

# Journal of Visualized Experiments

## Combined Endoscopic and Transoral Approach for Total Maxillectomy

--Manuscript Draft--

<b>Article Type:</b>	Invited Methods Article - JoVE Produced Video
<b>Manuscript Number:</b>	JoVE61785R2
<b>Full Title:</b>	Combined Endoscopic and Transoral Approach for Total Maxillectomy
<b>Corresponding Author:</b>	Ke-qing Zhao Eye and ENT Hospital of Fudan University Shanghai, Shanghai CHINA
<b>Corresponding Author's Institution:</b>	Eye and ENT Hospital of Fudan University
<b>Corresponding Author E-Mail:</b>	rhinoresearch@163.com
<b>Order of Authors:</b>	Lun Xu Ke-qing Zhao Hong-meng Yu
<b>Additional Information:</b>	
<b>Question</b>	<b>Response</b>
Please indicate whether this article will be Standard Access or Open Access.	Standard Access (US\$2,400)
Please indicate the <b>city, state/province, and country</b> where this article will be <b>filmed</b> . Please do not use abbreviations.	Shanghai
Please confirm that you have read and agree to the terms and conditions of the author license agreement that applies below:	I agree to the <a href="#">Author License Agreement</a>
Please specify the section of the submitted manuscript.	Medicine
Please provide any comments to the journal here.	

**TITLE:**

Combined Endoscopic and Transoral Approach for Total Maxillectomy

**AUTHORS AND AFFILIATIONS:**

Lun Xu<sup>1</sup>, Ke-qing Zhao<sup>1\*</sup>, Hong-meng Yu<sup>1,2\*</sup>

<sup>1</sup>Department of Otolaryngology, Eye & ENT Hospital, Fudan University, Shanghai, PR China

<sup>2</sup>Research Units of New Technologies of Endoscopic Surgery in Skull Base Tumor, Chinese Academy of Medical Sciences, Shanghai, China

**Corresponding Authors:**

Hong-Meng Yu (Yuhmrhinologist@163.com)

Ke-qing Zhao (rhinoresearch@163.com)

**E-mail Addresses of Co-authors:**

Lun Xu (xl107518@163.com)

Hong-Meng Yu (Yuhmrhinologist@163.com)<sup>1</sup>

Ke-qing Zhao (rhinoresearch@163.com)

**KEYWORDS:**

malignant tumor, endoscopic approach, total maxillectomy, transoral approach, reconstruction, quality of life

**ABSTRACT:**

The technique of maxillectomy has been revised since it was first described in the 1820s. During the past decade, the endoscopic approach has been widely practiced for resecting maxilla. Compared with the traditional approaches, the combined endoscopic and transoral approach has many advantages such as avoiding facial incisions and postoperative scars and better visualization of the surgical margin. However, this technique is complicated to master and possess several challenges. Here, we demonstrate this approach step-by-step to show how to perform a total maxillectomy. We also reported nine cases with malignant tumors originating from the maxilla, and for all of them total maxillectomy was performed with combined endoscopic and transoral approach. Our data showed that the combination of the endoscopic and transoral approach could be used to resect the total maxilla successfully, though the tumor extended to the infratemporal and pterygopalatine fossa should be treated very carefully to avoid its spread in the local area. Furthermore, besides denture, other reconstruction methods should be attempted to improve the postoperative quality of life after the total maxillectomy.

**INTRODUCTION**

The squamous cell carcinoma from the maxillary sinus reports the highest incidence among the tumor developments within the sinonasal compartment<sup>1</sup>. Besides squamous cell carcinoma, the pathological patterns of maxillary tumors also include various histological types, such as adenocarcinomas, melanoma, and esthesioneuroblastoma, etc.<sup>2</sup>. Since the symptoms in the early phases are dormant and nonspecific, most of the patients diagnosed with malignant tumor

originating from the maxilla are in an advanced stage during the time of diagnosis. This makes the maxillary malignant tumors one of the worst in comparison with other head and neck tumors.

The therapeutics options for the patients with malignant tumors involves maxilla surgeries combined with radiotherapies, and in some cases chemotherapies<sup>3-5</sup>. Many approaches of maxillectomy have been developed to resect the maxilla since it was first demonstrated in 1826<sup>6</sup>. Recently, the maxillectomy can be divided into an approach with and without a skin incision. Among these approaches, lateral rhinotomy and midfacial degloving are still practiced in total maxillectomy. However, the drawbacks of these procedures include leaving a facial scar, and difficulties in treating the lesion located at or beyond the posterior margin of the maxilla due to the restricted field of visualization, limited working space, and significant bleeding of these areas<sup>7</sup>. Compared to these traditional approaches. A combined endoscopic and transoral approach has been presented for total maxillectomy without facial incision<sup>8,9</sup>. This approach, taking advantage of the better visualization of the endoscopy, might lead to the better magnification of the operative field, especially for the surgical margins, resulting in potentially similar scales of resection but with less morbidity<sup>8</sup>. In addition, no facial scars are left with this approach, which might accelerate its application for the total maxillectomy in the future. However, the technique is complicated to master and possesses several challenges. Therefore, we present a step-by-step visual protocol of a combined endoscopic and transoral approach, which may help in shortening the learning curve of this approach.

## **PROTOCOL:**

This procedure was approved by the Institutional Review Board of the Eye and ENT Hospital, Fudan University, China. A written informed consent was obtained from all the enrolled patients.

### **1. Preparation for the surgery**

1.1. Before the surgery, examine the patients with anterior rhinoscopy, 4 mm endoscopy, computed tomography (CT), and Magnetic Resonance Imaging (MRI) scans to confirm the maxillary bone was invaded by the tumor and that a total maxillectomy is required. Make the surgical plan based on the location of the tumor.

