Feasibility of transoral endoscopic enucleation for large odontogenic jaw tumors

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Objective
The aim was to describe a transoral endoscopic approach for large odontogenic jaw tumors and to assess the feasibility of endoscopy in complete enucleation of any tumor remnants.

Materials and methods
This retrospective cohort study was done on patients presenting with different types of large jaw tumors in the period from 2013 to 2017 at the Department of Otolaryngology – Head and Neck Surgery, Mansoura University, Egypt. All patients were managed endoscopically. with the bony port measured in its largest dimension. Outcome measures were the occurrence of recurrence during the follow up. Follow-up ranged from 6 to 36 months.

Results
All patients had complete removal of tumor from the cavity with the transoral endoscopic approach through portal opening of the tumor cavity with a mean (SD) of 24.3 (3.12 mm). Various types of odontogenic tumors were included. No recurrence was detected in the follow-up period except for 1 case requiring a second look.

Conclusion
Management of large jaw tumors varies from incomplete excision as shaving to aggressive excision with greater morbidity requiring reconstruction. Endoscopic transoral route provides a marvelous option that ensures complete excision with functional preservation and less morbidity.

Keywords:
Endoscopic Enucleation, maxillary cyst, mandibular cyst, endoscopic apicectomy, jaw tumors, odontogenic tumors

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Introduction

Odontogenic tumors are rare neoplasms that are clinically and pathologically unique in their diagnosis and management. The frequency of odontogenic tumors, based on a systematic review of 12 articles, shows ameloblastomas (almost 38%) which have the highest frequency. Keratocystic odontogenic tumor (KCOT) frequency comes second and exceeds 35% of the cases. Then follows the myxomas, adenomatoid tumors, and ameloblastic fibromas that are collectively less than 10% [1].

Although these tumors are all odontogenic, their behaviors and odontogenic pathologies are variable. Ameloblastomas can arise from the reduced enamel epithelium, dental lamina, or epithelial rests of Malassez and Serres. This contributes to the variation in radiological findings of ameloblastomas (e.g., unicystic, multicystic). KCOTs are intraosseous aggressive benign tumors arising from the dental lamina and are lined by parakeratinized stratified squamous epithelium. In contrast, odontogenic myxomas are mesenchymal intraosseous tumors with a higher tendency of mandibular affection with local destructive characters. Odontogenic fibromas share origins similar to ameloblastomas [2–8].

Management options of odontogenic lesions are variable: local resection decompression, shaving, enucleation, etc. This depends mainly on the size, site, consistency, vicinity to important structures, and histopathology of the tumor. Patient factors include age, health status, and oral hygiene (especially for the cooperating dentist dealing with the offending cause). Another considerable factor is the surgeon's experience and background [9].

Addressing the surgical needs of patients adequately with limited morbidity and mortality is the goal of any intervention, particularly in the head and neck benign lesions [10]. The concept of minimally invasive surgery is evolving and becoming a focal point of attention [11] as using scopes and remotely placed miniature incisions. Enucleation of these lesions by the endoscope [endoscopic enucleation (EE)] combines the pros of single-stage surgery with a minimally invasive approach [12].

This study aims to assess the feasibilty of EE in the transoral management of odontogenic tumors, emphasizing its value in visualization, tissue conservation, and recurrence rate.

Materials and methods

After Institutional Review Board approval was obtained from the Faculty of Medicine, patients presenting with benign odontogenic tumors with available full clinical, radiological, and subsequent follow-up data in the period between January 2013 and October 2017 were identified. Those who had undergone EE with a diameter of not less than 3 cm were only included. Exclusion criteria included patients with cysts or malignant pathologies. Patients undergoing any other management modality as resection or shaving were excluded. Tumors of nonodontogenic origin were also excluded. We were able to identify 21 patients with benign tumors of the jaws, according to the 2017 WHO classification [13].

All patients were either referred from the Oral Surgery Department or primarily presenting to the Otolaryngology Department's Outpatient Clinic, Mansoura University. As a routine workup, all participants had full radiological assessment as well as evaluation by our department affiliated dentist. Computed tomography scans were ordered on a regular basis, yet in those with suspected malignancy with aggressive soft tissue extensions, MRI was complementarily added. Biopsy was obtained in cases with suspected malignancy, for example, in those with noticeable bony destruction. Middle meatal antrostomy (MMA) was considered in patients with suspected affection of the osteomeatal complex (OMC).

