviličnom sinusu delovati kao strano telo i izazivati upalu i sinusitiz. Ipak, nije bilo patoloških znakova u studiji ni kod jednog od gornjoviličnih sinus u procesu implantata bilo 4 mm ili 8 mm. Na izloženim stranama implantata koji nije bio pokriven sluzokožom nalazio se debris. Sluzokoža sinus oko implantata nije pokazivala nijedan znak upale, što se može objasniti direktom vezom sluzokože sinus za implantat, kojim se stvara prepreka ka sinusnoj šupljini.


Ustanovljeno je da protruzija implantata u nosnu šupljinu može izazvati rinosinusitiz, te upalu nosne i sinusne šupljine [33]. Najverovatnije objašnjenje za ovu komplikaciju, kako su objašnili Ragheber (Raghoerub) i saradnici [33], može biti pomećen tok vazduha u nos koji je mogao izazvati irritaciju sluzokože. Takođe, normalno čišćenje nosne sluzokože bi moglo biti ometeno blokadom mukociliarnog puta implantatom, što pojačava upalu [34, 35, 36]. Moguće je da protrudanje implantata u gornjovilični sinus može ometati normalnu funkciju sinusa na sličan način kao i u nosnoj šupljini [32]. Timenga (Tim-menga) i saradnici [28] su zabeležili da se postoperacioni sinusitis nakon uzimanja dela kosti s poda sinusa događa kod pacijenata s predispozicijom za takve upale. To znači da izloženost implantata sinusnoj šupljini može izazvati upalu kod tih pacijenata zbog zadebljavanja sluzokože, koja remeti osteomukozni kompleks [32].

Iako je poznato da implanti koji su migrirali u gornjovilični sinus ne mogu odrediti direktno upalni proces [4], strana tela u paranasalnim šupljinama ipak treba ukloniti jer mogu izazvati upalu ili sinusitis ometajući mukociliarne kretanjine [14, 15, 33]. Da bi se materijal uklonio iz gornjoviličnog sinus, postoje tri glavna pristupa: kroz hiruršku ranu izvađenog zuba, pravljenjem otvora kroz očnjaku jamu ili endoskopskim pristupom. Pritisk kroz zubnu čašicu je najlakši kada je mali koren zuba prošao u gornjovilični sinus tokom vađenja zuba [37]. Ipak, rezultat primene ovog postupka može biti neizvestan kad je materijal zarobljen u želu sinusa i obično vodi postoperacionom smanjenju alveolarnog grebena tokom procedure povećanja zubne čašice, da bi prošla tuba za sukci. Drugi postupak je klasičan pristup po Koldwel-Liku [37, 38]. Ipak, on može dovesti do retrakcije mekih tkiva obrasce i parestizije infraorba- tinalnog nerva [39]. Koldwel-Liko pristup je bila metoda izbora za pristupanje gornjoviličnom sinusu tokom različitih terapijskih procedura, uključujući uklanjanje stranih tela, dok nije razvijena endoskopska hirurgija [38].

Parangelu (Parangolou) [40] i Barott (Barroult) [41] su uveli u praksu endoskopsku hirurgiju, zato što neka obojenja gornjoviličnog sinusu nisu iziskivala obavezno odsecanje mekih tkiva i kosti. Endoskopski pristup se preporučuje zbog toga što pruža mogućnost dobre preglednosti uz minimalnu inciziju i čuvanje integriteta sinusa, što posledično smanjuje rizik od oštećenja infraorPostalnog nerva [5, 6, 8, 9, 10, 41-48].

Tokom donošenja plana za endoskopsko lečenje obojenja gornjoviličnog sinus, hirurg može odabrati dva različita pristupa gornjoviličnom sinusu: pristup kroz nos, kroz donji nosni hodnik, i pristup kroz usta, kroz očnjaku jamu. Pritisk kroz nos se označen kao neadekvatan da bi se pristupilo materijalima koji su u dnu sinusu zbog oštrog uglja od donjeg nosnog hodnika do poda sinusa, koji se dozvoljava instrumentima da dosegne objekat s lakoćom. Čak i ako se postupak uhvati, biće ga teško izvući kroz uzač i komplikovani prolaz. S druge strane, iako pristup kroz nos i donju dužinu zahteva malo zasecanje sluzokože i pravljenje otvora malo većeg od predmeta, on omogućava lako dosezanje do objekta koji se nalazi na dnu sinusne šupljine [5].


Poslednje dve decenije unapređenje hirurških tehnika pre tokom postavljanja implantata u zadnji deo gornje vilice, kao npr. kratkih implantata [49-53], kao i postavljanje implantata pod uglom da bi se izboljalo podizanje sluzokože sinus [54] ili nadoknada dela sinus, značajno je povećalo mogućnosti i in- dikacije za ovakve intervencije [55-61].