1.2. On the day of the operation, place the patient on the operating table and then give general anesthesia. Place the anesthesia intubation into the mouth on the opposite side of the tumor to facilitate to perform the following transoral approach.

1.3. Tilt the operating table to a 30° angle (to the dorsal elevated position) and place the patient's head in a neutral position (neither flexed nor extended).

1.4. Soak the gauze piece with iodine, then sterilize the gingivobuccal sulcus with the gauze piece.

### **2. Surgical procedure**

2.1. Soak 8 gauzes (6 cm x 60 cm) in a mixture of 20 mL of 1% tetracaine and 4 mL of 0.1% adrenaline. To shrink the nasal mucosa, put several pieces of soaked gauze into each nasal cavity for 5 min.

2.2. Cut off the middle turbinate and then perform a routine ethmoidectomy and sphenoidectomy. Widen the osteum of the frontal and maxillary sinuses on the side of the lesion by the quadcut and curved sinus blades powered by the dynamic planning system.

NOTE: To reduce bleeding, the above-mentioned procedures could also be carried out with plasma.

2.3. Cut off the inferior turbinate and remove the mucosa layer on the lateral wall of the nasal cavity with the mayo scissors and the plasma.

2.4. Drill the frontal process and the lacrimal bone with the trans-nasal skull base bur and expose the naso-lacrimal duct and lacrimal sac. Then, cut off the naso-lacrimal duct and perform the lacrimal sac incision with the blade and make sure that the mucosal flaps are laid out on the lateral nasal wall.

2.5. Wipe off the medial wall of the maxilla with the trans-nasal skull base bur from the level of maxillary palatal process inferiorly, to the level of inferior wall of orbit superiorly, to the piriform aperture forwardly, and to the palate bone posteriorly.

2.6. Remove the perpendicular plate of the palatine bone from the medial side to the lateral side with the trans-nasal skull base bur. Expose the palatine canal and cauterize the greater and lesser palatine arteries with the monopolar electrocoagulation.

NOTE: In this step, the conchal crest can be used as a landmark to differentiate the perpendicular plate of the palatine bone and the medial pterygoid plate.

2.7. Locate the sphenopalatine foramen, which is posterior to the ethmoidal crest. Introduce the Kerrison punch into the foramen and remove the posterior wall of the maxillary sinus anterior to the pterygopalatine fossa.

2.8. Use a needle connected to a 5 mL syringe to immerse the gingival buccal groove in several milliliters of a mixed solution of 20 mL of 0.9% NaCl and 0.05 mL of 0.1% adrenaline in the subperiosteal planes on the side of the tumor from the level of the central incisor to the level of the third ipsilateral molar.

2.9. Make the incision in the gingivobuccal sulcus with the blade or the monopolar electrocoagulation; start from the central incisor to the third ipsilateral molar (**Figure 1A**).

2.10. Dissect of the soft tissues subperiosteally with the suction elevator, electrocoagulation, and plasma along the anterior wall of the maxillary sinus until the infraorbital rim is exposed (Figure 1B).

NOTE: The infraorbital nerve should be preserved if it was not involved by the malignancy. Whether the infraorbital nerve was involved in the tumor was identified based on the MRI and CT scan pre-surgery and confirmed during the surgery.

2.11. Separate the soft tissue from the underneath bone to the pyriform aperture level medially, to the zygomaticomaxillary fissure level laterally, and to the mandibular tubercles posteriorly.

2.12. Retract and protect the facial soft tissue superiorly with the mastoid retractor. Wipe off the anterior wall of the maxilla with the trans-nasal skull base bur. Remove the residual bone of the piriform aperture.

2.12.1. Try to keep the periosteal and mucosa in the maxillary sinus intact when wiping off the anterior bony wall of the maxilla, which could reduce the bleeding. To achieve this goal, change the trans-nasal skull base bur to the carborundum drill at this step.

NOTE: After wiping off the anterior bony wall of the maxilla, the periosteal and mucosa will be seen under it. The periosteal and mucosa should be very obvious, if it is not involved by the tumor.

2.13. Then, remove the posterior lateral wall of the maxillary sinus by the trans-nasal skull base bur and the carborundum drill. If the infratemporal fossa was not involved by the tumor, the periosteal covering it should be kept intact in this step.

2.14. Medially, separate the connection of the vertical and the horizontal process of the palate bone by abrading the pyramidal process with the carborundum drill. Laterally, separate the maxillary tuberosity from the lateral pterygoid plate with the carborundum drill.

2.15. Use the carborundum drill to remove to the lateral and the malar process to remove the superior and the inferior orbital walls, respectively.

2.16. Pull out the ipsilateral central incisor. Make a hole between the soft palate and hard palate with the electricoagulation at the midline of the hard palate. Pull the fretsaw through the hole and make a sagittal incision along the hard palate from posterior to anterior (Figure 1C,D).

NOTE: In this step, the upper lip should be retracted upward and carefully protected.

2.17. Separate the hard palate from the soft palate with the Metzenbaum scissors. Then take out the maxilla from the mouth.

2.18. Put the warm gauze (40 °C) into the operative region immediately for several minutes to stop the bleeding. Then control the bleeding by electrocoagulation.

