Case report

Simplified technique of palatal augmentation prosthesis to increase swallow efficiency in a partial glossectomy patient: a case report

Wisarut Prawatvatchara, Atikom Surintanasarn, Niyom Thamrongananskul

Abstract

Rehabilitation of glossectomy patients can be more effective with a palatal augmented prosthesis (PAP) which substitutes space lost from surgery by increasing the thickness of palatal side of the prosthesis. There are several techniques for fabrication of PAP but this article presents a method that can save time and provide high efficiency for making a tongue impression during a patient's swallowing with irreversible hydrocolloid impression material. The tongue plaster model was produced; then PAP was fabricated in laboratory. The patient could swallow better after delivering this prosthesis. Moreover, wearing the prosthesis helped increase the patient's self-confidence.

Key words: PAP, Glossectomy, Palatal augmentation, Swallowing

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Introduction

Partial or Total glossectomy is a surgery that affects the functions of the tongue, related to chewing, pronouncing, and swallowing. Abnormal swallowing may cause aspiration-related pneumonia and life-threatening accident.[1]

The more the tongue is removed, the more swallowing efficacy decreases.[2] Furthermore, it can affect respiratory system, confidence and socializing.[3, 4]

Rehabilitation with palatal augmentation prosthesis (PAP) is aimed to restore the tongue functions in glossectomy patients, which can greatly improve their quality of life.

The principle of PAP is to modify the shape of palatal surface of prosthesis by increasing the thickness and reshaping palatal vault to match the range of the tongue functions such as swallowing and speaking[5] (Figure 1).The position and volume of the tongue in surgical glossectomy should be taken into consideration for treatment planning; in the case of total glossectomy, PAP and tongue prosthesis may be used to rehabilitate, while partial glossectomy can be rehabilitated with only PAP.[6]

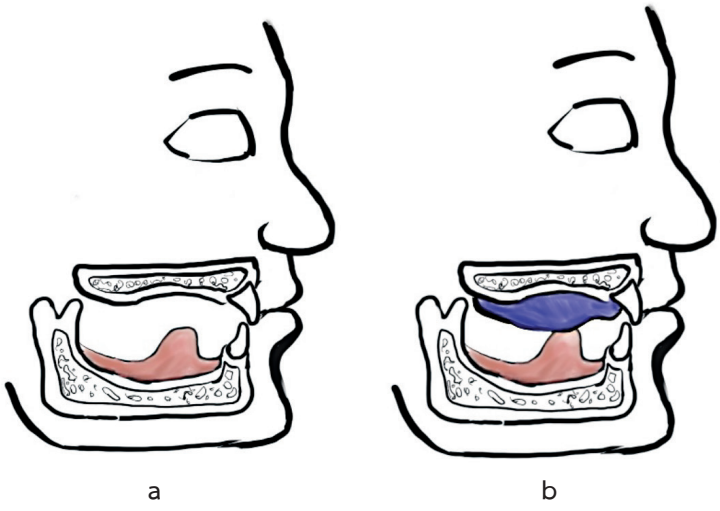

Figure 1 The drawing illusions show the swallowing of glossectomy patient, (a) swallowing without PAP, and (b) swallowing with PAP.

Cantor and his team[4], the first group that reported the usage of PAP in glossectomy on a patient, studied in glossectomy patients and determined restriction of tongue movement. The first group of 5 patients has severe tongue restriction which is unable to move the residual tongues to contact either palatal vault or teeth, whereas the other 5 patient groups have moderate tongue restriction with only partial tongues contact with palatal vault or teeth. They concluded that PAP can significantly increase speech improvement of both groups but the severe tongue restriction patients had more improvement than others, correlated to the report from Wheeler et al.[7]

