

Application of “parachute” technique for free flap reconstruction in advanced tongue cancer after ablation without lip-jaw splitting

A retrospective case study

Chin-Jui Liu, MD^{a,b}, Ku-Hao Fang, MD^c, Chang-Cheng Chang, MD, PhD^{d,e,*}, Erh-Ti Lin, MD^d, Geng-He Chang, MD^b, Jen-Hsiang Shen, MD^f, Yu-Tsung Chen, MD^g, Yao-Te Tsai, MD^b

Abstract

The hemi or subtotal/total glossectomy is usually approached by lip-jaw splitting procedure for advanced tongue cancer ablation. This highly invasive procedure can cause facial disfiguration, bone malunion, and osteoradionecrosis. The aim of this study is to compare the surgical outcome in free flap tongue reconstruction between novel parachute technique in an intact jaw and the conventional lip-jaw splitting procedure after tongue cancer ablation.

In this study, parachute technique was adopted for free flap inset in patients without mandibulotomy. We retrospectively reviewed patients who have received primary advanced tongue cancer resection and free flap reconstruction during April, 2008 to January, 2015. Patients were divided into 2 groups. Group A was undergoing parachute technique without lip-jaw splitting. We sutured all the strings through the edges of defect in the first step and through the matching points of flap margin in the second step from outside the oral cavity. Then, the strings were pulled and the flap was parachuted down on the defects after all the matching points were tied together. In group B, the patients received conventional lip-jaw splitting procedure. Student *t* test was used for results analysis.

There were 15 patients (n=15) in group A and 15 patients (n=15) in group B. In the patients receiving parachute technique, operation time showed 34 minutes ($P=.49$) shorter, hospital stay showed 4 days ($P=.32$) shorter, and the infection rate of surgical site showed 6.6% ($P=.64$) less than with conventional technique. The survival rates of the flaps were both 100% without revision.

The parachute technique is an effective and more accessible method for free flap setting in cases of tongue reconstruction without lip-jaw splitting, and provides patients with better aesthetic appearance.

Abbreviations: ALT = anterior lateral thigh, TORS = transoral robotic surgery.

Keywords: free flap reconstruction, parachute technique, tongue cancer

1. Introduction

The advanced tongue cancer ablation is usually approached midline by lip splitting with conjunction of a mandibulotomy.^[1] This approach was supported due to adequate tumor clearance

and better surgical field.^[2] However, such an intensive splitting procedure including destruction of lip, chin, oral mucosa, orbicularis oris muscle, and mandible bone can cause lots of related complications such as nerve injury, inadvertent fracture of the osteotomy segment, malocclusion, fistula, wound dehiscence, and infection. In addition, the patients in advanced stage who need radiotherapy can suffer from irradiation scar contracture, which may cause functional impairment such as limited mouth opening and poor saliva control.^[3–5] Due to the drawbacks, some otolaryngologists and oral surgeons tend to preserve the jaw intact instead of destroying of the structure to avoid the excessive damages, like the pull-through technique, as demonstrated by Lim and Choi.^[6]

Reconstruction with microvascular free flap has become the gold standard for after oral cancer ablation,^[7] but we experienced the technique challenge for flap setting in such a deep and narrow space after advanced tongue cancer ablation without any lip and jaw structure splitting. The process of inset when a flap was dropped into oral cavity is difficult to catch the matching point from flap to defect due to limited visual field. For better vision, repeated flap manipulation and stretch are usually inevitable and can possibly cause the kink or injury of vessels. Furthermore, the mismatched suture points can cause cosmetic dog-ear or prolonged mucosal healing. Herein, we were inspired by the suture technique of blood vessels^[8] and aortic valve replacement,^[9] which provide the great notion in performing suture in a narrow operation field and preventing mismatched

Editor: Yan Li.

The authors have no funding and conflicts of interest to disclose.

^a Department of Otolaryngology, An-Nan Hospital, China Medical University, Tainan, ^b Department of Otolaryngology-Head and Neck Surgery, Chang Gung Memorial Hospital, Chiayi, ^c Department of Otolaryngology-Head and Neck Surgery, Chang Gung Memorial Hospital, Taoyuan, ^d School of Medicine, College of Medicine, China Medical University, ^e Department of Plastic and Reconstructive Surgery, China Medical University Hospital, Taichung, ^f Department of Ophthalmology, Chang Gung Memorial Hospital, Taoyuan, ^g Department of Dermatology, Shuang Ho Hospital, Taipei, Taiwan (R.O.C.).