175  
176 2.19. Rinse the surgical cavity with 40 °C warm water.  
177

178 2.20. Fix the denture to reconstruct of the hard-palatal defect. Return the facial soft tissue to  
179 the normal position.  
180

181 2.21. Cover the surface of the surgical margin with gelatin sponge. Then, pack the nasal cavity  
182 with iodoform gauze and inflation sponge.  
183

### 184 3. Procedure and assessment after surgery 185

186 3.1. Take out the gauze and sponge 4 days after surgery. Then, examine through enhanced CT  
187 or MRI immediately.  
188

189 NOTE: Get rid of the denture before the MRI examination.  
190

191 3.2. Review the patient 2 weeks after the surgery to check and clean the surgical field. Then,  
192 review the patient according to the NCCN guidelines<sup>10</sup>.  
193

### 194 REPRESENTATIVE RESULTS:

195 In this study, we presented the details of the surgical protocol to resect the total maxillectomy  
196 with a combined endoscopic and transoral approach. We also included nine cases who were  
197 diagnosed with malignant tumors that originated from maxillary sinus and were treated in the  
198 Eye and ENT hospital of Fudan University. The combined endoscopic and transoral approach on  
199 all the patients was performed and clear surgical margins were achieved in all the patients. The  
200 patients' mean age was 47.9 years (with a range of 18–69 years). Five patients were male, and  
201 the other four were female. The stage of the tumors was assessed and recorded according to the  
202 8th TNM edition<sup>11</sup>. In addition, the pathological diagnosis, surgical approach, the treatment  
203 strategy, and the current situation is presented in **Table 1**.  
204

205 A representative CT scan of a patient before and after surgery is shown in **Figure 2**. The quality-  
206 of-life scores (QOL) of the six patients after surgery was assessed according to the University of  
207 Washington Quality of Life version 4 Questionnaire<sup>12,13</sup>. The scores of pain, appearance, activity,  
208 recreation, swallowing, chewing, speech, taste, saliva, mood, and anxiety are shown in **Figure 3**,  
209 and data is expressed as mean ± SE.  
210

### 211 FIGURE AND TABLE LEGENDS: 212

213 **Figure 1: Intraoperative endoscopic photographs.** (A) The incision was made in the gingivobuccal  
214 sulcus with the monopolar electrocoagulation. (B) Dissection of the soft tissues subperiosteally  
215 with the plasma along the anterior wall of the maxillary sinus. (C) Pull the fretsaw through the  
216 hole, which was between the soft palate and hard palate. (D) the incision was made sagittally  
217 along the hard palate from posterior to anterior.  
218

**Table 1: Characteristics of patients treated with a combined endoscopic and transoral approach.**

The demographic and clinical characteristics are summarized. There are 5 males and 4 females ranging in age from 12 to 69 years (average, 47.9). Of these patients, 8 (89%) presented with stage T4 disease, and 1 (11%) with stage T3 disease. Lymphatic metastasis and distant metastases were detected in three and one patient(s), respectively<sup>1</sup>. Two patients died due to the recurrence of the tumor in situ<sup>2</sup>; one patient died due to the distant metastasis; M = male; F = female; CT = chemotherapy; RT = radiotherapy; NR = no recurrence; LR = local recurrence; DM = distant metastasis; NERD = no evidence of recurrent disease; DWD = died with the disease; MS = maxillary sinus; PPF = pterygopalatine fossa; PPS = parapharyngeal space; ITF = infratemporal fossa.

**Figure 2: A presentative CT scan of a patient before and after surgery.** The CT images of one presentative patient are shown. The tumor invaded the right frontal, ethmoidal, maxillary sinuses, and the maxilla before surgery (A,B). Postoperative images showed that the tumor has been totally resected and the denture used to reconstruct the hard palate was in position (C,D).

**Figure 3: The quality of life of patients after total maxillectomy. (A)** The University of Washington-QOL (UW-QOL) scores were utilized to assess the QOL after surgery. The domains were scored on a scale ranging from 0 (worst) to 100 (best), focusing on the past 7 days. (Pain:  $91.7 \pm 12.9$ ; Appearance:  $70.8 \pm 18.8$ ; Activity:  $62.5 \pm 13.7$ ; Recreation:  $54.2 \pm 10.2$ ; Swallowing:  $68.3 \pm 22.3$ ; Chewing:  $8.3 \pm 20.4$ ; Speech:  $30.0 \pm 0.0$ ; Taste:  $58.3 \pm 28.6$ ; Saliva:  $63.3 \pm 16.3$ ; Mood:  $66.7 \pm 20.4$ ; Anxiety:  $75.0 \pm 12.2$ ). **(B)** In addition, we asked the patients to choose three of these domains that were the most important to them. Three patients rated appearance as the most important domain, four reported swallowing was important to them, five cared about chewing, while everyone reported speech was the single most important factor to them.

**DISCUSSION:**

In this work, we demonstrated an endoscopic approach to resect the total maxilla. Our results showed that this approach was effective and safe to achieve its goal, which is consistent with previous cadaveric<sup>8</sup> and clinical studies<sup>9</sup>. Nine patients with malignant tumor originated from maxillary sinus were treated with this endoscopic approach. All of their information was recorded, and the length of their follow-up ranged from 2 months to 32 months. During the follow-up period, six of them were alive without recurrence, two of them had local recurrence and died in the fourth and ninth months after surgery, respectively, and one of them died due to progressive cachexia without local recurrence.

In this study, all of the patients were diagnosed at an advanced stage, and the lesions in seven patients had extended to the infratemporal fossa, pterygopalatine fossa, or even the cavernous sinus. Besides total maxillectomy, most of the lesions beyond the maxilla were also resected with endoscopy successfully. However, there were still two patients with local recurrence after surgery, one was recurrent at the foramen rotundum, another was at the soft tissue in the infratemporal fossa, and these recurrent sites are consistent with the report of Deganello et al.<sup>14</sup>. This reminded us of the fact that the lesions located in these areas should be treated more radically.

