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## Modified maxillary vestibular approach with subperiosteal intranasal dissection for surgical extractions of mesiodentes impacted in the floor of the nasal cavity

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### ABSTRACT

**Introduction:** Impacted mesiodentes in the inverted position may interfere with the base of the nasal cavity or the nasal septum. They can rarely erupt into the nose as well. Traditionally they are extracted via intraoral approaches (transpalatal or vestibular). Also, an endoscopically assisted transnasal approach can be used. In this paper, the authors are the first to present a group of patients suffering from impacted mesiodentes who have been surgically treated using a modified maxillary vestibular approach with subperiosteal intranasal dissection.

**Material and Method:** The prospective study was completed in the time period 12/2013–6/2017. The inclusion criteria were: 1. Mesiodens impacted in the inverted position extending to the base of the nasal cavity or into the nasal septum without concomitant pathological lesion and without eruption into the nasal cavity. 2. Localization of the mesiodens at the level of or dorsally to the roots of the upper middle incisors in the sagittal plane or ventrally to the roots of these teeth, but with the crown extending significantly posteriorly to the base of the nasal cavity. 3. Indication for extraction because of clinical or orthodontic reasons.

**Results:** In total, 9 patients were enrolled into the group. In these patients, surgical extractions of 9 mesiodentes were performed using the alternative approach described above. All extractions were done according to a uniform surgical protocol. The mean age of the patients was  $11.7 \pm 3.1$  years (age range 7–17 years). The crown's most cranial point exceeded the bone of the nasal cavity on average by  $2.0 \pm 1.4$  mm (in the range 0–5 mm). 8 mesiodentes were conical, 1 was tuberculate. Surgical procedure and postoperative healing were always without any complications.

**Conclusion:** For the removal of midline supernumerary teeth, the modified maxillary vestibular approach with subperiosteal intranasal dissection in comparison to the intraoral palatal approach provides less postoperative morbidity and a lower risk of complications (smaller surgical wound, minimal exposure of maxilla, minimal bone loss, reduced risk of damage to the roots of the upper incisors, lower risk of damage to the nasopalatine neurovascular bundle, good visibility in the surgical field, easier surgery, and finally no need of postoperative palatal splint). For oral and maxillofacial surgeons the presented technique represents a more traditional way of surgical tooth extraction than the endoscopically assisted transnasal approach.

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### 1. Introduction

Supernumerary teeth are defined as an excess number of teeth when compared with the normal dental formula. They may occur as single or multiple, impacted or erupted in various regions of both jaws. These teeth may have heterogenous forms. They can have normal size and shape or can be morphologically malformed.

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The most common type of supernumerary teeth are mesiodentes (up to 90 %) (Kumar et al., 2012). They are mostly localized in the premaxilla in the region of the upper middle incisors. The prevalence of mesiodentes in permanent dentition for the Caucasian general population has been reported between 0.15% and 3%. The male population is affected twice as much in comparison with the female population (Canoglu et al., 2009). In some syndromes, mesiodentes may be present as a part of the symptoms (Gardner syndrome, cleidocranial dysplasia and others). Mesiodentes can also be found in cleft disorders (Kumar et al., 2012; Canoglu et al., 2009). 75% of these teeth are impacted (usually palatally). The other mesiodentes are completely or partially erupted into the oral cavity (Kumar et al., 2012; Canoglu et al., 2009; Aoun and Nasseh, 2016).

In some cases the crown of impacted mesiodentes can be directed to the base of the nasal cavity (inverted position). These inverted mesiodentes are reported to occur between 9 and 67% according to different studies (Canoglu et al., 2009). Sometimes these teeth may interfere with the base of the nasal cavity or the nasal septum (Mohebbi et al., 2013). Mesiodentes can also rarely erupt into the nose. Mossaz et al. reports that mesiodentes are in contact with the cortical bone of the nasal base in 20.5 % of cases. In 49% of cases mesiodentes have close relation to the incisive canal (38.8% are in the close proximity to this canal, 8.2% interfere with the canal and 2% are impacted right inside the canal – in total 49% of cases) (Mossaz et al., 2014). Palatal cleft, dislocation of the developing tooth bud (because of cyst, trauma or inflammation), are also factors of predilection for intranasal teeth appearance (Al Dhafeeri et al., 2014; Krishnan et al., 2013; Kirmeier et al., 2009). These supernumerary teeth are usually asymptomatic. Various clinical symptoms might occur mostly as a result of the nasal teeth eruption. Usually the following complications are described: pain, epistaxis, nasal obstruction and congestion, rhinosinusitis, oronasal communication, nasal septal deviation and perforation, septal abscess or nasolacrimal duct obstruction (Al Dhafeeri et al., 2014; Krishnan et al., 2013; Kirmeier et al., 2009; Lee, 2006).