* Correspondence: Chang-Cheng Chang, No. 91, Hsueh-Shih Road, Department of Plastic and Reconstructive Surgery, China Medical University Hospital, Taichung, Taiwan 40402, Republic of China (e-mail: changcc1975@gmail.com).

Copyright © 2019 the Author(s). Published by Wolters Kluwer Health, Inc. This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial License 4.0 (CCBY-NC), where it is permissible to download, share, remix, transform, and buildup the work provided it is properly cited. The work cannot be used commercially without permission from the journal.

Medicine (2019) 98:33(e16728)

Received: 20 August 2018 / Received in final form: 13 May 2019 / Accepted: 14 July 2019

<http://dx.doi.org/10.1097/MD.00000000000016728>

suture. Thus, we apply “parachute technique” from cardiovascular field into our intraoral field to overcome such a difficulty.

The aim of this study is to compare the parachute technique in free flap tongue reconstruction in an intact jaw with the conventional lip and jaw splitting procedure after tongue cancer ablation. The study was approved by the Institutional Review Board of Chang Gung Memorial Hospital (IRB: 102-0493B).

2. Patients and methods

We conducted a retrospective review of all patients who received primary advanced tongue cancer resection and free flap reconstruction at the Chang Gung Memorial Hospital, Chia-Yi during the period of January, 2008 to January, 2014. All the reconstruction procedure was done by 1 senior microsurgeon. The cases who received previous oral surgery, irradiation, or had recurrence, or combined with other oral cancer, were excluded. Patients were divided into 2 groups by otolaryngologists mainly based on the location of the tongue cancer. From January, 2008 to January, 2014, there had been 30 individuals ($n=30$) who had received advanced tongue cancer resection and flap reconstruction in our hospital. There are 5 females and 25 males. Among them, 15 individuals received the “parachute technique” and classified as group A. The other 15 individuals received the conventional “lip-jaw splitting technique” and classified as group B. All the patients in group A and group B received more than hemi-glossectomy. Most of them are stage III or IV with tumor larger than 4 cm in the greatest dimension or nodal metastasis according AJCC 2018. However, 1 case with T1 stage had also been enrolled in group B, and this is due to the preoperative biopsy showing sarcoma. Based on the pathological classification, we performed near total glossectomy.

In group A, we applied “parachute technique” without lip-jaw splitting procedure for reconstruction. The technique started from suturing all the strings through the edges of defect in the first step and then passing each strings through the matching points of flap margin from outside the oral cavity in the second step. Then,



Figure 2. The parachute technique started from passing the unlocked strings through the edges of the tongue and mouth floor defect in a round circle. (asterisk indicates the defect).

the strings were pulled and the flap was parachuted down on the defects after all the matching points were tied together. In group B, the patients received conventional lip-jaw splitting procedure and flap reconstruction (Fig. 1). Demographics, operative time, safe margins, flap survival rate, and the wound infection rate between 2 groups were compared using Student *t* test. Statistical significance was defined as $P < .05$. Between these 2 groups, there are no significant differences in age (A: 55.86 ± 10.48 years, B: 49.53 ± 12.19 years; $P = .861$) and sex.

2.1. Surgical technique for “parachuting” a flap

The tongue cancer lesion and neck lymph nodes were ablated through the neck horizontal incision with 8 cm in length by otolaryngologist. The flap dissection had then been done. The parachute technique started from passing the unlocked strings through the edges of the tongue and defect of mouth floor in a round circle (Fig. 2). We clamped the unlocked string in 1 long and the other short head ends. The long head of string we marked on purpose was going to be connected to the corresponding