Health-related quality of life has been increasingly applied as an important outcome parameter of surgery, it refers to the patients' physical, emotional, and social health<sup>15</sup>. The maxilla is located in the center of the face, and it plays an important role in bearing the maxillary teeth, transmitting masticatory forces, giving support to the orbit, and attaching the muscles of facial expression<sup>16</sup>, so the resection of the maxilla will lead to the patient's esthetics and functional disfigurement. To review the impact of the total maxillectomy by the combined endoscopic and transoral approach and our reconstruction method on the patients' QOL, the UW-QOL version 4 questionnaire, which is a comprehensive questionnaire and had been used in head and neck cancer patients, was investigated retrospectively in our study. Three patients died during the follow-up, therefore, the questionnaires were responded by six patients. As shown in **Figure 3A,B**, the procedure of the surgery and the construction method had a significant impact on the patients' chewing and speaking functions while the patients reported that these two domains were the most important domains to them. In our opinion, this might be because most of the patients had lesions in the infratemporal fossa; to resect these lesions, we have to sacrifice the medial pterygoid muscle and lateral pterygoid muscle sometimes, which will influence the chewing and speaking inevitably. In addition, we only used denture to reconstruct the defects in our cases, that would leave a huge cavity and would impact the speech function of the patients. One of the disadvantages of the combined endoscopic and transoral approach is it limited the transplantation of the pedicle flap in the surgical area. Recently, some other reconstruction procedures such as free flaps and three-dimensional printing techniques appear to be helpful to reach the vital functional and aesthetic reconstruction consequences<sup>17-20</sup>. What needs to be pointed out is that, in this work, the QOL was investigated after the denture was used to reconstruct the defects. Thus, we couldn't evaluate the influence of the surgery itself on the patients' QOL and compare it with other total maxillectomy procedures.

There are some tips in the combined endoscopic and transoral approach based on our experience. First, the plasma is extremely useful in this approach. The cutting and hemostasis function of the plasma make it possible to resect and stop the bleeding in the meantime, which will not only reduce the bleeding but also make the anatomical sign easier to be confirmed. Second, the bone and the periosteum should be resected separately, especially for the posterior lateral wall of the maxillary sinus. If the periosteum is not invaded by the tumor, it should be saved to avoid the injury of the contents of the pterygopalatine fossa and infratemporal fossa. To achieve this, the fine emery diamond should be used instead of the rough diamond when the resection is close to the periosteum. Third, before packing, we apply 40 °C warm water to douche the surgical field to check whether there are any potential bleeding points.

To sum up, the combined endoscopic and transoral approach can be applied for total maxillectomy, which can be further extended to resect the tumor in the pterygopalatine fossa and infratemporal fossa using higher visualization potential of endoscopy. However, the facial incision should be performed if the tumor has invaded the facial skin, which is the contraindication of the combined approach. Furthermore, other reconstruction techniques besides denture should also be tried to improve the patients' QOL after surgery.



**ACKNOWLEDGMENTS:**

This work was sponsored by the Shanghai Municipal Commission of health and Family Planning (201740187), Shanghai Science and Technology Committee Foundation (19411950600 and 19441900300), Research Units of New Technologies of Endoscopic Surgery in Skull Base Tumor (2018RU003, Chinese Academy of Medical Sciences), New Technologies of Endoscopic Surgery in Skull Base Tumor: CAMS Innovation Fund for Medical Sciences (CIFMS) (2019-I2M-5-003), National Nature Science Foundation of China for Young Scholars (81300810), Natural Science Foundation of Shanghai (20ZR1410000), National Natural Science Foundation of China (81970856).

**DISCLOSURES:**

The authors have nothing to disclose.

**REFERENCES:**

1. Santos, M. R. et al. Squamous cell carcinoma at maxillary sinus: clinicopathologic data in a single Brazilian institution with review of literature. *International Journal of Clinical and Experimental Pathology*. **7** (12), 8823–8832 (2014).
2. Turner, J. H., Reh, D. D. Incidence and survival in patients with sinonasal cancer: a historical analysis of population-based data. *Head & Neck*. **34** (6), 877–885 (2012).
3. Choi, E. C. et al. Surgical outcome of radical maxillectomy in advanced maxillary sinus cancers. *Yonsei Medical Journal*. **45** (4), 621–628 (2004).
4. Hanna, E. Y. et al. Induction chemotherapy for advanced squamous cell carcinoma of the paranasal sinuses. *Archives of Otolaryngology—Head and Neck Surgery*. **137** (1), 78–81 (2011).
5. Kovacs, A. F., Eberlein, K., Hulsmann, T. Organ preservation treatment using TPF-a pilot study in patients with advanced primary and recurrent cancer of the oral cavity and the maxillary sinus. *Oral and Maxillofacial Surgery*. **13** (2), 87–93 (2009).
6. Sisson, G. A., Sr., Toriumi, D. M., Atiyah, R. A. Paranasal sinus malignancy: a comprehensive update. *The Laryngoscope*. **99** (2), 143–150 (1989).
7. Kreeft, A. M. et al. Preoperative imaging and surgical margins in maxillectomy patients. *Head & Neck*. **34** (11), 1652–1656 (2012).
8. Rivera-Serrano, C. M., Terre-Falcon, R., Duvvuri, U. Combined approach for extensive maxillectomy: technique and cadaveric dissection. *American Journal of Otolaryngology*. **32** (5), 417–421 (2011).
9. Liu, Z. et al. Combined transoral and endoscopic approach for total maxillectomy: a pioneering report. *Journal of Neurological Surgery. Part B, Skull Base*. **74** (3), 160–165 (2013).
10. Pfister, D. G. et al. Head and neck cancers, Version 2.2020, NCCN Clinical Practice Guidelines in Oncology. *Journal of the National Comprehensive Cancer Network*. **18** (7), 873–898 (2020).
11. *TNM classification of malignant tumours*. 8<sup>th</sup> Editon. Wiley-Blackwell. (2017).
12. Akinmoladun, V. I., Akinyamoju, C. A., Olaniran, F. O., Olaopa, O. I. Maxillectomy and quality of life: experience from a nigerian tertiary institution. *Nigerian Journal of Surgery*. **24** (2), 125–130 (2018).
13. Rogers, S. N. et al. The addition of mood and anxiety domains to the University of

Washington quality of life scale. *Head & Neck*. **24** (6), 521–529 (2002).

