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Resolution of Symptomatic Incisional Keloids in Pediatric Patients Wearing Assistive Hearing Devices Using Intralesional Triamcinolone Acetonide

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Abstract

Cochlear implantation and traditional hearing aids represent auditory assistive devices that can serve as skin irritants with the rare side effect of keloid formation. This exact etiology of the scar response is unknown, but in the setting of auditory assist device use there is friction and repeated microtrauma. Device use is imperative to daily functioning. No consensus exists for the treatment of keloids. We present two cases of symptomatic keloids occurring among pediatric patients using hearing-assistive devices. In both cases, post-auricular incisional keloids were treated via a three-point series of injection of triamcinolone acetonide (TAC) into the lesion. In both cases, patients responded well to the intervention and were able to continue utilizing their devices without discomfort. Keloid scar reactions can form at incisions under constant contact with assistive hearing devices, and patients/families should be counseled about this rare but potential side. This can result in more rapid keloid treatment, improving compliance with device use and improving treatment outcomes. Triamcinolone acetonide (TAC) is an excellent and minimally invasive treatment option in these cases, with clinically significant resolution possible and sustainable after just three injections.

Keywords: Keloid; Incisional scar; Pediatric patient; Hearing aid; Triamcinolone acetonide

Abbreviations: TAC: Triamcinolone acetonide; UCMD: Ulrich congenital muscular dystrophy

Introduction

Keloid formation is a pathologic, nodular scar response following incidental or surgical skin injury that extends beyond the borders of the initial insult [1]. Current theories for formation propose that the keloid pathophysiology consists of enhanced deposition of collagen and extracellular matrix, mediated by transforming growth factor beta (TGF-β) [1]. Keloid formation constitutes a rare yet significant adverse effect of hearing assistive device use [2]. Though relatively rare occurrences, their presence can be detrimental to patients for both cosmetic and functional reasons. The firm rubbery scars can cause emotional and physical distress, including associated pain and pruritis [1]. In contrast to hypertrophic scars, keloids rarely spontaneously regress.

Keloids occurring at the site of hearing assistive devices may impede device use and hence interrupt the benefit of the device. At least one case of cochlear implant extrusion secondary to keloid formation has been reported [3]. In addition, keloid formation is associated with longer time to time to processor loading [4]. Such outcomes occur significantly more frequently among patients with natural darker skin pigmentation [4]. Many options exist for treatment of keloids, including cryotherapy; lasers; anti-inflammatory therapies, such as triamcinolone acetonide (TAC); and chemotherapies, such as 5-fluorouracil [1,5]. There is currently no standard recommendation or clear consensus for treatment of keloids nor in the pediatric population [6-8]. We present here two cases of successful treatment of children with keloids associated with hearing assistive devices using TAC.

Case Report 1

The first case is of an African American female with sensorineural hearing loss and no personal history of keloid scar reaction. The subject's father, notably, was treated with air-infection

into keloids of acne scars. Cochlear implants were placed bilaterally at age 3 years 11 months. At the two-week postoperative visit, the subject was noted to have normal external ears and normal ear canal exams bilaterally. The surgical incision sites were noted to be healing well, with no residual eschar. One month after the procedure, the subject returned to clinic with complaint of discoloration and discomfort at the magnet site on the left side. This discomfort was exacerbated with continued use of the hearing aid device. Physical exam at this time was notable for erythema and glassiness directly at the site of the processor magnet.

Mepilex was trimmed and used to cover the underside of the processor magnet in order to reduce development of pressure ulceration. The subject was changed to a lower power magnet strength. The problem resolved entirely without keloid response. At routine three months post-operatively, the subject had the finding of mild incisional scar hypertrophy at the superior aspect. The subject had begun to consistently wear her cochlear implant processors and started to wear glasses as well. No treatment was rendered at this time. The mom scheduled a dedicated visit with concern for keloid formation at the bilateral incisions. Physical exam demonstrated bilateral post-auricular pink, hypertrophic keloids. Silicone gel was started for immediate treatment, and plans were made for rapid follow up treatment with TAC injections.