The endoscopic procedure was done under general anesthesia with endotracheal intubation in all cases. Preoperative endodontic management was settled to be done preoperatively if needed. Teeth extraction and/or (endoscopic) apicectomy was done intraoperatively. The endoscopic procedure was done in the affected jaw (either maxilla or mandible) accordingly. All endoscopic approaches are done transorally with the exception of those maxillary tumors who needed an additional MMA for maintaining a patent physiologically functioning OMC. In all procedures, the concept was to achieve a small bony port for adequate central debulking of the tumor followed by an EE of the tumor's periphery. The endoscopic debulking was either performed by a Blakesley forceps or a debrider. In some situations, there is a semisolid or watery content (as in KCOT or unicystic ameloblastoma, respectively) that can be sucked out rather than debulked (allowing peripheral collapse).

After ensuring complete endoscopic removal from all remote aspects of the cavity, authors applied a Carnoy's solution for not more than 2 min in patients with KCOT to minimize chances of recurrence. In all patients with exposed roots, we perform endoscopic apicectomy for decreasing the chances of recurrence. At the end of the procedure, the resulting large cavity is filled with an antibiotic-soaked gauze; changed every 3–4 days with decreasing gauzes in size to allow granulation to fill the cavity and avoid food accumulation. Patient underwent a routine follow-up every week for a month, then every month for 6 months, and finally were recommended to have a visit every 6 months.

Results

In this retrospective study, 58 patients with primary benign lesions of the jaws were managed in our department. Jaw cysts were excluded as well as those with malignant pathologies. Patients with benign tumors of the jaws were 21. From these patients, 10 patients met the inclusion/exclusion criteria and were managed exclusively by transoral EE. The types of tumors according to their histopathology and site are shown in Table 1.

Maxillary benign tumors included a variation of ossifying fibromas, odontogenic fibromas, KCOT, and myxoma. In all cases, an MMA was co-performed with the transoral EE. Mandibular tumors were of a less variability, unicystic ameloblastoma and KCOT.

The approach was considered successful in all patients as they were all managed solely by EE. During their follow-up visits, no recurrence was encountered except in one case of KCOT that needed a second endoscopic look during her follow-up visits with subsequent endoscopic apicectomy.

Table 1 Baseline characteristics for patients included in this cohort MX: Maxillary, MN: Mandibular

	Sites	Sex	Age	Port size (largest dimension)
Ossifying fibroma	MX	Male	15	22
Ossifying fibroma	MX	Female	16	31
Odontogenic fibroma	MX	Male	31	19
Odontogenic fibroma	MX	Male	26	24
Unicystic amelobastoma	MN	Male	25	25
Unicystic Ameloblastoma	MN	Male	14	23
KCOT	MX	Male	19	23
KCOT	MN	Female	34	25
KCOT	MN	Male	23	24
Myxoma	MX	Female	19	27

MX: Maxillary, MN: Mandibular

Discussion

Jaw cysts were managed endoscopically in a previous series with promising results [12,14–17]. These authors mainly relied on the possible and easier dissection of the lining after reducing the cyst size, thus, allowing for subsequent manipulation and delivery via endoscopic instruments. Using the same principle, authors believe that the same concept can be applied to solid and semisolid tumors of benign nature.

Although transoral endoscopic use in jaw tumors was previously mentioned as case reports rather than series [10,18,19], authors usually focused on identifying unusual pathologies [20,21]. This is attributed to the rarity of odontogenic tumors and the recent application of endoscopy in odontogenic lesions. In addition, the variable diversity of presentations of these lesions lead to a wide dispersion of patient's population among different specialties and institutes. Thus, one could appreciate the slow progress in the field of endoscopic jaw surgery due to previous factors as well as the common use of transnasal endoscopy.

In maxillary lesions, care should be given to the relation of the tumor to the lateral nasal anatomy, particularly the OMC. As previously published, missing an MMA in an obstructed OMC could result in maxillary sinusitis or recurrence of the offending pathology. In a case of maxillary ossifying fibroma, an impacted molar (possible offending nidus) was identified behind the growing lesion via endoscopy and as predicted, see Figs. 1 and 2. Yet, in this series, the OMC was affected in all maxillary cases, encouraging an MMA to be included in their procedures.

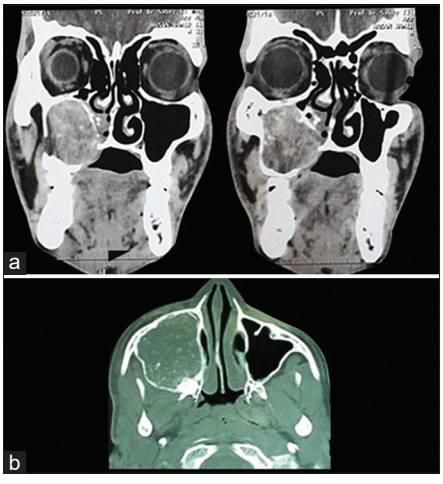
From an otolaryngologist point of view, primary maxillary tumors could be approached by the endoscopic transnasal route Yet, transoral endoscopy is believed by the authors to be a more direct approach with less nasal morbidity, especially when using the already existing bony thinning/erosion of the anterior maxillary wall. For reaching a lateral extent of the maxillary occupying tumor, either a contralateral trans-septal approach is used or a modified endoscopic Denker is needed. These approaches are significantly associated with jeopardizing of disease-free bony structures as the nasal septum, maxillary bone, turbinates, lacrimal bone, etc. This could result in more nasal comorbidity especially in the postoperative period.

