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Reverse Activated Hyrax Pressure Appliance for Treatment of a Keloid Located at Auricula Helix

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Abstract

Keloids are considered aberrations of the wound healing process, and various treatment regimens are described depending on the morphology and size of the lesion. Compression therapy using custom-made pressure clips or splints is widely used for the treatment of keloids. The most common complication of this therapy is ulceration due to excessive soft tissue pressure, resulting in delays and prolonged treatment time. This article describes the fabrication of a custom-made pressure appliance for the treatment of a keloid located at the auricle helix. The pressure appliance can be modified to fit the auricle helix and covers the area needing pressure.

Keloids are essentially slow-growing neoplasms[1] that grow beyond the boundaries of the original wound and invade peripheral tissue, which is histologically characterized by an abundance of fibroblasts, thick collagen bundles, and ground substance[2,3] representing unregulated proliferation of fibrous tissue after cutaneous injury, inflammation, burn, or surgical incision. Keloids are flesh-colored, firm, and occasionally painful or pruritic tumors. The pathogenesis of keloid formation is largely unknown.[4,5] Although a familial tendency is well documented[4,6–8] keloid etiology is not yet fully known.[9]

Several procedures have been described for effective treatment of auricular keloids, including surgical excision, bleomycin tattooing,[10] topical application of immune response modifiers,[1,11] corticosteroid injection[12] cryosurgery,[13] radiotherapy,[14] prolonged pressure application by pressure earrings, magnets, or bandages,[2,15–22] CO_2,[23] 980-nm diode laser treatment,[24] and 5-flourouracil injection.[25] Compression therapy is widely used in the management of hypertrophic and keloid scars, usually in combination with corticosteroid injection or surgery.[26] After surgery, compression of the excision site is recommended for 3 weeks[27] or 4 to 6 months.[28] Compression therapy with dressings or devices is effective. When applying more than 24 mmHg, the capillary pressure creates a hypoxic microenvironment resulting in fibroblast degeneration, disintegration, and collagen degradation.[22] Pressure earrings with different sizes of compression plates are successfully used for earlobe keloids. The helical rim, with its concave anterior and convex posterior surface, is not easily amenable for compression with plates.[29]

This article presents a custom-made pressure appliance fabrication technique for keloid treatment at the auricle helix. Due to a mismatch of compression plates and pressure earrings to the convex structure of the helical rim, this custom-made pressure appliance can be modified to fit the auricle helix and covers the area needing pressure according to the healing process and contraction of the keloid during recall appointments. The integrated hyrax screw allows easy pressure adjustment, eliminating side effects such as excessive pressure,[30] tenderness,[18] and tissue necrosis.[15] In daily clinical practice, this custom-made pressure appliance can be easily fabricated using basic dental laboratory instruments with traditional techniques.

Technique

1. Make an impression of the ear following the standard methods for fabrication of facial and body prostheses[31] and fabricate the definitive cast (Figs 1, 2).
2. Place putty impression material with 2 mm thickness (Affinis Precious, Coltène-Whaledent, Altstätten, Switzerland) on to the cast to create sufficient place for silicone-based denture liner.
3. The keloid scars must be completely covered by the silicone layer. The shape of the silicone layer must follow the outline of the keloid scars.

Figure 1 Keloid on the left helical rim.

Figure 2 Posterior view on the patient's left ear.

4. Adapt the Hyrax screw (Hyrax® Medium-10 /straight, Ispringen, Germany) on the silicone layer with forceps.
5. Cover the entire silicone layer with a cold-cured acrylic resin excluding the screw mechanism.
6. Process and finish the appliance according to conventional techniques[31] (Fig 3).
7. Roughen the intaglio surface of the appliance with an acrylic bur (Brasseler GmbH, Lemgo, Germany).
8. Remove grinding dust with a dry brush or dry, oil-free air.
9. Degrease the appliance surface by wetting a dust-free cloth with isopropanol/pure alcohol (minimum 90%) and wiping the surface clean. Then let aerate for 1 minute.
10. Apply the adhesive (Ufi Gel Adhesive, Voco GmbH, Cuxhaven, Germany) to the prepared surfaces and let aerate for 1 minute.
11. Place putty impression material with 2 mm thickness (Affinis Precious, Coltène-Whaledent, Altstätten, Switzerland) on to the cast to create sufficient place for silicone-based denture liner.
12. Place the pressure appliance over the helix and on the areas to be relined. The silicone layer should be at least 2 mm thick. Wait for the mixed material to set (Fig 4).
13. Remove any excess material with fine sharp (cuticle) scissors or a scalpel.
14. Place the pressure appliance over the helix and tighten the screw until blanching of the tissue is evident.
15. Train the patient how to remove and insert the appliance comfortably by using a face mirror. Teach the patient to thoroughly clean the keloid scar area and the appliance with a dust-free gauze under clean water every day.
16. Instruct the patient how to tighten the screw for applying pressure and to use the pressure appliance for 12 hours a day for 4 to 6 months.[25] If it is initially painful, instruct the patient how to remove the appliance.
17. Schedule the patient for periodic recall appointments of 2-week intervals.

Discussion

Most clinicians face challenges during the treatment of keloids, and Hassel et al stated that there is little evidence based on controlled clinical studies.[32] Treatment of ear keloids is also complicated and characterized by discomfort and high recurrence rates.[33] Compression therapy is effective through the keloid scar by creating a hypoxic microenvironment resulting in tissue degradation and decreasing lesion size.[22] According to Hassel et al, through compression therapy, "tissue metabolism and fibroblast proliferation are reduced; compression has also been shown to increase collagenase activity and induce mast cell stabilization. These processes lead to attenuation of hypertrophy and pruritic symptoms. The shape of the ear creates

Figure 3 Reverse activated hyrax pressure appliance.

problems for compressive therapy."[32,34] For efficiency, the appliance should provide uniform and adjustable pressure and be cosmetically acceptable. Prefabricated devices may cause excessive pressure and frequent bleeding with the increased possibility of infection and/or necrosis of the surrounding soft tissues.

Yiğit et al stated that it is difficult to pressurize the posterior auricular region with clips and other prefabricated devices. Thus, application of pressure to the cartilaginous auricle requires custom-made devices.[35] Uncompromised hearing is an advantage of custom-made pressure appliances, as is providing uniform pressure by confinement of the soft tissue to the internal dimensions of the appliance. Additionally, they are inexpensive and easily applied and removed by the patient, and they can be applied for the treatment of both a helix or earlobe keloid.[19]

It has been reported that treatment without compression is not effective on large keloids.[36] Kadouch et al stated that patient compliance is essential when using postoperative pressure therapy for the treatment of keloids, as it may recur as soon as the external pressure is relieved. Improved patient training may even further decrease the recurrence rate of ear keloids when using compression devices.[37]

Figure 4 Activated pressure appliance in use on ear.

Summary

This article presents a reverse-activated hyrax pressure appliance with a design-integrated adjustable tissue component. This screw design allows for control over the amount of the pressure applied on the keloid scar. The patient can easily adjust the amount of the pressure by himself or herself. Also, the silicon layer could avoid the possibility of complications. This appliance is suitable for large keloid scars, because within the progression of the healing period, it can be easily adapted for reduced size of the keloid by soft denture liners. The patient must be motivated and use the appliance regularly for a successful outcome.

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