14. Deganello, A. et al. Endoscopic-assisted maxillectomy: Operative technique and control of surgical margins. *Oral Oncology*. **93**, 29–38 (2019).

15. Weinberger, M., Oddone, E. Z., Samsa, G. P., Landsman, P. B. Are health-related quality-of-life measures affected by the mode of administration? *Journal of Clinical Epidemiology*. **49** (2), 135–140 (1996).

16. Baliarsing, A. S., Kumar, V. V., Malik, N. A., B., D. K. Reconstruction of maxillectomy defects using deep circumflex iliac artery-based composite free flap. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontics*. **109** (3), e8–13 (2010).

17. Moya-Plana, A. et al. Reconstruction of maxillectomy and midfacial defects using latissimus dorsi-scapular free flaps in a comprehensive cancer center. *Oral Oncology*. **99**, 104468 (2019).

18. Jang, W. H. et al. Mirror image based three-dimensional virtual surgical planning and three-dimensional printing guide system for the reconstruction of wide maxilla defect using the deep circumflex iliac artery free flap. *The Journal of Craniofacial Surgery*. **30** (6), 1829–1832 (2019).

19. Kim, S. E., Shim, K. M., Jang, K., Shim, J. H., Kang, S. S. Three-dimensional printing-based reconstruction of a maxillary bone defect in a dog following tumor removal. *In Vivo*. **32** (1), 63–70 (2018).

20. Largo, R. D., Garvey, P. B. Updates in head and neck reconstruction. *Plastic and Reconstructive Surgery*. **141** (2), 271e–285e (2018).

Case	Age	Sex	TNM stage	Pathological diagnosis	Tumor sites	Treatment strategy	Current status/Follow-up(months)	Recurrence site
1	24	M	T4aN0 M0	Chondrosarcoma	MS, ethmoidal sinus, orbital floor, alveolar bone, PPS, PPF, ITF	Surgery + CT + RT	NERD(11)	NR
2	69	M	T4aN0 M0	Squamous cell carcinomas	MS, hard palate	Surgery + CT + RT	NERD(12)	NR
3	18	F	T4aN2 cM0	Adenoid cystic carcinoma	MS, ethmoidal sinus, orbital floor, alveolar bone, PPS, PPF, ITF, hard palate	Surgery + RT	NERD(10)	NR
4	12	M	T4aN2 cM0	Soft tissue sarcoma	MS, alveolar bone, ITF	Surgery + RT	NERD(4)	NR
5	68	M	T4aN0 M0	Squamous cell carcinomas	MS	RT + Surgery	NERD(14)	NR
6	54	M	T3N0 M0	Adenoid cystic carcinoma	MS, ethmoidal sinus, alveolar bone, PPF, hard palate, pterygoid process	Surgery	NERD(32)	NR
7	63	F	T4bN0 M0	Postradiosarcoma	MS, ethmoidal sinus, alveolar bone, orbital floor, PPS, PPF, ITF, hard palate, cheek	Surgery	DWD+LR (4) <sup>1</sup>	PPF, ITF
8	64	F	T4bN2 cM0	Adenoid cystic carcinoma	MS, ethmoidal sinus, orbital floor, alveolar bone, PPS, PPF, ITF, hard palate, pterygoid process	Surgery	DWD+LR (9) <sup>1</sup>	PPF, ITF, PPS, ethmoidal sinus, sphenoid sinus
9	59	F	T4bN2 cM1	Metastasis of breast cancer	MS, cavernous sinus, middle skull base	Surgery + CT + RT	DWD+ DM(2) <sup>2</sup>	NR