A study by Aramany[6] reported the rehabilitation for total glossectomy and edentulous patient by using a PAP and prosthetic silicone tongue which snapped into a “mushroom-like” button in the mandibular prosthesis. This study described the means of management by fabricating a mandibular prosthesis

and a two-tongue prosthesis; one tongue for swallowing had its elevated anterior part which gradually sloped down to its posterior end with a channel for passing the bolus to oropharynx while the other for speech was flat and wide at the anterior portion for /t/ and /d/ sound. Then PAP was fabricated later. Modeling compound material and functional impression wax were used for replicating the speech function of residual tongue, /t/ and /d/ sound for anterior portion and /k/ and /g/ sound for posterior portion. Moreover, they suggested that dentulous partial glossectomy and radiation therapy patients with absence of a mandible resection could use PAP with the groove added at the midline of palatal prosthesis for fricatives /s/ and /z/ sound.

Davis and his team[8] had examined the effect of PAP in hemi glossectomy and used PAP for one year by videofluoroscopy to estimate tongue and related organs in swallowing and speech process. The PAP was fabricated by using red wax on temporary plate. Then it was replaced with clear, self-cure acrylic resin on temporary plate. Finally, it was adjusted by checking speech and swallowing. The definitive prosthesis was the PAP made from cobalt-chromium alloy and palatal aspect of PAP was hollowed to reduce weight. They also estimated oral and pharyngeal transit time, food residue in the oral cavity after first swallow and after dry swallows, aspiration as well as pharyngeal residue between normal patients who did not undergo glossectomy surgery and glossectomy patients before and after wearing PAP. They found that the patients who used PAP took transit time and had oral residue lesser than the patients who did not wear PAP and the patients whose condition was close to normal. In speech test, they used /p/,/b/,/t/,/d/,/k/,/g/ sound for estimation and concluded that PAP can improve the understandability of /t/,/d/ sound about 20% and 33% in /k/,/d/ sound given that the patients who did not wear PAP could not move the residual tongue to contact the palate for producing speech or swallowing which differs from normal patients. The other studies[3-5] also determined the efficacy of PAP in aspects of speech and swallowing for the glossectomy patients who wore and did not wear the PAP. The studies that introduced functional tongue impression during speech had made the impression with materials such as soft liner[9] and impression wax.[8] After the tongue impression, heat cure acrylic was packed on the denture base again or false palate section before being attached to denture base, or the PAP was hollowed out to reduce weight.[9]

This article introduces the technique for fabricating plaster index, that replicates the movement of tongue during swallowing which can be done in dental laboratory. In addition, this technique can reduce the procedures for making PAP and does not cause any junction between acrylic resin in PAP.

Case Report

A 56-year-old female patient was referred from a public hospital to the Graduate Clinic of Department of Prosthodontics, Faculty of Dentistry, Chulalongkorn University. Her major complaint included her dry mouth and difficulty *in swallowing* food. The patient felt disappointed and lack of confidence in socializing. She has carcinoma at the right side of her tongue (CA Tongue T2N0M0) and received a hemi glossectomy with right modified radical neck dissection, after radiation therapy.

Intraoral examination showed partially edentulous maxillary and mandibular arches. Teeth missing were 24, 25, 26, 37,46 and the post hemi glossectomy tongue, which can move little to contact the palate.

First, the impression of upper and lower arch with irreversible hydrocolloid or alginate (Jeltrate, Dentsply Caulk, Milford, DE, USA) was taken before the impression with gypsum type III (dental stone type III, Silky-Rock, Whip Mix, Louisville, KY, USA) was poured and a land area on gypsum model was prepared with

plaster of Paris. Next steps were surveying tooth and tissue undercut with surveyor, blocking out undercut with pink dental wax, fabricating base plate with self-cure acrylic resin (Formatray, Kerr, Romulus, MI, USA) on upper gypsum model and making occlusion rim with pink dental wax since the gypsum model was estimated having retention enough during the patient's swallowing, so wrought wire clasp was not added.

The gypsum models were occluded. On looking through from the posterior aspect, we found some space enough to pour the gypsum there in the next procedure (Figure 2).