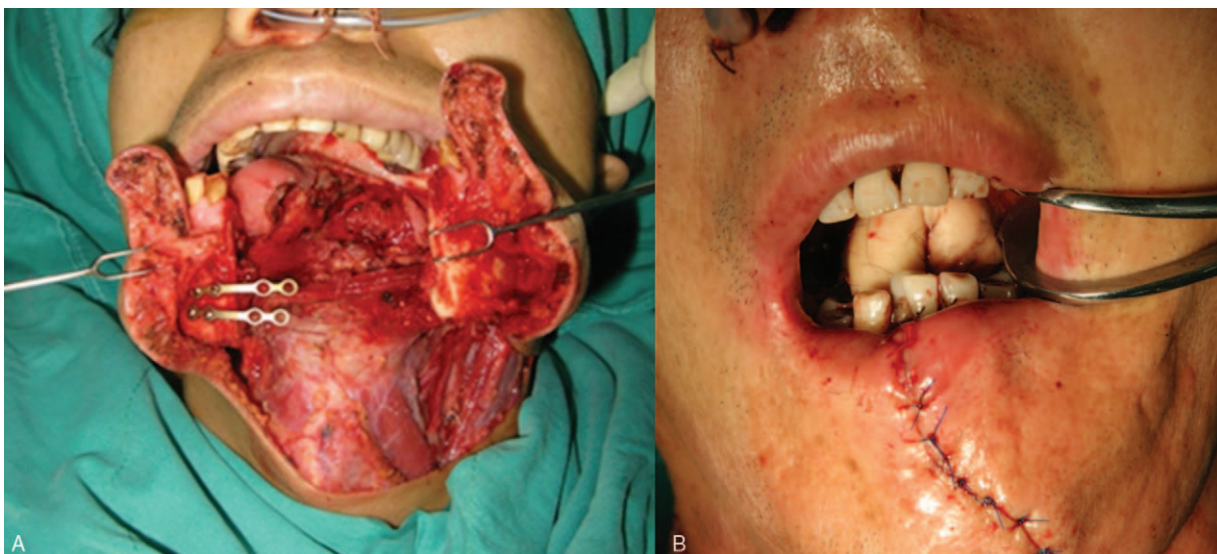


Figure 1. (A) In this patient, he received tongue cancer excision with lip-jaw splitting procedure for better operation field. (B) After the surgery, the patient may suffer from bone malunion, improper occlusal plane, and scar contracture due to the intensive procedure.

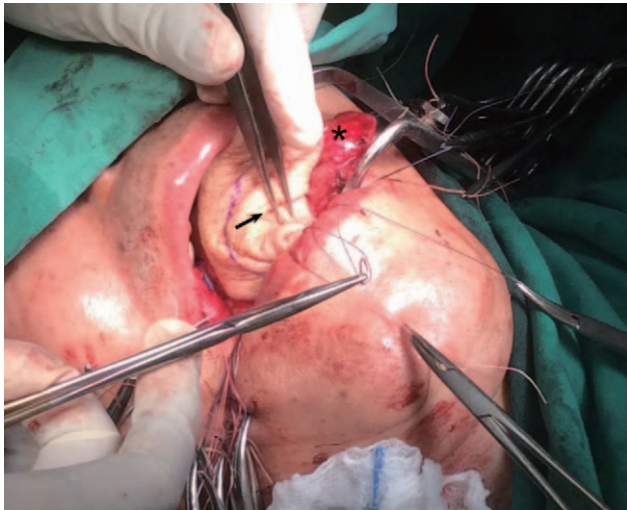


Figure 3. Direct good vision assures that the edge of flap and defect could be matched precisely (asterisk indicates the defect; arrow indicates the flap).

points of the transferred flap later. Two colors of strings (blue next to white) were used to make each suture lines easier to identify. The adjacent mosquito clamps were divided into right and left areas for clamping the strings, and was hanged into 2 pean-clamp teeth one by one in order. Then, the pedicle of radial forearm or anterolateral thigh (ALT) flap was put gently after saline irrigating into a protective rubber sheath which was going to be pulled through an intra-nuchal tunnel to reach for the recipient vessels such as superior thyroid vessels. Once the pedicle reaches the neck region, the sheath was then removed. The long ends of blue or white strings were passed into the corresponding points on the flap margins one by one. The surgeon can have a direct good vision to assure the edge of flap and defect could be matched precisely (Fig. 3). So far, all the sutures were processed from outside the oral cavity. In the final step, once all the unlocked strings were correctly connected to the corresponding points of flap margins with the defect edges, we locked in and pulled the strings down, letting the flap parachute down on the defect along the strings. And then, we could make edge-to-edge flap and mucosa sutures to the defect (Fig. 4). The structure of lip and jaw was completely reserved after such extensive cancer ablation and free flap reconstruction, without any facial scar (Fig. 5).