Intervention

The subject returned for the first injection one week later in the children's hospital sedation suite. Under general mask anesthesia, the skin site was treated with isopropyl alcohol swab and a 26-gauge needle was inserted into the middle of the body of each keloid scar. One milliliter of TAC was injected bilaterally. During this injection the keloid was very tough, and injection of the TAC was challenging. One month after the first injection, the scars were noted to be softer and less thick. The left mid-scar aspect demonstrated scar resolution at this time. The subject had continued to wear the implant processor and now had glasses added. The subject's family was additionally counseled about styling the subject's hair such that large coils of hair were not placed directly over the scar site.

A second injection was performed two months later (12 weeks after the first injection) in the children's hospital sedation suite under general mask anesthesia. After isopropyl alcohol skin preparation, 1mL of TAC was injected using a 30-gauge needle. The subject had continued to wear the processor and glasses. At two months follow up (20 weeks after the first injection), the left post-auricular keloid had completely resolved. The right ear still demonstrated hypertrophic scarring at the post-auricular surgical site. A third injection was planned at this time, the schedule delayed due to a positive COVID test at presentation for sedation for the infections and then by other social circumstances.

The third injection procedure was performed approximately 4 months after the second injection (28 weeks after the first injection). Under general mask anesthesia, 0.25mL of TAC was injected into the surgical scar site for each ear using a 30-gauge needle. The subject has had no recurrence of the keloid in 6 months from the last injection and is wearing the processors and glasses full time.

Case Report 2

The second subject is seven-year-old African American male with a history of chronic otitis media and prior use of Pressure Equalization tubes complicated by a tympanic membrane perforation ipsilateral moderate-severe sloping up to moderate conductive hearing loss. Tympanoplasty was performed and at one-month post-operatively, his wound site demonstrated no residual post-auricular scab, no erythema, and was not edematous. At two months follow up post-operatively, the right post-auricular scar was well healed without any evidence of scar hypertrophy or keloid formation. The tympanic membrane was intact with normal landmarks and tympanic membrane mobility. Repeat audiogram showed mild conductive hearing loss in both ears. The subject was fitted for hearing aids at 3 months post-tympanoplasty.

At six months from the tympanoplasty, routine exam revealed absence of hypertrophic or keloid scarring and good school-time hearing aid compliance. At nine months post-operatively, his grandmother noted a large mass forming behind the ear under the hearing aid and he was in clinic for complaints of discomfort with wearing the hearing aid. At the incision site was a new keloid in the shape of the hearing aid processor itself. The keloid was firm and much of it was subcutaneous, without pus, erythema, induration, or desquamation. A series of three TAC injections with procedural sedation were planned at three- to six-week intervals.

Intervention

The first injection was performed two weeks later. Under general mask anesthesia, the skin was prepared with an isopropyl alcohol swab and then 1mL of TAC was injected into the right post-auricular keloid. This was difficult due to the fibrotic nature of the keloid itself. The 1mL was distributed in injections throughout the keloid, though only to the extent where the hearing aid touched the incisional scar. At four-week follow up from this first injection, the keloid was softer and appeared smaller. The second injection was performed six weeks after the first Under general mask anesthesia, the skin was prepared with an isopropyl alcohol swab and then 1mL of TAC was injected into the right post-auricular keloid, though with marked improvement in ease of injection.

The third injection occurred five weeks after the second (at 11 weeks from the first infection). The same procedure was performed. The subject was seen in clinic one month later (at 15 weeks from the first infection), and the keloid was noted to be 80% smaller without any depigmentation of the overlaying skin. The subject returned three months after the last injection with complaint of depigmentation at the area of dependent TAC drainage. Upon exam, the post-auricular scar keloid was resolved.

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A faint depigmentation shadow was noted. After 6 months further observation, the keloid remains resolved.

Discussion

Keloids are a rare yet important adverse outcome for children with hearing assistive devices. Post-surgical incidence of keloid formation ranges from 4.5-16%, with increased incidence with darker skin color [9]. Other risk factors include associations with pregnancy, puberty, and rare genetic conditions such as Ehlers-Danlos syndrome (OMIM# 130050), Ulrich congenital muscular dystrophy UCMD (OMIM#254-090), Geominne TKCR syndrome (OMIM#314300) and Rubinstein-Taybi syndrome (OMIM#180849) [9]. In both of our cases, the subjects had darker skin type as their predominant predisposing factor for keloid formation. Neither subject had a personal history of keloid, nor did either subject have a known condition such as pregnancy or puberty associated with timing of keloid development.