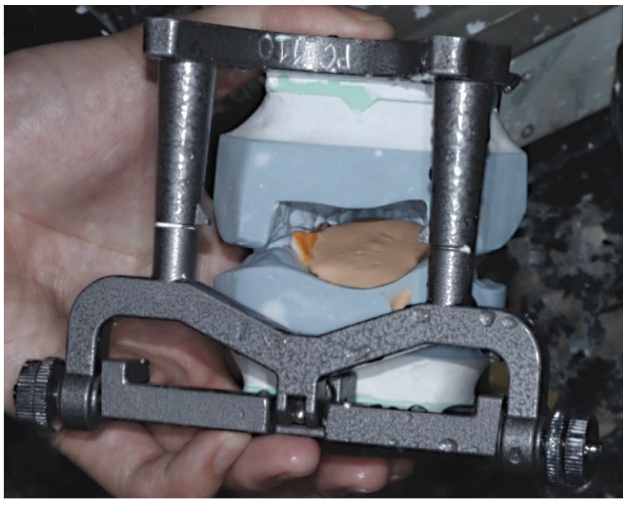

Figure 2 The posterior view between the upper and lower models had a space for pouring the gypsum.

Tongue mold preparation during swallowing

Here is the process of tongue mold preparation during swallowing. First, the patient was advised sitting up in a sitting position and trying to make some swallow. For the patient who has xerostomia due to radiotherapy, sipping some drinking water could help her swallowing better. When try-in occlusion rim was finished, alginate adhesive (Dentsply Caulk, Milford, DE, USA) was applied at palatal portion of upper base plate one time and air-blown to remove the solvent. The irreversible hydrocolloid impression was mixed with water in the 1:1 portion, and then loaded on the palatal portion of base plate before being delivered into the patient's oral cavity. The patient was suggested making a few swallows in order to have an accurate functional tongue impression before impression material was set. After the impression was completely set (Figure 3), the base plate was placed into upper gypsum model. The upper and lower gypsum models were articulated and, later, glued together with sticky wax before application of vaseline, a kind of petroleum jelly, to the upper gypsum model.

Figure 3 The irreversible hydrocolloid impression on the upper base plate

Next, the gypsum type III at the posterior aspect was poured and rest into the space between the upper and lower gypsum models, which were held together on vibrating table with two hands, until gypsum was set and ready to be separated.

The functional tongue gypsum model was attached to the floor of the mouth on the lower gypsum model which could be articulated to the upper model and mounted in articulator (Figure 4).

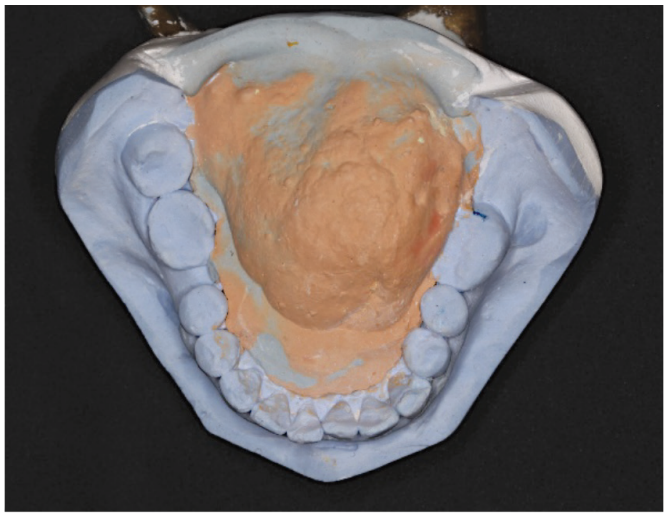

Figure 4 Lower gypsum model with the functional tongue model

Upper acrylic removable partial denture, C clasps (circumferential clasp) on 17, 27 were fabricated and rest on 27 was made from 19 gauge wrought wire. Meanwhile, 20 gauge wrought wire was used to C clasp on 23. Artificial teeth (Yamahachi FX, Yamahachi Dental Mfg.Co., Aichi Pref., Japan) were arranged at 24-26 edentulous ridge while pink wax was added on the palatal portion in order to keep contact with the functional tongue gypsum model that was attached to the lower model (Figure 5c).