Surgical extractions of mesiodentes in the inverted position are usually done via the intraoral transpalatal approach. Sometimes the vestibular approach can be used as well, especially if the crown or root of mesiodentes is situated ventrally from the roots of the upper incisors. The endoscopically assisted transnasal approach is recommended to be used for extractions of supernumerary teeth that are erupted into the nasal cavity. Sometimes this method can be appropriate for extraction of mesiodentes situated right under the nasal mucosa (Sanei-Moghaddam et al., 2009; Clementini et al., 2012).

The authors present their own experience with the original alternative surgical approach – the modified maxillary vestibular approach with subperiosteal intranasal dissection. This is the first published group of patients to have been analyzed for accurate localization of supernumerary teeth. In all patients the uniform surgical protocol was used.

## 2. Material and methods

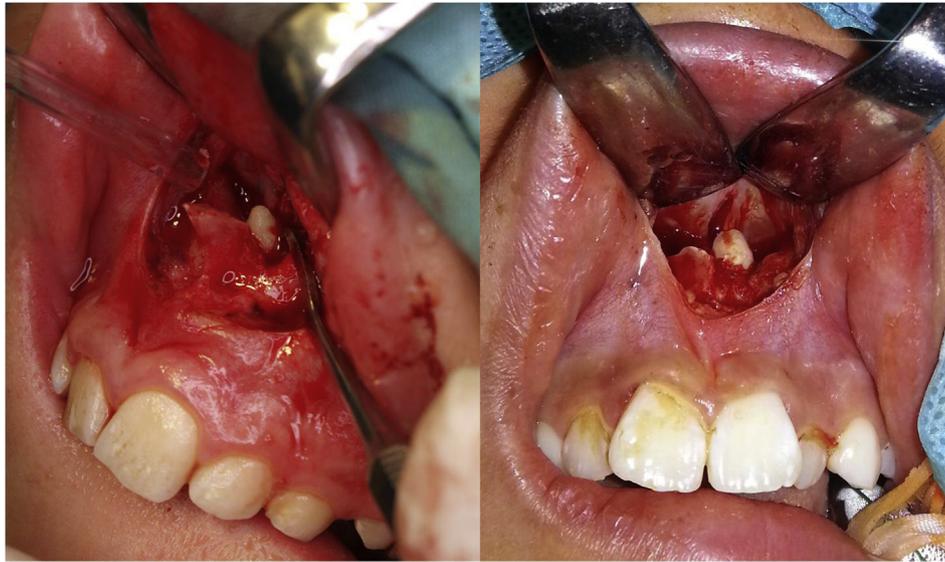
The prospective study was done in the time period 12/2013–6/2017. The inclusion criteria were: Mesiodentes impacted in the inverted position extending to the base of the nasal cavity or into the nasal septum without concomitant pathological lesion and without eruption into the nasal cavity. Localization of the mesiodentes in the level of or dorsally from the roots of the upper middle incisors in the sagittal plane or ventrally from the roots of these teeth, but with the crown extending significantly posteriorly to the base of the nasal cavity. Indications for extraction were clinical or orthodontic reasons.

