

A Simplified Method of Fabricating External Auditory Canal Stent to Prevent Recurrent Canal Stenosis in Auricular Atresia Repair.

Dr. Aparna.P.M¹, Dr. Harsha Kumar.K², Dr. Kavitha Janardanan³,
Dr. Deepthi.V. S⁴

¹Junior Resident, Dept. of Prosthodontics, Govt. Dental College, Thiruvananthapuram, Kerala, India

²Professor and Head, Dept. of Prosthodontics, Govt. Dental College, Thiruvananthapuram, Kerala, India

³Assistant Professor, Dept. of Prosthodontics, Govt. Dental College, Thiruvananthapuram, Kerala, India

⁴Assistant Professor, Dept. of Prosthodontics, Govt. Dental College, Thiruvananthapuram, Kerala, India

Corresponding Author: Dr. Aparna.P.M

Abstract

Congenital aural atresia is a developmental defect characterised by absence or hypoplasia of external auditory canal, middle ear and occasionally the inner ear. The most important surgical goal in rehabilitation of congenital aural atresia include reestablishment of hearing by restoring the normal sound-conducting mechanism of the ear and creation of a clean, well-epithelialized, patent external auditory canal. However, the high frequency of postoperative external ear canal stenosis and unsatisfactory hearing results remains a significant challenge. Conventional stenting materials like sponges or gauze can be used effectively to prevent restenosis of the external auditory canal following surgery, but these materials need to be firmly packed inside the canal which will result in occlusion of the canal with poor drainage and ventilation leading to partial hearing loss. This clinical report describes a simplified method of fabricating external auditory canal stent with a central bore to prevent recurrent canal stenosis in surgically repaired congenital auricular atresia.

Keywords: Congenital aural atresia, External auditory canal, Acrylic trimming bur, External auditory canal Stent

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I. Introduction

Stenosis or atresia of the external auditory canal (EAC) may be congenital, acquired, oriatrogenic. Congenital aural atresia is a developmental defect characterised by absence or hypoplasia of external auditory canal, middle ear and occasionally the inner ear. Rate of occurrence of the condition is 1 in 10,000–1 in 20,000 live births. Unilateral atresia is more prevalent than bilateral and is having sexual predilection for males. The severity of atresia can range from a mild malformation with a membranous external auditory canal, narrowing and a normal middle ear to severe malformation characterized by complete absence of external auditory canal, middle ear and ossicles as well as an anomalous facial nerve.¹ Patients with external auditory canal atresia experience conductive hearing loss. The most important surgical goals in congenital aural atresia are rehabilitation of hearing by restoring the normal sound-conducting mechanism of the ear and creation of a clean, well-epithelialized, patent external ear canal. However, the high frequency of postoperative external ear canal stenosis and unsatisfactory restoration of hearing remains a significant challenge.² Chang et al. reported that in patients with congenital aural atresia, 12 of 25 ears exhibited postoperative stenosis, with tympanic membrane lateralization in two ears, and the rate of postoperative complications was 56 %.³ In cases of congenital atresia, Chandrasekhar reports a 30% restenosis/lateralization rate.⁴ Usually postoperative external ear canal stenosis and poor hearing necessitates revision surgery.⁵ Therefore, in canaloplasty, it is essential to reduce the rate of postoperative external ear canal stenosis and the need for revision surgery. To prevent external auditory canal stenosis and atresia, various methods have been proposed in the literature.⁶ Stenting or packing materials to keep the EAC open immediately after surgical repair require Merocel or Ambrose wicks, Owens silk with cotton balls, or NuGauze with Bacitracin ointment. A thick Silastic button is then placed over the new skin-grafted tympanic membrane to prevent lateralization. Unfortunately, this still leads to a high restenosis rate. To decrease this rate, the use of long-term custom acrylic stents was implemented.⁷ The long-term use of stents made from these materials have the drawback of reduced hearing and ventilation due to lack of venting. Hence EAC stents in Poly Methyl Methacrylate (PMMA) with an internal opening was suggested as a valuable alternative. This

article presents a case report where stenting of external auditory canal was accomplished through a customised heat cure acrylic ear stent with a central bore.