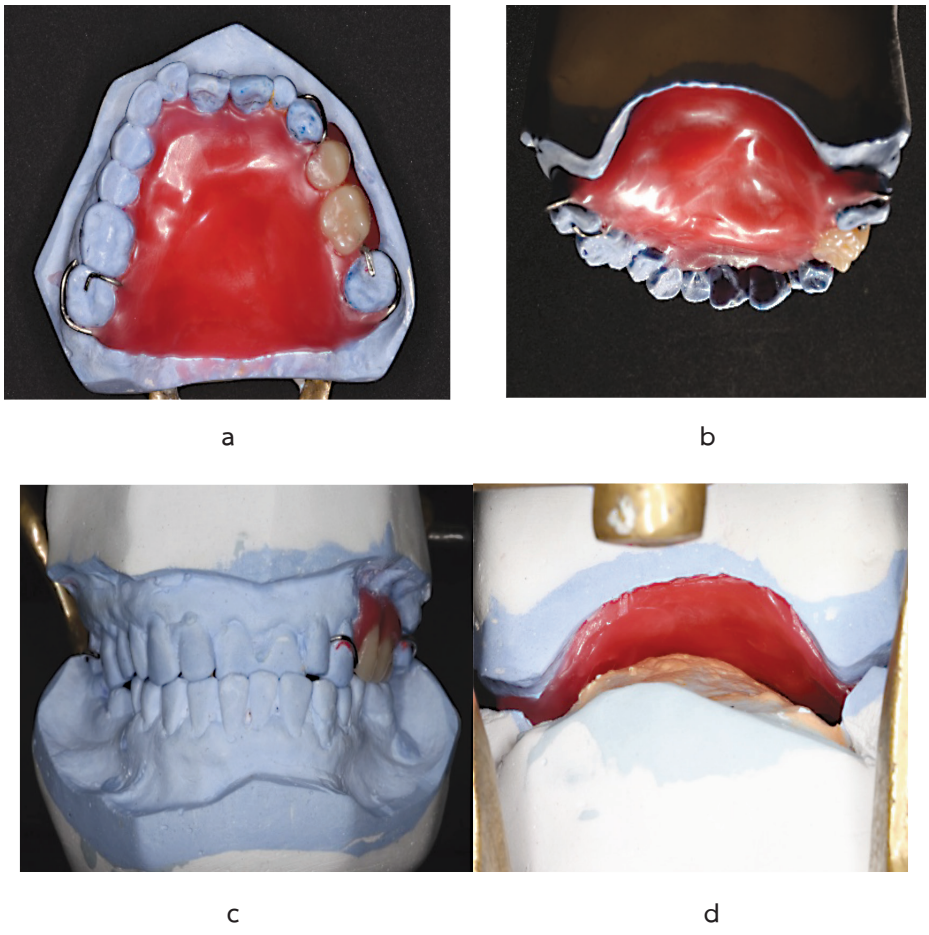

Figure 5 (a), (b) and (c) The upper gypsum model with artificial teeth arrangement
Figure 5 (d) Posterior view which the pink wax was increased to make a tongue contact

Figure 6 shows the result of completed curing acrylic resin after being flasked and heated and later deflasked and polished. Adjustment was done in delivery visit, and tissue surface of PAP was checked with pressure indicator paste. Occlusal adjustment was also done and checked with articulating paper until harmonized occlusion. The patient received a home-care denture instruction and an appointment for the next day visit.