### 2.1. The surgical protocol used in our patients

The mesiodentes were diagnosed using panoramic or intraoral radiographs. To clarify the relationship of the supernumerary tooth to the surrounding anatomical structures (upper incisors, incisive canal, base of nasal cavity, anterior nasal spine, nasal septum) CB CT was added. Considering the age of the patients and the nature of the surgical procedure, all patients were briefly hospitalized. Surgical procedures were performed under general anesthesia with orotracheal intubation. This method of airways maintenance is preferred in childhood and usually does not interfere with the surgical procedure. After the patient was put under general anesthesia, the nasal mucosa was infiltrated through the nostrils (using injection application) with articaine hydrochloride 4% with adrenaline 1:200 000 due to the reduction of perioperative bleeding. This step provides better clarity of the operation field. After the application of the anesthetic, the paramarginal horizontal incision was done (mostly using electrocautery). This incision was placed just 1–2 mm inferior to the vestibular fornix of the upper jaw. The horizontal incision length was about 3 cm. It was usually placed between small incisors but sometimes even a smaller incision was also sufficient. After the mucosal incision was done, the periosteum was cut and the caudal margin of the piriform aperture and anterior nasal spine were exposed. Subsequently the subperiosteal dissection continued in the dorsal direction. The nasal mucosa was elevated from the base of the nasal cavity using a periosteal elevator. The extent of the dissection in the coronal and sagittal plane was corresponding with the position of the crown of the mesiodentes based on CB CT evaluation. In some cases a part of mesiodentes was found immediately during the dissection. In other cases, a thin layer of bone or a part of the nasal septum overlapping the tooth had to be removed



**Fig. 1.** The mesiodens impacted in the region of the nasal septum (patient No. 8). The situation before and after the bone preparation of the nasal septum. Exposed crown of mesiodens can be seen.



**Fig. 2.** The extractions of mesiodentes impacted on the base of the nasal cavity using the modified maxillary vestibular approach with subperiosteal intranasal dissection (patients No. 2 and No. 7).

(Fig. 1). This can be done by hand using a scaler or by a rotational bur. In some cases, a piezosurgical osteotome was used. It is also possible to remove a small caudal bony part of the piriform aperture to maintain better visibility in the surgical field. The anterior nasal spine has always been preserved. After some part of the crown had been exposed, the mesiodens was extracted using a scaler or elevator (Fig. 2). The socket then was excavated, hemostasis done if bleeding was present and the wound was cleaned from possible debris. The nasal mucosa was placed back to the bottom of the nasal cavity and in some cases it was reattached to the anterior nasal spine with a suture. The wound was then closed with a primary suture in one layer with resorbable material. Postoperative care included analgesia, wound cooling and irrigation. Other pharmacological therapies like antibiotic or antiedematous medication were not necessary. Patients were discharged from hospital between day zero (immediately postoperatively) alternatively on the second postoperative day (depending on the size of postoperative swelling). The standard treatment regimen for dentoalveolar surgical procedures was recommended (wound cooling, soft diet, proper oral hygiene, oral mouth wash irrigation, analgesia, etc.). The medical check-up of the wound healing was done in one or two weeks after the surgery.

### 3. Results

In total, 9 patients were enrolled into the group. In these patients, surgical extractions of 9 mesiodentes were done using the alternative approach described above (Fig. 3). All extractions were performed according to a uniform surgical protocol. The mean age of patients was  $11.7 \pm 3.1$  years (age range 7–17 years). None of the patients had clinical symptoms caused by mesiodentes. All extractions were indicated because of orthodontic reasons (removal of obstruction in tooth movements before the start of orthodontic therapy, abnormal position of upper incisors). The crown's most cranial point exceeded the bone of the nasal cavity on average by  $2.0 \pm 1.4$  mm (in the range 0–5 mm). The supernumerary teeth were always localized ventrally from the incisive canal. 8 mesiodentes were conical, 1 was tuberculate. Two patients (n° 3 and 7) also had another mesiodens which erupted palatally. In one of these patients, this tooth had been extracted in the past by his dentist. In the other one, this tooth was extracted simultaneously