In mandibular tumors, the role of endoscopyenhances the visualization of remote aspects of the cavity for subsequent precise EE (or pealing) of the tumor's periphery. Preservation of the inferior alveolar nerve (IAN) is very feasible throughout its course to the lingula as well as reaching remote inaccessible regions as the condyles. The authors also believe that this approach adds a great advantage in avoiding partial or total resections of facial bones.

In a case of mandibular unicystic ameloblastoma, a 14-year-old boy had barely any bony remnant after having his left hemimandible occupied by the tumor. During his EE, the IAN was identified and preserved up to the level of the nerve's entrance opposite to the lingula. Although the remaining bone was very sparse with nearly no bony bulk, patient's follow-up showed complete restoration of his lost bone in a less than 18 months follow-up interval, see Figs. 3–5.

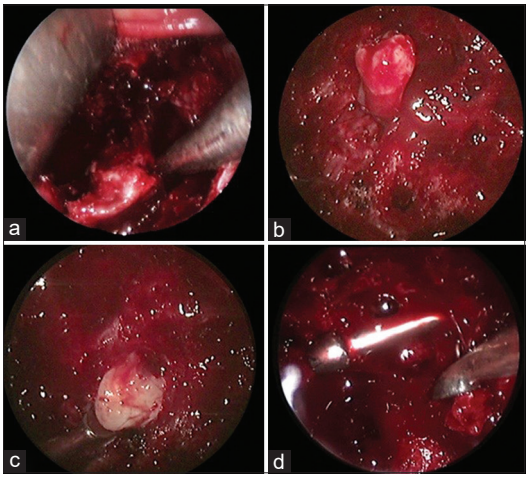
Authors do not recommend direct mucosal suturing over large bony cavities to enhance frequent irrigation and minimize potential food or blood accumulation with subsequent secondary infection. In some patients, close early postoperative visits are mandatory for strict

Figure 1



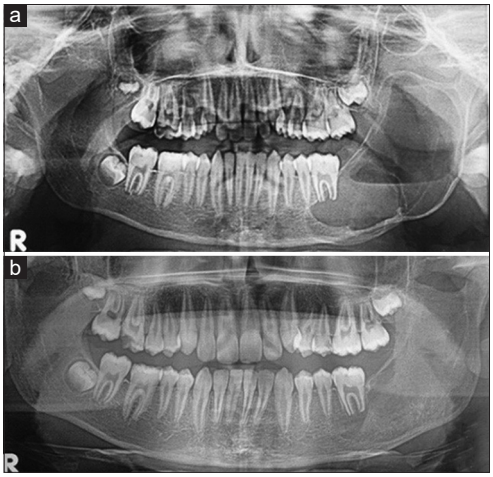
a: Coronal section showing the superior displacement of the orbital floor. b: Axial section showing the anterior displacement of the maxillary wall resulting in fullness of the right cheek. The impacte molar's hyperdensity can be appreciated

Figure 2



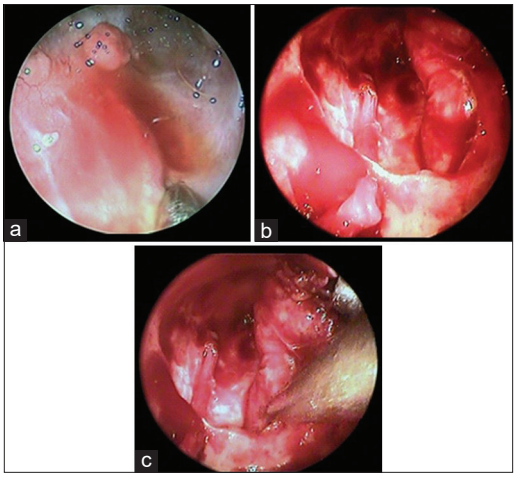
a: Creation of a bony port (22 mm). b: After debulking, the impacted molar can be visualized. c: Endoscopic removal of the impacted molar. d: Completion of enucleation

Figure 3



(a) Preoperative radiography of a 14-year-old, boy with left ameloblastoma. (b) postoperative view after 18 months.