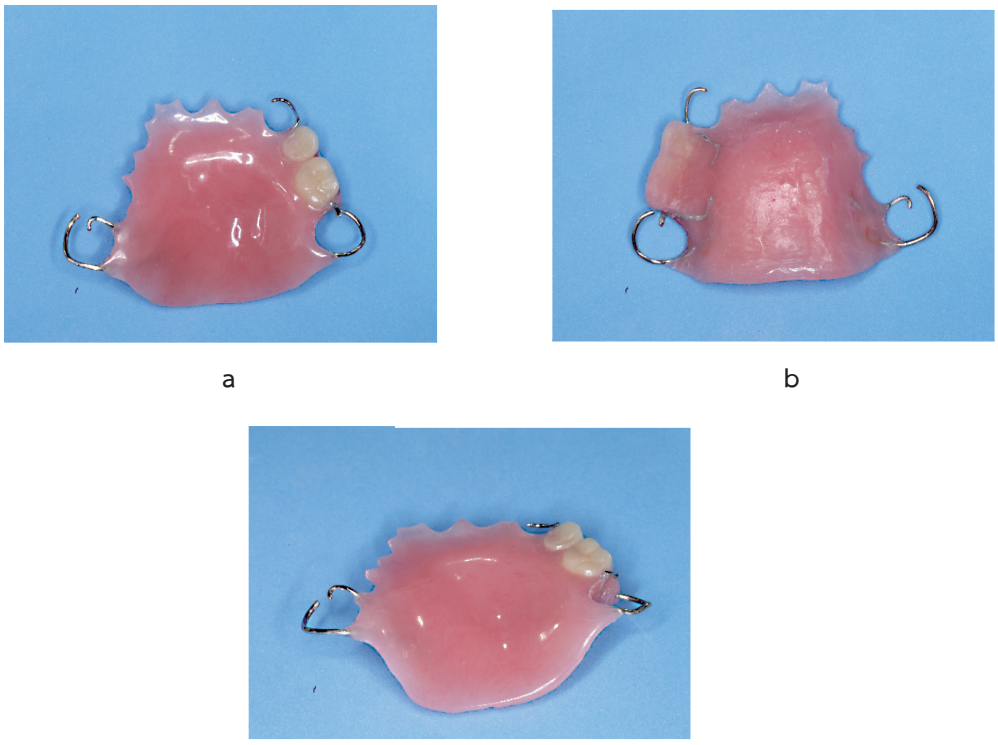

Figure 6 PAP at (a) occlusal view, (b) tissue surface, (c) posterior view

Later, the patient returned for the first check-up after PAP delivery. She felt uncomfortable during the removal and application of the PAP, yet according to her intraoral examination, there was no sign of traumatic mucosa under PAP base. Then oral hygiene and denture instructions were given to the patient.

On her second visit, two weeks after delivery, the patient said that she felt familiar with the PAP. Later, on her third visit after 2 months, the patient said that she could normally chew and swallow the food. Moreover, she could speak comfortably while wearing the PAP and felt confident to socialize with other people. No traumatic mucosa was found following her intraoral examination although the PAP appeared slight loss of retention, so the clasps were adjusted and the PAP was cleaned with scaler and polished with pumice and rouge.

Discussion

This obtained result provided a treatment option with less time consuming. In addition, it is for the patient whose tongue is malfunctional as a consequence of a tongue surgery.

Other provisions include a functional tongue impression technique during speech or swallowing such as using soft liner or impression wax and replacing it with heat cure acrylic resin. Treatment selection depends on individual cases and a clinician's opinion.

Moreover, the study revealed that the impression technique using irreversible hydrocolloid available and modified portion of powder and water, giving a viscous consistency of impression material, so the patient would not swallow the impression material while waiting during the setting time. Following was fabrication of the functional tongue gypsum model which was kept contact by pink wax added later.