3. Results

From January, 2008 to January, 2014, there had been 30 patients ($n=30$) who had received advanced tongue cancer resection and flap reconstruction in our hospital. The parameters of care including operation time (A: 627.13 ± 112.43 minutes, B: 661.33 ± 152.35 minutes; $P=.49$) and hospital stay (A: 26.20 ± 7.25 days, B: 30.06 ± 13.04 days; $P=.32$) showed improvement in group A. There is also improvement in infection rate between the 2 groups (A: 13%, B: 20%; $P=.64$). Surgical efficacy in tumor-free resection had been noted statistical difference, and this part will be discussed later (tumor-free margin: A: 11.66 ± 3.53 mm, B: 7.80 ± 4.05 mm; $P=.01$). The flap survival rates are both 100% without revision (Table 1).



Figure 4. Edge-to-edge flap and mucosa sutures to the defect is made by "parachute technique" (asterisk indicate the residual tongue; arrow indicates the flap).

4. Discussion

The reconstructive goal of head and neck cancer surgery should not only be focused on rebuilding anatomic continuity, minimizing the complications for wound healing, achieving



Figure 5. After tongue cancer resection with free flap reconstruction adopting parachute technique without lip-jaw-splitting, the lip and jaw were completely reserved without facial disfigurement and scar formation. (B) This patient recovered well and spared the possibilities of bone malunion and scar contracture after the surgery.

Table 1
Comparisons of clinical outcomes between “parachute technique” group and conventional lip-jaw splitting group.

	Group A	Group B	P
Age (y)	55.86 ± 10.48	49.53 ± 12.19	.14
Operation time (min)	627.13 ± 112.43	661.33 ± 152.35	.49
Hospital stay interval (d)	26.20 ± 7.25	30.06 ± 13.04	.32
Tumor-free margin (mm)	11.66 ± 3.53	7.80 ± 4.05	.01
Flap survival rate	100%	100%	
Infection rate	13.33%	20.00%	.64

Group A: parachute technique; group B: conventional technique.

on-time oncologic therapy, but the functional restoration. Any residual visual or functional deficit may bring psychological impact and social disability. As above, the head and neck cancer surgeons hope to excise the tumor with enough safe margin, but destruct the structure of the face as less as possible, just like cardiovascular surgeons developing novel technique to prevent injury to the heart.^[9] The less damage we cause in the process of operation, the less possibilities nerve injuries, inadvertent fracture of the osteotomy segment, malocclusion, fistula, wound dehiscence, and infection are made.^[10] In addition, to take aesthetic and psychological aspects into consideration, the facial scar will affect patient’s psychological health and interpersonal relationship. People with facial disfigurement are often stigmatized for appearing different than “normal”^[11] and may be considered “dysfunctional” by others.^[12–14] In these series, we demonstrated the oncological safety in such a facial non-scar procedure. Apart from this, the parachute flap technique provides a great access when we face the difficulty of reconstruction due to narrow operation field in these series. Our results show that there are several advantages. Firstly, we performed the suture of the flap to the defect completely from outside the oral cavity instead of working in a narrow deep space, which could explain the reduction of the operation time in patients receiving parachute technique. The broader operative vision assists us to minimize inappropriate manipulation of the flap, such as overstretching, twisting, or kinking of the pedicle or perforator. Secondly, accurate edge-to-edge matches from flap margin to defect can be done and consequently enhance the wound healing process and further prevent the saliva leakage from the mouth floor to the neck, which could explain the reduction of the infection rate in patients receiving parachute technique. The similar rationale was applied in operations for colorectal anastomosis with lower postoperative complications.^[15] The intact lip and jaw structure and the shorter healing duration of the skin-to-mucosal flap also could explain why the parachute technique presented with lower infection rate of surgical site and hospital stay. Thirdly, no iatrogenic facial wound was made, and hence no accompanying contracture followed with. Also, mandibular bone was kept intact, which decreases the possibility of intractable osteoradionecrosis. Last, but also important, this procedure requires no extra medical expenditure and no steep learning curve compared with robotic-assisted surgery.

In Taiwan, many patients have betel quid chewing habit, which caused submucosal fibrosis and subsequent trismus of oral cavity.^[16] The trismus will increase the difficulty of intraoral suture technique. Our method provides a good solution especially to this condition, and also provides a good edge-to-edge wound suture. To suture the flap before “pull-up,” the tongue in the oral cavity may cause tissue distortion, and it pays much effort to

perform water-seal mucosa-flap skin edge suture in conventional method. With our method, to perform the flap suture from outside the oral cavity with the connecting strings will be more accessible for surgeons to complete the subsequent edge-to-edge flap and mucosa sutures to the residual tongue more ergonomically and provides good outcomes.