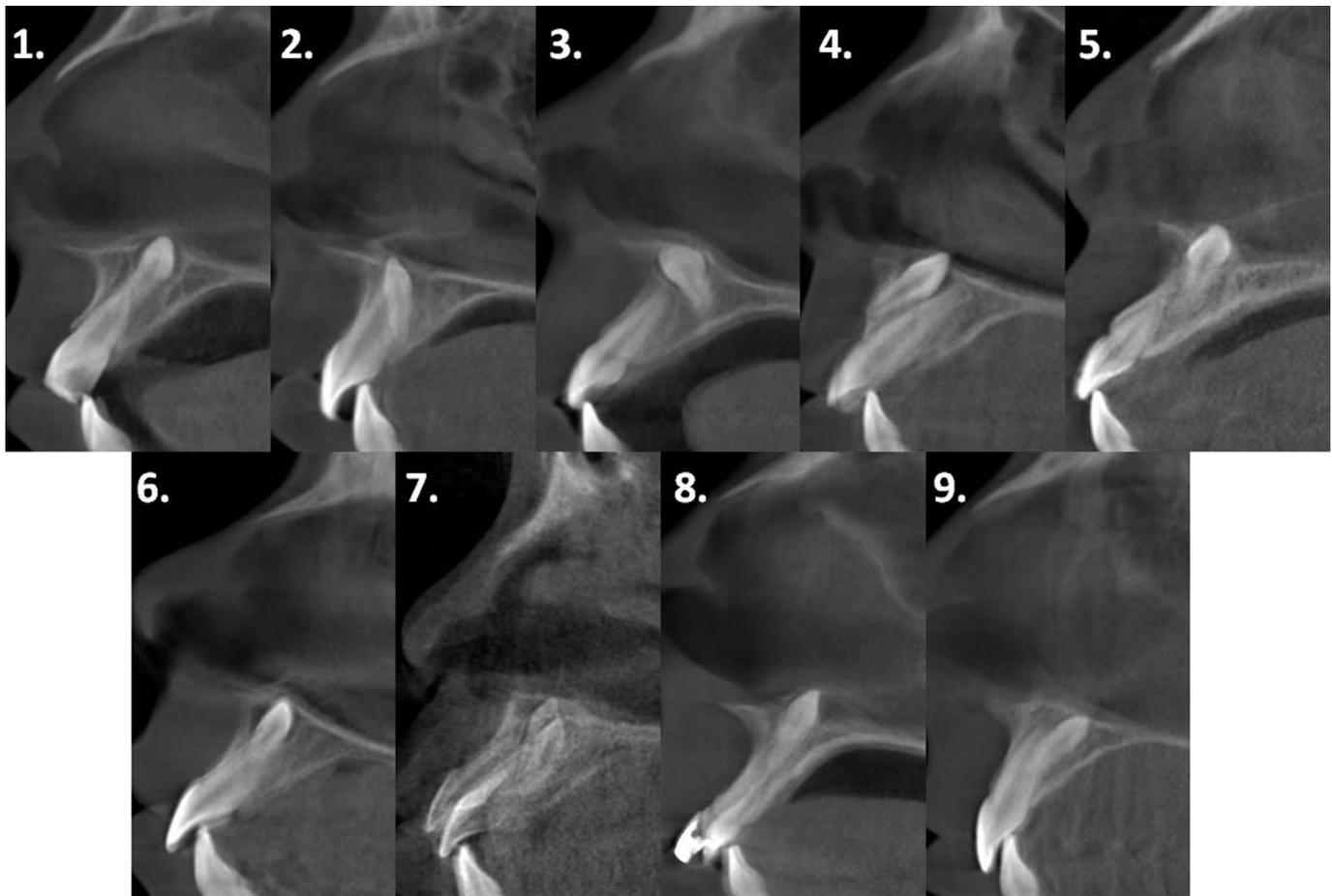
with the inverted supernumerary tooth. All mesiodentes were extracted in one piece, no tooth separation was needed. Not even in one case was the nasopalatine neurovascular bundle interrupted. Also, no perforation of the nasal mucosa ever occurred, but this complication could be easily solved by a suture. Surgical performance and subsequent healing were without complications in all cases. The average surgery time was 30 min. All frontal teeth had positive vitality tests on control. All patients were transferred to the care of their dentist and the orthodontist after the surgery.

Details are summarized in Table 1.

### 4. Discussion

Indications for the extraction of inverted mesiodentes are: symptomatic teeth, nasal eruption, concomitant pathological lesion (mostly dentigerous cyst), adjacent teeth roots resorption or orthodontic reasons. Orthodontic reasons mean an obstruction in tooth movements during orthodontic therapy and eruption disorder of the upper incisors (impaction, ectopic eruption, rotation/inclination, diastema) (Kumar et al., 2012; Sammartino et al., 2011). Also mesiodentes obstructing surgical solution of some other pathological conditions or reconstructive surgeries (oncological surgery, orthognathic surgery, implantology) are supposed to be extracted. If the mesiodens is not indicated for extraction, it should to be clinically and radiologically monitored (Kumar et al., 2012; Canoglu et al., 2009; Krishnan et al., 2013; Sanei-Moghaddam et al., 2009; Sammartino et al., 2011).