The advantage of this type of PAP above others is its only one step processing of acrylic resin that does not have junction in PAP or any problem of dislodgement. The PAP was not hollowed in this case, so the liquid does not leak into prosthesis, which reduces the procedure when applied to patient. Thus, this PAP can improve patient's swallowing and quality of life, while lessening food residue in oral cavity after swallowing (Figure7), compared to the food residue when the patient wore no PAP (Figure 8a and 8b). However, the limitation of this technique is the irreversible hydrocolloid impression material with limited working time and is unable to be added on. Therefore, it is rather difficult to make a functional speech impression, if wanted.

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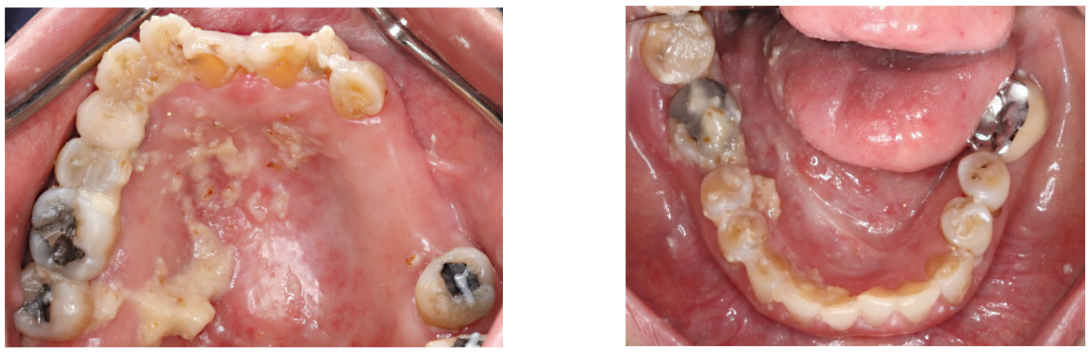
Figure 7 (a) and (b): The food residue in oral cavity after swallowing when the patient wears PAP



a b

Figure 8 (a) and (b): The food residue in oral cavity after swallowing when the patient with not PAP.

Since PAP was thicker than normal denture base, choosing the short heat curing cycle might cause gaseous porosity due to exothermic reaction of polymerization of resin rising above 100°C. Thus, the solution was choosing a long heating cycle with heat cure at 70-74°C for 7-8 hours.[10-12]

Another technique to fabricate PAP easily and speedily was adding self-cure polymethyl methacrylate on the palatal surface and replicating the tongue movement. However, this technique has several disadvantages such as heat form exothermic polymerization of self-cure polymethyl methacrylate

that may harm patient mucosa and cause more odor and more porosity leading to dissatisfaction of both patient and operator. Meanwhile, artificial color and liquid absorption may promote accumulation of micro-organisms, which later affects patient's oral hygiene.

The treatment for hemi-glossectomy patient requires a clear patient history and chief complaint, a proper procedure, understanding of the limitation of treatment, as well as a patient's response and cooperation during treatment for highly efficient result of treatment.

Opinion

The rehabilitation with PAP requires cooperation of both operators and patients, Including dentist, who gives examination and treatment, and technicians, for a better result.

Although there are several techniques for fabricating PAP, this study presents the technique that reduce a laboratory procedure and clinical visits. Moreover, the PAP does not have an acrylic resin junction which, in effect, gives more strength than others.