Since mandibulotomy is not done in this technique, the surgical field is limited, and we prefer to perform the flap suture to the root of tongue through the oral cavity rather than through the tunnel from the neck region. Compared with parachute method, “pull-through” method may cause more stretch force on the pedicle vessel after flap suture when the tongue is lifted up into the oral cavity. In contrast, our parachute method can protect and minimize the possibility of damage of pedicle vessels because the pedicle passes through the tunnel before the flap suture. Therefore, in our opinion, parachute technique is more accessible for the surgeon to perform water-seal mucosa-flap skin edge suture and get expected surgical outcomes.

With the development of robotic-assisted surgery, to operate in the narrow operation field seems to become an enjoyable procedure. O’Malley et al have reported the potential of transoral robotic surgery (TORS) in head and neck tumors in preclinical and early clinical studies in 2006. Nowadays, much experience had been mentioned in using TORS to do tumor excision and reconstruction in head and neck area, and these also showed great outcomes in the disease control, organ function, and quality of life.^[17–21] However, some research showed the operational time for TORS is longer than conventional methods,^[22,23] which was mainly a result of raising the flap and creating the working space. Although the TORS gives us a great solution to overcome the narrow operation field in the oral cavity, it requires much more medical expenditure than the manual operation, and also needs the doctors to overcome the steep learning curve.^[24–26]

The parachute technique is not only applied to tongue reconstruction. Theoretically, it can also be broadly applied for any other flap surgeries performed in a narrow and deep space. Apart from the bulky flap-like ALT and thin flap-like radial forearm we demonstrate, this technique can be fit any other type of flaps. Pectoralis major myocutaneous (PMMC) flap is still playing a role in head and neck cancer reconstruction.^[27–30] The bulkiness of this flap can increase the difficulty of flap inset. The “reverse upward” parachute technique can also be a good solution once we face this situation in our practice for a mouth floor reconstruction.

The tumor-free resection margin had been noted statistically difference between these 2 groups. During the surgery, the otolaryngologist performed 1.5 cm resection margin from the tumor in all patients. However, we still encountered with the close margin problem. The situation may relate to the specimen shrinkage after formaldehyde fixation, microscopic satellite lesion, and the location of the primary tumor. In group B, the primary tumor location of some cases extended to the tongue base, parapharyngeal wall, and masticator space. The very advanced cancer status in these cases caused surgical difficulty and less tumor-free resection margin due to anatomy limitation.^[31–33] Also, in these patients, we may not get enough free margin, no matter using which kind of surgical approach. After discussion of these cases in the head and neck cancer conference, we transferred them to oncologic ward for further chemoradiotherapy, if needed. The decision of the management is based on National Comprehensive Cancer Network treatment guideline.

We did not use any scale to evaluate the aesthetic outcome because the aesthetic comparison for facial appearance between

these 2 surgical methods were nonscarring versus scarring, rather than scarless versus apparent scar. We believe the patients in group A can avoid from scar pain and itching during recovery and get rid of skin dyspigmentation and scar contracture after recovery.

Certain limitation should be considered when evaluating the findings from this study. If the tumor is located posteriorly and may not achieve the proper and wider excisional tumor-free margin for the oncologic safety, the otolaryngologists would split the lip and jaw to get better vision for resection, which could possibly affect operative time because the extra time would be spent on splitting and fixation. The study did not evaluate or compare the postoperative tongue function because the functional performance is mainly related to the intensity of cancer invasion, the irradiation therapy, possible flap choice, and the compliance of rehabilitation.^[34–36] It cannot purely contribute to the procedure of splinting the jaw or not. There was no data provided for follow-up after the hospitalization.

The facial scar will affect the quality of life and human relationship, which had been well studied in the other literatures.^[37,38] But the oncological safety is still the first priority for any cancer ablation surgery. Once we face the advanced cases with tumor involving or nearly invading the adjacent skin or bone, the parachute method and lip-jaw-preserving procedure cannot be adopted even though the anesthetic and wound healing outcome are considered.

5. Conclusions

The intact structures of lip and jaw let the patients avoid the annoyance of scar formation and also let them have no scar on the face. The parachute technique makes us overcome the difficulty of sutures in a narrow operation field in oral cavity with accurate flap inset while possibly shortening the operation time, reducing infection rate, and decreasing hospital stay.

