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CLINICAL REPORT

Canalization and Maintaining the Patency of External Auditory Canal in a Congenital Aural Atresia Patient: A Multidisciplinary Approach

Guruprasada Upadhyaya

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Abstract This clinical report describes the role of a prosthodontist in rehabilitating a patient with congenital aural atresia. The external auditory canal and structure in the middle ear fail to develop completely in cases of congenital aural atresia. Canalization procedure to establish the communication between the external ear and middle ear, and maintaining the patency of the created canal plays an important role in the success of treatment in selected patients. Post Operative external auditory canal restenosis is the most common complication after congenital aural atresia surgery. The prosthodontist has an important role in assisting ENT surgeons in canalization procedure and also maintaining the patency of the canal during healing phase.

Keywords Ear canal · Acrylic · Polymethylmethacrylate · Methylmethacrylate · Impression material · Silicones

Introduction

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 [1, 2]. Unilateral atresia is more common than bilateral. Occurrence is more common in males than females. 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. These patients suffer from conduction deafness because of the absence of external auditory canal. This condition is also commonly accompanied by microtia, or incomplete development of the auricle, which is also a surgical reconstructive challenge. Creation of a proper external meatus, aerated middle ear space with a functioning conductive system, preservation of the facial nerve and inner ear and avoiding post operative canal stenosis or infection are the primary surgical goals [3, 4].

G. Upadhyaya (✉)
Army Dental Centre (Research & Referral), Delhi Cantt,
New Delhi 110010, India
e-mail: guruprasadabs@gmail.com

Case Report

A 25 year old patient with congenital aural atresia was referred from the Dept of ENT, Army Hospital, for fabrication of an ear stent simulating the anatomy of the external auditory canal of the right ear. Examination of patient's right ear showed absence of ear canal on the right side (Fig. 1). The left ear was normal. CT scan pictures showed a normal middle ear cavity on the affected side (Fig. 2). Patient had conduction deafness in the right ear. Surgery was planned for creating a communication between the external and the middle ear cavities. The stent was required for maintaining the patency of the ear canal after the surgery.

Since the patient didn't have the right ear canal, it was planned to make an impression of his brother's right ear canal for creating the mould. Impression procedure was carried out in the presence of an ENT surgeon. A small gauze piece lubricated with petroleum jelly tied to a long thread was inserted inside the ear canal. The purpose of the thread was to pull out the gauze piece after the impression procedure. Irreversible hydrocolloid impression material

Fig. 1 Pre-operative view of patient's *right ear* without *external* auditory meatus

Fig. 3 Attachment of metal wire clips on the impression to support the plaster base

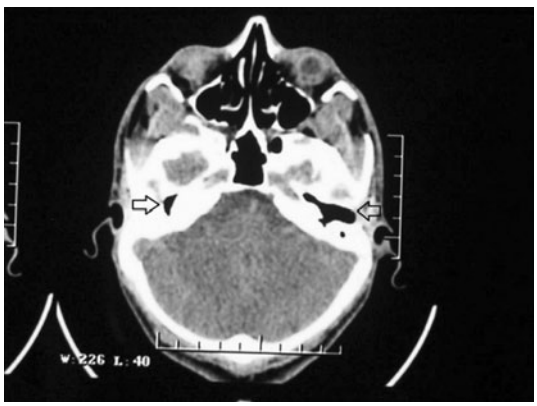

Fig. 2 *Arrows* showing the *middle ear cavities* on *both side* on CT scan

Fig. 4 Impression of the *right ear* with a plaster supporting base

was injected into the ear canal using a syringe. Adhesive clips were attached to the impression material from outside to hold the plaster base for the impression (Fig. 3). A mix of plaster of paris was poured on it to support the impression. Once the material was set, the impression was removed from the ear (Fig. 4) and poured with dental stone to fabricate a cast (Fig. 5). The ear canal of the model was enlarged using acrylic trimming burs mounted on a straight hand piece. The procedure of widening the canal was carried out slowly and carefully so that the anatomy of the original canal in the model was maintained. The reason for widening the ear canal on the model was to fabricate a stent of slightly larger diameter that can compensate for the amount of tissue shrinkage which would happen during tissue healing. Modelling wax was melted and poured into the canal on the model (Fig. 6). The model was flasked and dewaxed (Fig. 7). The flask was packed with a clear acrylic resin and acrylization was done using a long curing cycle to reduce the residual methymethacrylate content [5]. Once the process of acrylization was complete the deflasking was done and finishing and polishing of the acrylic stent was carried out (Fig. 8). The stent was kept in water for 24 h for further reducing the monomer content and kept immersed in 2 % glutaraldehyde solution before using it.