II. Case Report

A 6-year-old girl was referred to the department of Prosthodontics for the fabrication of an ear stent simulating the anatomy of external auditory canal of the right ear. The patient had diffused soft tissue areas within the external auditory canal on right side of about 14 mm causing complete occlusion of the bony segment of the canal suggestive of type A fibrocartilaginous meatal occlusion. She also had mild to moderate conductive hearing loss on right side. She was diagnosed as having congenital right external ear canal atresia and was treated surgically with right external canalplasty. In order to maintain the patency of ear canal after surgery and to prevent restenosis a temporary packing of ear canal with merocel pack was placed. The patient was referred to the department for the fabrication of a long-term stent. It was decided to fabricate a heat cured PMMA stent with a vent hole to provide ventilation and improved hearing during the stenting period.

An impression of the external auditory canal along with the pinna of the affected ear was made with light body consistency of polyvinyl siloxane elastomeric impression material and alginate respectively. A small gauze piece lubricated with petroleum jelly tied to dental floss of sufficient length was inserted inside the ear canal. The whole of pinna and adjacent areas were lubricated with petroleum jelly to facilitate easy removal of the impression. A cylindrical container of approximately 6 inches diameter with openings at both ends was used as a tray for the impression procedure. Light body consistency of Polyvinyl siloxane elastomeric impression material was injected into the ear canal using a syringe. A cellophane sheet was placed over the impression material and gentle finger pressure was applied to ensure complete filling of the canal without air entrapment (Figure.1). Once the material had set, the cellophane sheet was removed and a thin mix of irreversible hydrocolloid was poured over the remaining surface of the ear not completely filling the container (Figure.2). Gauze pieces were placed over it and a thick mix of plaster of Paris was poured over the irreversible hydrocolloid impression material for support (Figure.3). The impression was removed as two parts and reoriented (Figure.4). Alginate-gauze-dental plaster complex as one part and light body PVS impression as another. The cast was poured in type IV dental stone.

A wax pattern was fabricated extending into the folds of the auricle so as to obtain maximum retention for the prosthesis. A smooth and cylindrical shaped shank of a used acrylic trimming bur was cut and placed in the wax pattern extending into the canal, the removal of which will create a bore in the final processed prosthesis (Figure.5). The wax pattern was flaked and dewaxed in a conventional manner (Figure.6). Vaseline was applied around the bur shank to allow easy removal after processing of the prosthesis. After dewaxing, the mould was packed in clear heat cured PMMA acrylic and cured. After retrieval of the prosthesis, the shank of the acrylic bur was removed by pulling it with an orthodontic plier (Figure.7). Thus, a continuous vent was formed within the stent. Acrylic stent was trimmed according to the anatomy of the auricle followed by finishing and polishing (Figure.8). The stent was then kept in water bath for 24 hours before insertion to further reduce the monomer content. The patient was advised to wear the stent 24 hours a day and instructions were given regarding maintenance of the appliance. The patient was recalled once in every 2 weeks for the first 2 months and later once in every 1 month for 18 months. No signs of stenosis were found during the recall visits.



Figure.1. Light body PVS impression material injected and pressed into the ear

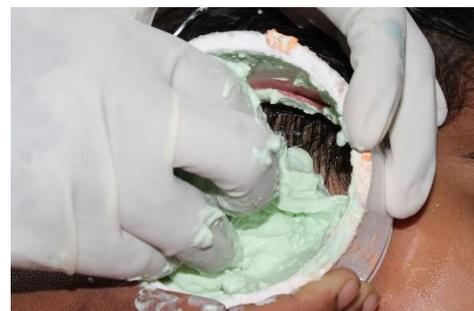


Figure.2. Alginate impression material being poured over PVS impression



Figure.3. Thick mix of plaster poured to support alginate impression

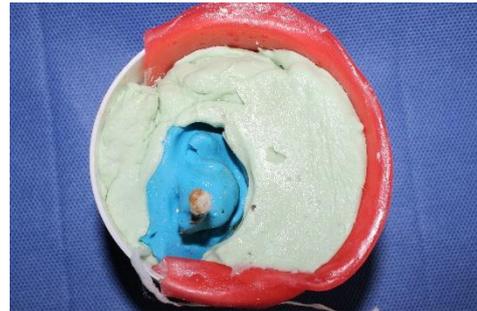


Figure.4. Completed impression



Figure.5. Wax pattern for ear stent with acrylic bur shank inserted



Figure.6. After dewaxing of the pattern



Figure.7. Processed external auditory canal stent with partially removed bur shank