Figure 4



(a) An intralesional endoscopic view showing unusual growths. (b and c) Endoscopic dissection of the outer wall from the inferior alveolar nerve.

control of the cleanliness of the cavity by frequent suction and lavage till healing is guaranteed. Loss of this close follow-up could lead to cavity complications.

Literature does not currently present a definite consensus about the most appropriate surgical method (s) for KCOT treatment. Although en-bloc resection offers a high cure rate, it results in significant morbidities: loss of jaw continuity with subsequent facial disfigurement [22]. Conservative treatment in an aggressive, frequently recurring tumor is questionable. Thus, a variety of adjuvant treatments have been proposed, including removal of the peripheral bone (osteotomy), cryotherapy (freezing) with liquid azote, and use of Carnoy's fixative solution into the cavity after enucleation [22]. In two patients with KCOT out of three in this series, two patients had a local application of Carnoy's solution for not more than 2 min after ensuring complete EE to minimize chances of recurrence.

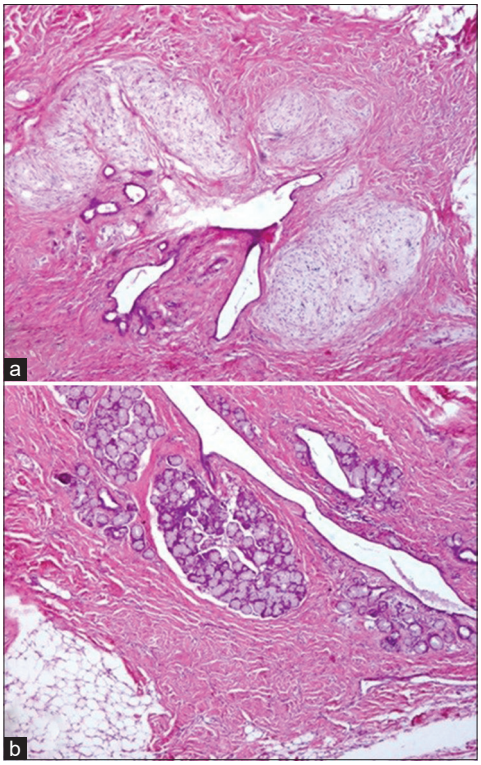
Benefits appreciated by minimally invasive jaw surgery and transoral EE include direct visualization of an illuminated magnified field and unrecognized scars in the oral cavity avoiding external scars and sizeable internal ones. Previous authors also reported minimal dissection and manipulation of tissues resulting in less pain and swelling, and minimal postoperative morbidity and cost due to decreased operating room use and shorter stay [13,16,17,23]. The bone removal for obtaining a working bony port is also reduced (not exceeding 3 cm in the current series) in sizeable lesions, occupying the hemimandible.

Other valuable advantages include safe manipulation around important structures as the IAN (in mandible cases) and ION (infraorbital nerve in maxillary tumors). The feasibility of safely approaching inaccessible regions as the coronoid and condylar processes can eliminate – in some circumstances – the need of an external approach. Recently, apicoectomy of exposed roots is performed under complete endoscopic visualization 'endoscopic apicectomy' for minimizing recurrence and avoiding development of secondary infection of dental origin[16].

Limitations of this study include the small number of patients enrolled; yet, as a new concept we believe that the results are encouraging for a larger series, perhaps in further studies. The authors have included only benign tumors as they still believe that malignant lesions necessitate wide local resection with achieving free safety margins. Although oncological safety is always the primary goal in malignancy, smaller lesions could perhaps be included with growing experience in the field of endoscopic jaw surgery. Another limitation is not using a score for evaluating the nasal outcome and compare it with a corresponding transnasal endoscopic group.

Reviewing the literature and observing the evolution in different techniques in handling nasomaxillary tumors as the juvenile nasopharyngeal angiofibroma shows the expanding potentials in using endoscopy for jaw tumors. We have emphasized previously how steps can be tailored to deal with juvenile nasopharyngeal angiofibroma extensions by validating the NSF-COR staging system Nose-Sinus-Fossa-Cranium-Orbit-Rsidual vascularity (NSF-COR) with its endoscopic surgical recommendations [24]. Perhaps, similar future plans can be made for benign jaw lesions. However, we have to acknowledge that these lesions are odontogenic in origin. Although transoral EE is a promising minimally invasive procedure, the value

Figure 5



(a and b) Histopathology of the lesion proved to be a unicystic ameloblastoma.

of the skilled use of endoscopy by otolaryngologists is never sufficient to solely handle these lesions. The role of the dentist in controlling the offending tooth remains a must to achieve an optimum outcome especially in tumors with high recurrence rate, as in KCOT. Thus, a multidisciplinary team is key for successfully managing odontogenic cysts [16] and benign tumors.

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Conflicts of interest
There are no conflicts of interest.

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