Surgery was carried out to create an external auditory canal by ENT surgeons. Incision was done on the pinna and a communication was created between external and middle ear in the bone using the stent as guide (Fig. 9). After the surgery the stent was placed in external ear canal to prevent the stenosis of canal (Fig. 10). The stent was kept in situ till the epithelisation process was complete, for almost 8 weeks. The surgery helped the patient to attain a hearing threshold of 30 dB.

During the post-operative phase, patient complained of pain in the ear area during his jaw movements. This was mainly because of the proximity of the surgical wound to TMJ. It was planned to fabricate an occlusal stent to keep the mandibular condyle slightly anteriorly in the glenoid fossa to permit uneventful healing. Impressions of patient's maxillary and mandibular arch were made using irreversible hydrocolloid impression material. Casts were fabricated in dental stone. Patient's protrusive record was

Fig. 5 Cast fabricated by pouring the impression

Fig. 6 Wax poured in the ear canal to make a pattern

Fig. 7 Photograph of flask after the dewaxing procedure

recorded by protruding the lower jaw by 3–4 mm anteriorly. The casts were articulated using the protrusive record. Occlusal stent was fabricated (Fig. 11). Patient was instructed to wear the occlusal stent during the healing phase.

Fig. 8 Photograph of the ear stent made in clear acrylic material

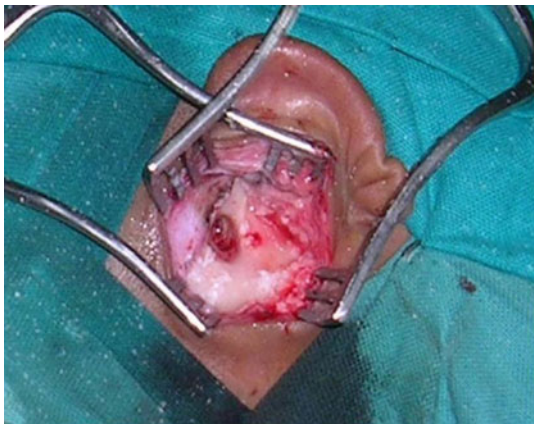

Fig. 9 Surgical procedure to create *external* auditory canal

Fig. 10 Ear stent in *position* after creating the communication between *external and middle ear*

Discussion

Surgical repair of congenital aural atresia is one of the most challenging jobs for an ENT surgeon. Proper case selection is very important for treatment success. Atresia repair

Fig. 11 Occlusal stent in situ

Fig. 12 Post operative view of *right ear* with surgically created *external* auditory canal after 3 weeks of surgery

surgery is worthwhile if proper patient selection is made by use of stringent audiological and radiological criteria and if state of the art surgery is performed [6]. Meatal restenosis and infection are the most frequent post surgical complications which lead to the failure.

Surgical stent is any device or mould used in conjunction with surgical procedures to hold the skin graft in place or provide support for anastomosed structures according to GPT-8 definition. In this case the function of the stent was to hold the graft in place, prevent the reattachment and collapse of the surgically created external ear canal. Polymethyl methacrylate, Polyethylene tetrapthalate and silicones are the most commonly used materials for fabricating the surgical stent. Medium density viscosity dental impression material had also been used after repair of an atretic canal to stent open newly created external auditory canal for 2 weeks followed by a hard acrylic stent for a few months [7].

Unilateral loss of hearing impairs localization of the sound source and causes difficulty in discrimination of speech in presence of background noise. Patient also finds some difficulty in hearing at a meeting or in class room when the speaker is on the side of affected ear. The corrective surgery helps the patient to have bilateral hearing, where two cochleae work independently stimulated enough to allow sound localization to occur [8, 9]. In this patient surgery was performed to create a communication between external and middle ear to correct the conductive hearing loss. Hearing level of 30 dB was achieved in the affected ear after surgical procedure. Hearing level of normal ears is between 0 and 25 dB. A patient with hearing level from 20 to 45 dB is considered to have a mild hearing loss according to WHO classification of degree of hearing loss. In this condition patient will find some difficulty with faint speech which can easily be corrected using hearing aids (Fig. 12) [9, 10].

Summary

This clinical report describes the rehabilitation of a patient with congenital aural atresia of right ear. An acceptable result was obtained because of the multidisciplinary approach in treatment planning and execution from the beginning to the end. The role of the prosthodontist role is equally important as other members of the team in maintaining the patency of the canal and assisting the wound healing.

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