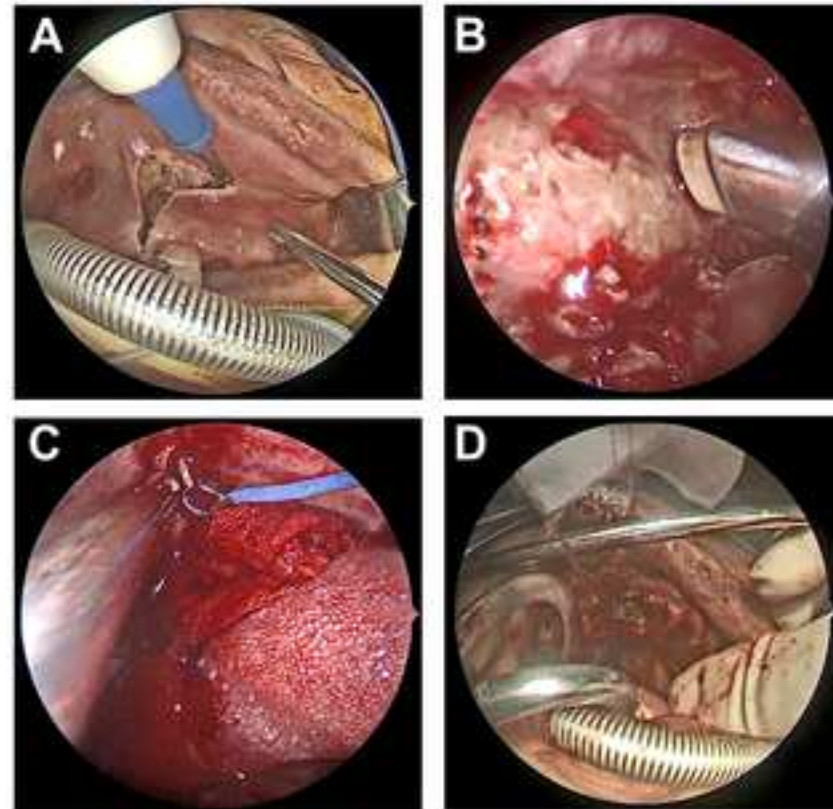
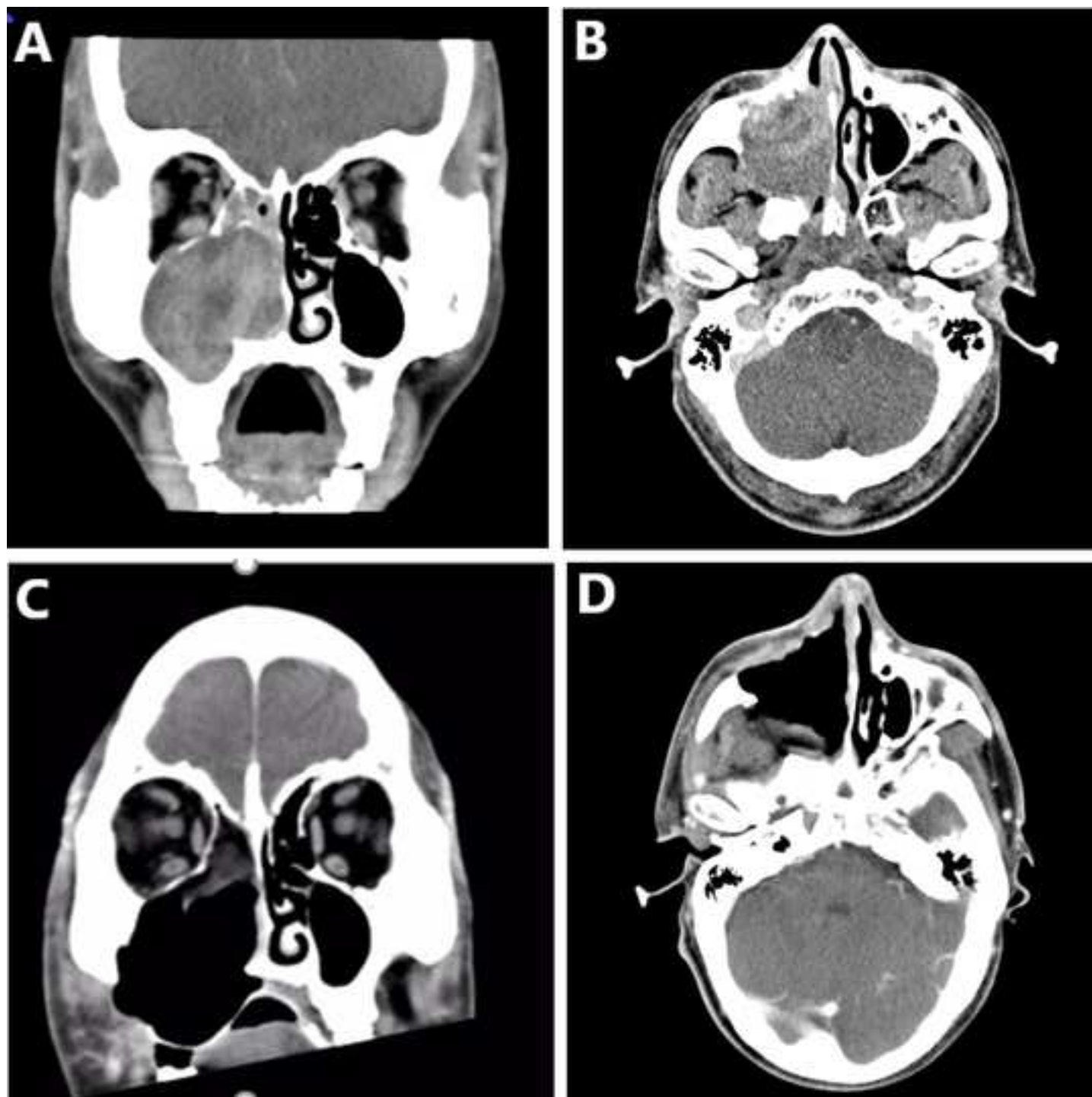