Acknowledgment

We would like to thank Dr Joe Chi-Cheng Fang of Greenslopes Private Hospital, Australia, for his assistance in editing the manuscript.

Author contributions

Conceptualization: Chin-Jui Liu, Yao-Te Tsai.

Data curation: Chin-Jui Liu, Erh-Ti Lin, Jen-Hsiang Shen.

Formal analysis: Yu-Tsung Chen.

Methodology: Chang-Cheng Chang, Geng-He Chang.

Project administration: Erh-Ti Lin.

Resources: Chang-Cheng Chang.

Software: Erh-Ti Lin.

Supervision: Ku-Hao Fang, Chang-Cheng Chang, Geng-He Chang, Yao-Te Tsai.

Visualization: Erh-Ti Lin, Geng-He Chang.

Writing – original draft: Chin-Jui Liu.

Writing – review & editing: Chin-Jui Liu, Chang-Cheng Chang, Erh-Ti Lin, Yu-Tsung Chen, Yao-Te Tsai.

References

[1] Calabrese L, Giugliano G, Bruschini R, et al. Compartmental surgery in tongue tumours: description of a new surgical technique. *Acta Otorhinolaryngol Ital* 2009;29:259–64.

- [2] Devine JC, Rogers SN, McNally D, et al. A comparison of aesthetic, functional and patient subjective outcomes following lip-split mandibulotomy and mandibular lingual releasing access procedures. *Int J Oral Maxillofac Surg* 2001;30:199–204.
- [3] Eisen MD, Weinstein GS, Chalian A, et al. Morbidity after midline mandibulotomy and radiation therapy. *Am J Otolaryngol* 2000; 21:312–7.
- [4] Dziegielewski PT, Mlynarek AM, Dimitry J, et al. The mandibulotomy: friend or foe? Safety outcomes and literature review. *Laryngoscope* 2009;119:2369–75.
- [5] Altman K, Bailey BM. Non-union of mandibulotomy sites following irradiation for squamous cell carcinoma of the oral cavity. *Br J Oral Maxillofac Surg* 1996;34:62–5.
- [6] Lim YC, Choi EC. Unilateral, clinically T2N0, squamous cell carcinoma of the tongue: surgical outcome analysis. *Int J Oral Maxillofac Surg* 2007;36:610–4.
- [7] Brunnicardi F, Andersen D. Chapter 45 Plastic and Reconstructive surgery. Schwartz Surgery, 9th ed.
- [8] Zannis K, Mitchell-Heggs L, Di Nitto V, et al. Correction of anterior mitral prolapse: the parachute technique. *J Thorac Cardiovasc Surg* 2012;143:S24–8.
- [9] Watanabe G, Ushijima T, Tomita S. Revival of continuous suture technique in aortic valve replacement in patient with aortic valve stenosis. *Innovations* 2011;6:311–5.
- [10] Na H-Y, Choi E-J, Choi E-C, et al. Modified mandibulotomy technique to reduce postoperative complications: 5-year results. *Yonsei Med J* 2013;54:1248–52.
- [11] Goffman E. Stigma: Notes on the Management of Spoiled Identity. Englewood Cliffs: Prentice-Hall; 1963.
- [12] Borah GL, Rankin MK. Appearance is a function of the face. *Plast Reconstr Surg* 2010;125:873–8.
- [13] Kim YJ, Park JW, Kim JM, et al. The functionality of facial appearance and its importance to a Korean population. *Arch Plast Surg* 2013;40:715–20.
- [14] Sobanko Joseph F, Sarwer David B, Zvargulis Zinta, et al. Importance of physical appearance in patients with skin cancer. *Dermatol Surg* 2015;41:183–8.
- [15] Mousavi SR, Mehdikhah Z, Kavyani A. Fish mouth and parachute surgical technique for Hirschsprung's disease. *Dis Colon Rectum* 2008;51:1559–61.
- [16] Chiu CJ, Chang ML. Interaction of collagen-related genes and susceptibility to betel quid-induced oral submucous fibrosis. *Cancer Epidemiol Biomarkers Prev* 2002;11:646–53.
- [17] De Almeida JR, Genden EM. Robotic assisted reconstruction of the oropharynx. *Curr Opin Otolaryngol Head Neck Surg* 2012;20:237–45.
- [18] Genden Eric M, Kotz Tamar, Tong Charles CL, et al. Transoral robotic resection and reconstruction for head and neck cancer. *Laryngoscope* 2011;121:1668–74.
- [19] Mukhija Vijay K, Desai Shaun C, Wanna George, et al. Transoral robotic assisted free flap reconstruction. *Otolaryngol Head Neck Surg* 2009;140:124–5.
- [20] Bonawitz SC, Duvvuri U. Robotic-assisted FAMM flap for soft palate reconstruction. *Laryngoscope* 2013;123:870–4.
- [21] Garfein ES, Greaney PJJr, Easterlin B, et al. Transoral robotic reconstructive surgery reconstruction of a tongue base defect with a radial forearm flap. *Plast Reconstr Surg* 2011;127:2352–4.
- [22] Lee HS, Kim WS, Hong HJ, et al. Robot-assisted supraomohyoid neck dissection via a modified face-lift or retroauricular approach in early-stage cN0 squamous cell carcinoma of the oral cavity: a comparative study with conventional technique. *Ann Surg Oncol* 2012;19:3871–8.
- [23] Kim WS, Byeon HK, Park YM, et al. Therapeutic robot-assisted neck dissection via a retroauricular or modified facelift approach in head and neck cancer: a comparative study with conventional trans cervical neck dissection. *Head Neck* 2015;37:249–54.
- [24] Turchetti G, Palla I, Pierotti F, et al. Economic evaluation of da Vinci-assisted robotic surgery: a systematic review. *Surg Endosc* 2012;26:598–606.
- [25] White Hilliary N, Frederick John, Zimmerman Terence, et al. Learning curve for transoral robotic surgery: a 4-year analysis. *JAMA Otolaryngol Head Neck Surg* 2013;139:564–7.
- [26] Huang JJ, Wallace C, Lin JY, et al. Two small flaps from one anterolateral thigh donor site for bilateral buccal mucosa reconstruction after release of submucous fibrosis and/or contracture. *J Plast Reconstr Aesthet Surg* 2010;63:440–5.