The first use of the modified maxillary vestibular approach with subperiosteal intranasal dissection for extraction of mesiodens impacted in the base of the nasal cavity was described by Sammartino G. et al. in 2011 (Sammartino et al., 2011). Even though the surgical approach to the nasal cavity has not been documented in detail in this work it has so far been the only publication on this topic. The technique of performing the aforementioned surgical procedure is not new in oral and maxillofacial surgery. It is a standard part of the orthognathic surgery of the Le Fort I osteotomy (Cornelius CP et al., 2018). This approach is not indicated in the case of teeth erupted through the mucosa into the nose. In these cases endoscopically assisted transnasal extraction is preferred (Al Dhafeeri et al., 2014; Krishnan et al., 2013; Kirmeier et al., 2009; Lee,



**Fig. 3.** The positions of mesiodentes impacted on the base of the nasal cavity in relation to the upper middle incisors. Sagittal CBCT scans of different thickness (movement artifacts can be seen in patient No. 7).

2006; Sanei-Moghaddam et al., 2009; Clementini et al., 2012; Tang and Reisacher, 2014). Some authors use this endoscopic method for extraction of mesiodentes impacted right under the nasal mucosa as well (Krishnan et al., 2013; Clementini et al., 2012). In these cases, it is necessary to perform fenestration – excision of nasal mucosa and sometimes also the removal of the thin bone lamella covering the mesiodentes which leads to a worse clarity of the operation field. If the mesiodentes is impacted in the nasal septum or deep under the base of the nasal cavity, rhinoscopy will not detect any camber of the nasal base caused by the crown of the mesiodentes. This

does not allow the surgeon to estimate the location of the tooth. The advantage of the intranasal approach is the possibility of performing septoplasty at one time, if indicated (Mohebbi et al., 2013; Krishnan et al., 2013; Sanei-Moghaddam et al., 2009).

Surgical extraction of impacted mesiodentes in the inverted position is usually performed via intraoral transpalatal approach. This kind of surgery, however, is accompanied by a high risk of damage to the surrounding teeth. The roots of these teeth can be injured and their stability can be disrupted by removing the surrounding bone. It is often necessary to elevate the palatal

**Table 1**  
Patients characteristics and the analysis of accurate localization of mesiodentes based on CBCT.

| No | Gender | Age (years) | Indication  | The localization of mesiodentes (distance in mm) |   |   |  |                   | Type of mesiodentes | Surgery time (min) |
|----|--------|-------------|-------------|--|---|---|--|-------------------|---------------------|--------------------|
|    |        |             |             | ANS-Crown  | The crown's most cranial point - ANS and PNS line | Midline - crown edge (laterality, relationship to the nasal septum) | Position from the roots of the upper middle incisors in the sagittal plane | Crown inclination |                     |                    |
| 1  | Male   | 9           | Orthodontic | 19   | 3   | 4 (right, outside the nasal septum)                                 | in the level   | dorsal            | conical             | 20                 |
| 2  | Male   | 11          | Orthodontic | 12   | 1   | 0 (inside the nasal septum)   | dorsal   | ventral           | conical             | 28                 |
| 3  | Male   | 13          | Orthodontic | 9  | 2   | 4 (left, inside the nasal septum)                                   | dorsal   | lateral           | conical             | 28                 |
| 4  | Male   | 10          | Orthodontic | 13   | 3   | 2 (left, outside the nasal septum)                                  | ventral  | dorsal            | conical             | 40                 |
| 5  | Female | 16          | Orthodontic | 12   | 1   | 0 (inside the nasal septum)   | dorsal   | dorsal            | conical             | 40                 |
| 6  | Male   | 10          | Orthodontic | 12   | 2   | 4 (left, outside the nasal septum)                                  | in the level   | dorsal            | tuberculate         | 45                 |
| 7  | Male   | 7           | Orthodontic | 11   | 1   | 4 (left, outside the nasal septum)                                  | dorsal   | dorsal            | conical             | 30                 |
| 8  | Female | 17          | Orthodontic | 16   | 5   | 0 (inside the nasal septum)   | in the level   | dorsal            | conical             | 20                 |
| 9  | Male   | 12          | Orthodontic | 17   | 0   | 3 (right, outside the nasal septum)                                 | dorsal   | dorsal            | conical             | 22                 |