References

1. Kazi R, Johnson C, Prasad V. Quality of life outcome measures following partial glossectomy: Assessment using the UW-QOL scale. J. Cancer Res Ther 2008;4:116-20.
2. Beumer J lll, Marunick MT, Silverman S, Garrett N, Rieger J, Abemayor E, et al. Rehabilitation of tongue and mandibular defects. In: Beumer J lll, Marunick MT, Esposito SJ editors. Maxillofacial rehabilitation: prosthodontic and surgical management of cancer-related, acquired, and congenital defects of the head and neck, 3rd ed. Illinois: Quintessence, 2011:109-18.
3. Robbins KT, Bowman JB, Jacob RF. Postglossectomy deglutitory and articulatory rehabilitation with palatal augmentation prostheses. Arch Otolaryngol Head Neck Surg 1987;113:1214-8.
4. Cantor R, Curtis TA, Shipp T, Beumer J lll, Vogel BS. Maxillary speech prostheses for mandibular surgical defects. J Prosthet Dent 1969;22:253-60.
5. Marunick M, Tselios N. The efficacy of palatal augmentation prostheses for speech and swallowing in patients undergoing glossectomy: A review of the literature. J Prosthet Dent 2004;91:67-74.
6. Aramany M A, Downs J A, Beery Q C, Aslan Y. Prosthodontic rehabilitation for glossectomy patients. J Prosthet Dent 1982;48:78-81.
7. Wheeler RL, Logemann JA, Rosen MS. Maxillary reshaping prostheses: effectiveness in improving speech and swallowing of postsurgical oral cancer patients. J Prosthet Dent 1980;43:313-9.
8. Davis JW, Lazarus C, Logemann, J, Hurst PS. Effect of maxillary glossectomy prosthesis on articulation and swallowing. J Prosthet Dent 1987;57:715-9
9. Knowles JC, Chalian VA, Shanks JC. A functional speech impression used to fabricate a maxillary speech prosthesis for a partial glossectomy patient. J Prosthet Dent 1984;51:232-7.
10. Bonsor SJ, Pearson GJ, editors. A clinical Guide to Applied Dental Materials. London: Elsevier, 2013:406-24.
11. McCabe JF, Walls AWG, editors. Applied Dental Materials. 9thed. Oxford: Blackwell Pub, 2008:110-23.
12. Rawls HR. Prosthetic Polymers and Resins. In: Anusavice KJ, Shen C, Rawls HR, editors. Phillips' Science of Dental Materials. 12thed. St. Louis, Mo: Elsevier/Saunders, 2013:474-98.

บทคัดย่อ

การเสริมเพดานเทียมอย่างง่ายเพื่อเพิ่มประสิทธิภาพการกลืนให้กับผู้ป่วยที่ผ่านการตัดลิ้น : รายงานผู้ป่วย

วิศรุตม์ ประวัติวัชรา, อธิคม สุรินทร์ธนาสาร, นิยม ธำรงค์อนันต์สกุล

ภาควิชาทันตกรรมประดิษฐ์ คณะทันตแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

การบูรณะผู้ป่วยที่มีความวิการของลิ้นที่เกิดจากการศัลยกรรมผ่าตัดลิ้น สามารถแก้ไขได้โดยการใส่ชิ้นงานซึ่งเป็นอวัยวะเทียมที่เรียกว่าพีเอพี โดยชิ้นงานดังกล่าวช่วยเสริมการทำงานของลิ้นที่บกพร่องไปด้วยการเสริมเพดานให้นูนและหนาขึ้น ซึ่งการเสริมเพดานดังกล่าวสามารถทำได้หลายวิธี แต่วิธีที่นำเสนอครั้งนี้มีข้อดีคือ ร่นระยะเวลา และมีประสิทธิภาพในการสร้างรอยพิมพ์ลิ้นในขณะกลืนด้วย วัสดุพิมพ์ปากไฮโดรคอลลอยด์ชนิดผันกลับไม่ได้ จากนั้นนำรอยพิมพ์ไปเทแบบหล่อเพื่อจำลองการเคลื่อนไหวของลิ้น แล้วสร้างชิ้นงานพีเอพีในห้องปฏิบัติการทางทันตกรรมตามลำดับ ผู้ป่วยสามารถกลืนอาหารได้ดีขึ้นหลังจากวันแรกที่ใส่พีเอพี อีกทั้งยังเพิ่มความมั่นใจในการกินอาหารในที่สาธารณะ

คำสำคัญ: พีเอพี, การตัดลิ้น, การเสริมเพดาน, การกลืน