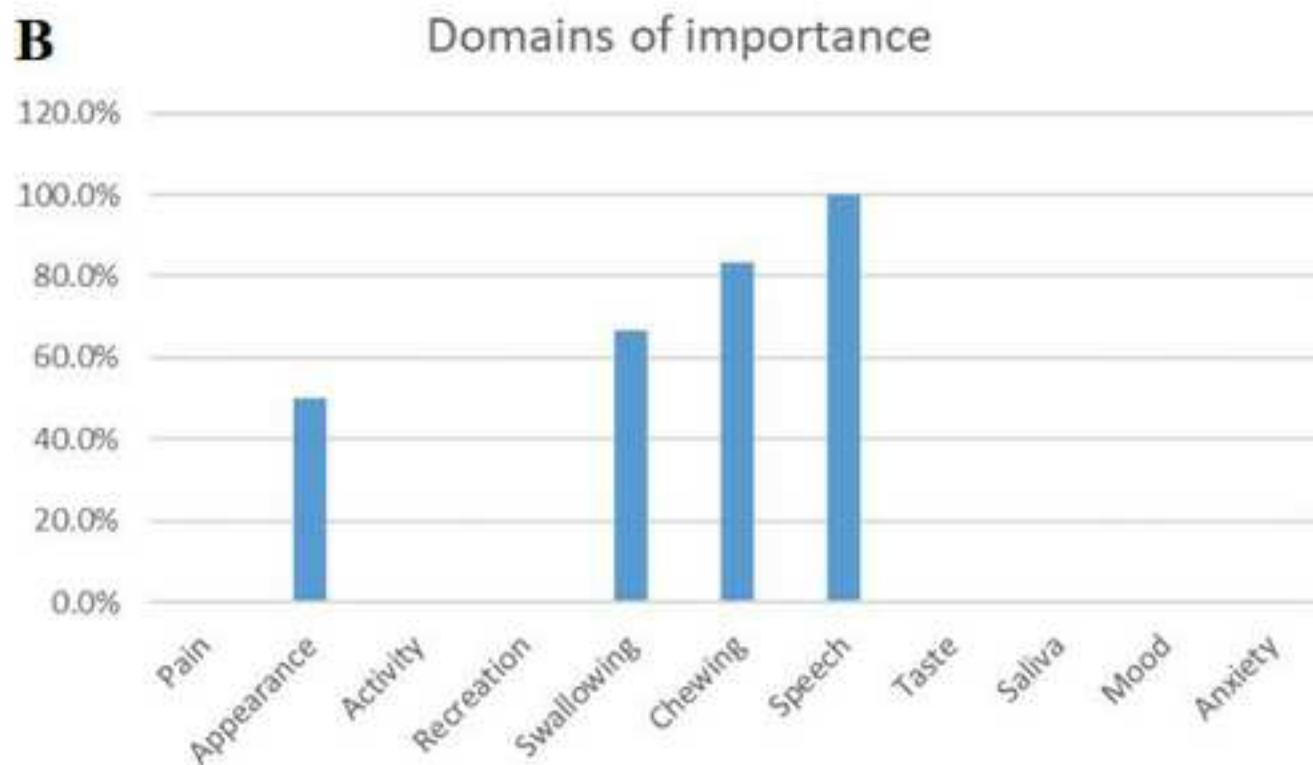
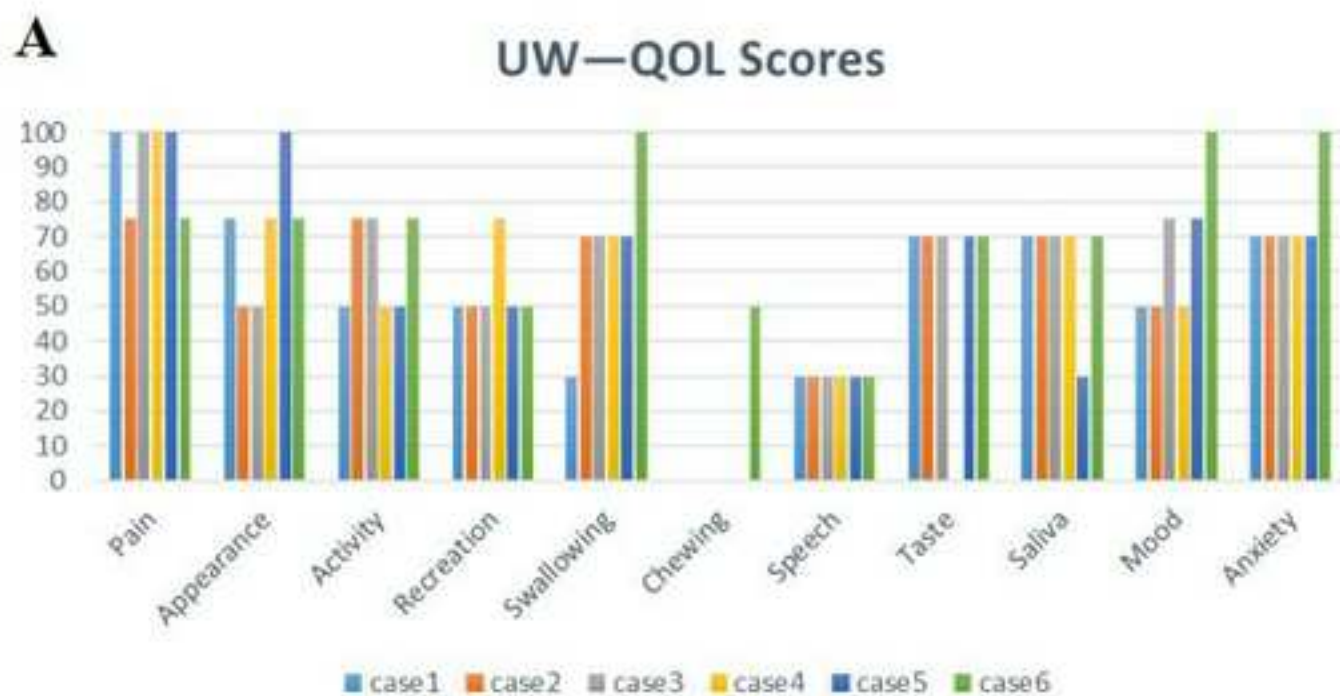