ANS - anterior nasal spine, PNS - posterior nasal spine.

mucoperiosteal flap extensively to ensure the approach. This may cause interruption of the nasopalatine neurovascular bundle, leading to permanent anesthesia of the palate in the region of the premaxilla. The advantage of the modified maxillary vestibular approach with subperiosteal intranasal dissection versus intraoral palatal approach is lower postoperative morbidity and a lower risk of complications (smaller surgical wound, minimal exposure of maxilla, minimal bone loss, reduced risk of damage to the roots of upper incisors, lower risk of damage to the nasopalatine neurovascular bundle, greater clarity of the surgical field and easier surgery, no need of postoperative palatal splint).

To minimize the invasiveness of the surgery, preoperative CB CT analysis is helpful. This analysis can detect complications related to the tooth impaction and allows determining the exact location of the tooth (Aoun and Nasseh, 2016; Mossaz et al., 2014; Al-Sehaibany et al., 2016). Planning helps to reduce incision size and to minimize maxillary exposure. The distance between the mesiodens's crown and the anterior nasal spine (ANS) is not equal to the extent of the intranasal dissection in the dorsal direction due to the variable size of this bone structure in different patients. In individuals with a short nasal spine (ANS), intranasal preparation may be more extensive even at a smaller "ANS-tooth crown" distance than in patients with more prominent ANS. However, this is a well identifiable and measurable distance during the surgery. ANS should be preserved during the surgery, as it is the support of the columella and the nasal tip. Moreover ANS forms an individual nasolabial angle. On the other hand, Cho YS et al. report that the ANS removal has only a negligible effect on the overall shape of the nose, including nose tip collapse and widening of the nasal base (Cho et al., 2013).

Hu YK et al. have recently published a study involving a group of 8 patients who underwent surgical extraction of inverted and deeply impacted mesiodentes using piezosurgery. In these patients, the modified maxillary vestibular approach with the use of upward lifted bone flap on the cranial mucoperiosteal pedicle ("trapdoor" method) was performed. (Hu et al., 2017). Moreover, in some patients a surgical cutting guide template was used. In contrast to traditional surgical procedures, the authors evaluate this approach as safe and less invasive with minimal bone loss due to the possibility of the vascularized bone flap repositioning. ANS was preserved in these patients. However, compared with the approach proposed by us, this is a more invasive procedure. In line with our experience, the importance of pre-operational 3D imaging and planning is emphasized in this paper. Surgical extractions of mesiodentes presented in our study were performed by three surgeons with different skills. This may have some effect on the length of the operation.

In terms of time planning for surgical tooth extraction, two approaches are generally accepted (Canoglu et al., 2009). One option is an early extraction before the development of the root of a permanent incisor is finished. This reduces the consequences of the presence of the supernumerary tooth and thus reduces the requests for later orthodontic treatment (Kumar et al., 2012). On the other hand, the main disadvantage of this method is the possible risk of damage to the developing root of the permanent upper incisors. The second option is the delayed extraction, which is done just after the development of the roots of the upper incisors has been completed. This method is friendlier towards these teeth, but the threat of subsequent longer and more complicated orthodontic therapy grows (Krishnan et al., 2013).

In the case of surgical extraction of the inverted mesiodens impacted to the bottom of the nasal cavity using the modified maxillary vestibular approach with subperiosteal intranasal

dissection, the risk of damage to the incisors is minimal. Therefore the authors of this paper prefer an early tooth extraction. It can be assumed that subsequent orthodontic treatment will be less demanding or altogether unnecessary.

## 5. Conclusion

In this indication the modified maxillary vestibular approach with subperiosteal intranasal dissection versus the intraoral palatal approach provides less postoperative morbidity and a lower risk of complications. For oral and maxillofacial surgeons this is a more natural way of surgical tooth extraction than the endoscopically assisted transnasal approach. With today's possibilities of preoperative CB CT diagnostics enabling precise positioning of the tooth, this is a minimally invasive and safe approach, which can be advantageously used for surgical extraction of completely impacted mesiodentes situated on the bottom of the nasal cavity.

## Conflicts of interest

The authors declare no conflict of interest.

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