Figure.8. Finished and polished external auditory canal stent



Figure.9. Processed stent placed in the patient's ear

III. Discussion

When patients with congenital aural atresia are treated by reconstruction of the external auditory canal, the most common complication is the recurrence of external auditory canal stenosis or atresia, leading to poor efficacy and a need for secondary reconstructive surgery.⁸ Unlike most surgical wounds in the body, which heal by primary intention, surgical wounds in the EAC following canalplasty often heal by secondary intention and seldom benefit by means of primary closure because of their structural limitations. Similar to the use of ear packing at the end of surgery, which creates a pressure effect to minimize the swelling and inflammation, the application of a stent in a newly made EAC is believed to modulate the remoulding process of both the extracellular matrix and bone through the pressure effect. Thus, stent placements have benefits in terms of preventing excessive granulation tissue formation, in addition to maintaining the width of the meatus until adequate epithelialisation has been achieved.⁹ Because restenosis may occur up to 12 months after surgery, long-term stenting was found to be beneficial in the prevention of restenosis/lateralization. The ear canal cannot be packed shut indefinitely with gauze packing or Meroceel wicks, as this would not only lead to poor healing, otitis externa, or an EAC fungal infection, but it would also hamper hearing. Stenting the EAC with a hard-acrylic stent, which is hollow and open down the centre, was believed to be a good alternative. This allows aeration, the ability to hear, and a conduit for medicated ear drops.⁷

In this clinical report a customized hard acrylic stent with a central hole was fabricated from the impression of external auditory canal made with elastomeric impression material. The folds of the auricle were also included in the design which not only improved the retention of the stent and prevents accidental removal but also guided the patient in correct placement of the stent. The patient showed a good outcome and normal hearing, without any recurrence, in a postoperative period of 18 months.

IV. Conclusion

The presented clinical report describes the fabrication of a customised external auditory canal stent for a 6-year-old child to prevent restenosis following repair of congenital external ear canal atresia. The hard nature of the stent helped in maintaining the width of the canal until adequate epithelialization had achieved. Since the stent was made with a central bore, there was no discomfort for the patient with regard to hearing and there was adequate aeration also. The fabrication of stent was economical and patient had no difficulty in using the stent. She showed a good outcome and normal hearing, without any recurrence, in a postoperative period of 18 months.

References

- [1]. Upadhyaya G. Canalization and Maintaining the Patency of External Auditory Canal in a Congenital Aural Atresia Patient: A Multidisciplinary Approach. *The Journal of Indian Prosthodontic Society*. 2013 Jun 1;13(2):128-31.
- [2]. Chen J, Liang H, Wang Y, Yu Y. Applications of titanium mesh tubing in external ear canal reconstruction in congenital aural atresia. *European Archives of Oto-Rhino-Laryngology*. 2015 Apr 1;272(4):835-8.
- [3]. Chang SO, Min YG, Kim CS, Koh TY (1994) Surgical management of congenital aural atresia. *Laryngoscope* 104(5 Pt 1):606–611
- [4]. Chandrasekhar SS, la Cruz De A, Garrido E. Surgery of congenital aural atresia. *The American journal of otology*. 1995 Nov;16(6):713-7.
- [5]. Bouhabel S, Arcand P, Saliba I. Congenital aural atresia: bone-anchored hearing aid vs. external auditory canal reconstruction. *International journal of pediatric otorhinolaryngology*. 2012 Feb 1;76(2):272-7.
- [6]. Moon IJ, Cho YS, Park J, Chung WH, Hong SH, Chang SO. Long-term stent use can prevent postoperative canal stenosis in patients with congenital aural atresia. *Otolaryngology--Head and Neck Surgery*. 2012 Apr;146(4):614-20.
- [7]. Weber PC, Davis B, Adkins Jr WY. Canal atresia reconstruction with dental impression material. *American journal of otolaryngology*. 1999 Jul 1;20(4):236-40.
- [8]. Battelino S, Hocevar-Boltezar I, Zargi M. Intraoperative use of mitomycin C in fibrous atresia of the external auditory canal. *Ear, nose & throat journal*. 2005 Dec;84(12):776-9.
- [9]. Kuo CY, Chen HC, Shih CP, Wang CH. A composite Foley catheter stent used to successfully manage recurrent canal stenosis caused by fibrous dysplasia of the temporal bone. *The Journal of International Advanced Otolaryngology*. 2014 May 1;10(2):194.

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