- [27] Lal D, Cain RB. Updates in reconstruction of skull base defects. *Curr Opin Otolaryngol Head Neck Surg* 2014;22:419–28.
- [28] Patel K, Lyu DJ, Kademani D. Pectoralis major myocutaneous flap. *Oral Maxillofac Surg Clin North Am* 2014;26:421–6.
- [29] Gadre KS, Gadre P, Sane VD, et al. Pectoralis major myocutaneous flap: still a workhorse for maxillofacial reconstruction in developing countries. *J Oral Maxillofac Surg* 2013;71:2005.
- [30] Metgudmath RB, Metgudmath AR, Metgudmath VV, et al. Versatility of pectoralis major myocutaneous flap in oncosurgery and its role in developing countries. *Indian J Otolaryngol Head Neck Surg* 2013;65:80–4.
- [31] Meier JD, Oliver DA, Varvares MA. Surgical margin determination in head and neck oncology: current clinical practice. The results of an international American Head and Neck Society member survey. *Head Neck* 2005;27:952–8.
- [32] Bradley PJ, MacLennan K, Brakenhoff RH. Status of primary tumour surgical margins in squamous head and neck cancer: prognostic implications. *Curr Opin Otolaryngol Head Neck Surg* 2007;15-2:74–81.
- [33] Baddour HMJr, Magliocca KR, Chen AY. The importance of margins in head and neck cancer. *J Surg Oncol* 2016;113:248–55.
- [34] Fang QG, Shi S, Zhang X, et al. Assessment of the quality of life of patients with oral cancer after pectoralis major myocutaneous flap reconstruction with a focus on speech. *J Oral Maxillofac Surg* 2013;71:2004.e1–5.
- [35] Stecewicz M, Wysocki R, Halczy-Kowalik L. Pronunciation and swallowing in patients with tongue deficits following resection of oral cavity tumor. *Ann Acad Med Stetin* 2006;52:97–106.
- [36] Sun J, Weng Y, Li J, et al. Analysis of determinants on speech function after glossectomy. *J Oral Maxillofac Surg* 2007;65:1944–50.
- [37] Hunter TA, Medved MI, Hiebert-Murphy D, et al. Put on your face to face the world”: women’s narratives of burn injury. *Burns* 2013;39:1588–98.
- [38] Parry I, Sen S, Palmieri T, et al. Nonsurgical scar management of the face: does early versus late intervention affect outcome? *J Burn Care Res* 2013;34:569–75.