Regardless of the underlying cause, the pathophysiology of keloids remains consistent. The third stage of wound healing, or remodeling phase, begins approximately three weeks after the initial wound [10]. During this time fibroblasts become aberrantly activated in excess, which contributes to keloid formation [10]. Fibrotic remodeling continues until the wound stabilizes and reaches full maturity at month six [10]. Retro-auricular keloids constitute a unique site for keloid formation. In a previous case series of keloids in this same location, none were reported associated with cochlear implants or hearing assistive devices [11]. This scarcity of keloid occurrence may be due in part to the nature of cochlear implants: though not yet fully elucidated, there is evidence that intermittent use of a general magnet-applied pressure is associated with reduced burden of fibroproliferative keloids [12].

While the mechanism of this improvement remains poorly understood, it may be associated with loading and unloading forces improving physiologic tensions on the capillaries [12]. Hypertrophic scars, a type of less-severe, fibrotic response related to keloids have been reported more commonly following surgical implantation of cochlear implants [13]. None of the keloids we report formed at the site of consistent pressure or magnetic contact; rather they formed directly under the lose fitting processor body. In addition to treatment of the keloid itself, our female subject's family was counseled about hair styling in order to reduce skin tension at the site of the keloid. Increased tension in the reticular dermis, such as occurs with certain tightly braided hairstyles, may promote inflammation with subsequent worsening of the keloid [14]. Indeed, reduction of skin tension is one method for keloid treatment [14].

Counseling regarding keloids and hair styling must be in a culturally sensitive manor, particularly when patient-provider demographics differ. While data are limited in the pediatric population, a survey of 200 African American women demonstrated that only 32% felt that their physician understood African American hair [15]. Discussion of this topic is beyond the scope of our case report, though this is an important concept for clinicians following the use of hearing assistive devices that overlapping with or are in close proximity to patient hairlines. A thorough review of hair-associated considerations for African American children and families can be found in the work of Mayo and Callender [16]. Keloid treatment is critical in order to preserve the patient's ability to effectively use their device. Patients with darker natural skin pigmentation are at increased risk for keloid formation [17].

In addition, pediatric patients with darker natural skin pigmentation are less likely to receive early interventions with hearing assistive devices, which is in turn associated with reduced long-term device use [18,19]. Clinicians should closely monitor patients with darker natural skin pigmentation for keloid formation following cochlear implantation or hearing aid initiation in order to allow for early intervention. Other treatments for keloids have included surgical removal of the scar tissue and e conservative approach to which both of our case subjects responded extremely well. We recommend consideration of TAC use prior to invasive surgical procedures, which have been associated with a cochlear implant salvage rate of only 83% [20].

TAC works to reduce and reverse keloid formation via direct interference with the local immune cell milieu as well as creation of a hostile growth environment. The anti-mitotic effect of TAC results in reduced inhibition of dermal fibroblasts and keratinocytes, thereby reduced deposition of new collagen [5]. More generally, TAC is associated with reduced expression of alpha-1-antitrypsin and alpha-2-macroglobulin, both of which are collagenases known to be present at increased levels in existing keloids [5]. Finally, TAC-mediated vasoconstriction limits new growth via reduction in local oxygen and nutrient delivery [5]. Side effects of TAC include hypopigmentation, and indeed this occurred in one of our subjects.5 Other side effects known to occur with TAC use include telangiectasia formation, delayed wound healing, and dermal atrophy [5].

At this time, no keloid or hypertrophy recurrences have been noted in either subject. However, the injection series were completed with 6 months of follow up and both subjects remain free of recurrence. Previous studies have reported pediatric keloid recurrence rate as high as 20% [21]. We continue to monitor these subjects on a routine basis in order to ensure scar healing and keloid remission. It is possible that additional injection sequences will be necessary in the future, though at this time a three-point series of TAC injections is sufficient to support continued device use and significant clinical reduction in keloid severity and sensitivity.

Conclusion

Keloid scar reactions can form at incisions under constant contact with assistive hearing devices, and patients/families

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should be counseled about this rare but potential side. This can result in more rapid keloid treatment, improving compliance with device use and improving treatment outcomes. Triamcinolone acetonide (TAC) is an excellent and minimally invasive treatment option in these cases, with clinically significant resolution possible and sustainable after just three injections and despite ongoing microtrauma.

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