Figure 2

[Click here to access/download;Figure;Fig 2.tiff](#)





Name of Material/ Equipment	Company	Catalog Number	Comments/Description
Carborundum drill	Medtronic, Inc.	REF15BA60D	
Curved sinus blade	Medtronic, Inc.	REF1884006	11 cm x 4 mm
Dynamic planing system	Medtronic, Inc.	REF1898001	
Electrocoagulation	Shanghai Hutong Electronics. Co.,Ltd	GD350-B5	
Epinephrine	Shanghai Harvest Pharmaceutical Co., Ltd	10170405	
Fret Saw Wire Instruments	Shanghai Medical Instruments (Group) Ltd., Corp. Surgical Instruments Factory	N30030	
Gauze	Ningbo Shenyuan Medical Material Co., Ltd		6 cm x 60 cm
Mastoid Retractor	Shanghai Medical Instruments (Group) Ltd., Corp. Surgical Instruments Factory	NH6F090	Length: 16 cm
Mayo scissors	Shanghai Medical Instruments (Group) Ltd., Corp. Surgical Instruments Factory	J22040	Length: 16 cm
Metzenbaum scissors	Shanghai Medical Instruments (Group) Ltd., Corp. Surgical Instruments Factory	JC2514	Length: 25 cm

Nasal Endoscopy	Karl Storz-Endoskope	7230 AA	
Plasma (EVAC 70 Xtra HP With integrated Cable)	Smith & Nephew	EIC5874-01	
Quadcut blade	Medtronic, Inc.	REF1884380HR	4.3 mm
Suction Elevator	Zhejiang Tian Song Medical Products Co., Ltd	B2117.1	Width: 4 mm
Tetracaine	Eye & ENT Hospital of Fudan University	180130	
Trans-Nasal Skull Base Bur	Medtronic, Inc.	REFTN45RCD	13 cm x 4.5 mm





---

Ke-qing Zhao M.D., Ph.D.

Division of Rhinology and Sinus Surgery

Department of Otorhinolaryngology-Head & Neck Surgery

Eye & ENT Hospital, School of Shanghai Medicine, Fudan University

We are submitting a revised version of our manuscript with the title of “Combined Endoscopic and Transoral Approach for Total Maxillectomy” (JoVE61785R1). We would like to thank the editor and the reviewers for their insightful comments and have addressed their critiques in the revised manuscript. All changes are highlighted with blue text. Below are our point-to-point responses to the reviewers’ comments or questions.

Editorial comments:

1. Title made concise. Please check and approve. The manuscript needs a thorough proofreading.

R: Thanks for your editing, the new title is better than the old one. Following the editor’s suggestion, we have proofread the manuscript.

2. Reworded please check.

R: Thanks for your editing, we have checked the revised sentence.

3. Reworded please check. What was performed? Please bring out clarity.

R: Thanks for your editing, we have checked the revised sentence. Following the editor’s suggestion, we have revised lines 30-32 in the original version.

4. Anesthesia steps cannot be filmed.

R: Thanks for your reminding.

5. How is this done?

R: Thanks for your question. we have revised the sentence to show the sterilization step (Line 84).

6. Notes cannot be filmed.
-



---

R: Thanks for your reminding.

7. How do you identify this?

R: Thanks for your question. We identified if the infraorbital nerve was involved by the tumor based on the MRI and CT scan pre-surgery and confirmed it in the surgery.

8. How do you visually identify these?

R: Thanks for your question. After we wiped off the anterior bony wall of the maxilla, we will see the periosteum and mucosa under it. The periosteum and mucosa should be very obvious if it is not involved by the tumor.

9. As we are a methods journal, please ensure that the Discussion explicitly cover the following in detail in 3-6 paragraphs with citations:

- a) Critical steps within the protocol
- b) Any modifications and troubleshooting of the technique
- c) Any limitations of the technique
- d) The significance with respect to existing methods
- e) Any future applications of the technique

Some of the details as currently written can be moved to the introduction section.

R: According to your suggestion. We have revised the introduction and the discussion.

### **Reviewers' comments:**

Reviewer #5:

Minor Concerns:

The advantages of this approach are well described in the text, but in my opinion, the possible limitations, disadvantages and contraindications are not sufficiently discussed. Only a brief listing of these issues would increase the quality of the work.

R: Thanks for your reminding. We added the sentences of "One of the disadvantages of the combined endoscopic and transoral approach is it limited the transplantation of the pedicle flap the surgical area" (Line 277-278) and "However, the facial incision should be performed, If the tumor has invaded the



---

facial skin, which is the contraindication of the combined approach” (298-300) in the discussion section to describe the limitation, disadvantage and contraindication of the combined approach.

# AJESCI

## EDITORIAL CERTIFICATE

This document certifies that the manuscript listed below was edited for proper English language, grammar, punctuation, spelling, and overall style by one or more of the highly qualified native English speaking editors at AJESCI.

### Manuscript

Endoscopic total maxillectomy: a precise approach to resect the total maxilla  
Batch-to-batch Quality Control of Seven Constituents in Chenxiang Huaqi Tablets Based on Network Pharmacology

### Authors:

Lun Xu, Ke-qing Zhao, Hong-meng Yu

### Date Issued:

September 06 2020

This document certifies that the manuscript listed above was edited for proper English language, grammar, punctuation, spelling, and overall style by one or more of the highly qualified native English speaking editors at AJESCI. Neither the research content nor the authors' intentions were altered in any way during the editing process. Documents receiving this certification should be English-ready for publication; however, the author has the ability to accept or reject our suggestions and changes. If you have any questions or concerns about this edited document.

AJESCI provides a range of editing, translation and manuscript services for researchers and publishers around the world. Our top-quality PhD editors are all native English speakers from America's top universities. Our editors come from nearly every research field and possess the highest qualifications to edit research manuscripts written by non-native English speakers. For more information about our company, services and partner discounts please visit [www.aje-cn.com](http://www.aje-cn.com).