Correction of Darwin’s Tubercle with Plasma Exeresis

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Summary: Darwin’s tubercle (DT) is a congenital outer ear deformity characterized by a posterior thickening of the auricular helix. It is particularly common in certain ethnic groups, with reports ranging between 10% and 58% of the specific populations. Despite being common, this vestigial trait is poorly known. It carries no clinical significance, except in the cases where it might be hypertrophic, potentially causing psychological distress and significant social impairment. DT has been traditionally treated with surgical resections where part of the helical cartilage is removed. More recently, cartilage reshaping has been envisioned without cutting, suturing, or scars, using laser irradiation. Surgical resection, laser ablation and plasma exeresis are different tools in the surgeon’s armamentarium which may all be used successfully. Nevertheless, the first may cause noticeable scarring while the second may cause relevant laser-related complications. We present a noninvasive aesthetic medicine procedure based on plasma exeresis, which combines the benefits of a noninvasive procedure with the advantage of not requiring lasers for the correction of this cartilage defect. We present the case of a 28-year-old woman with right-sided hypertrophic DT, who requested a correction of the outer ear deformity. Two sessions were required, pain intensity during treatment was low, no complications were reported, and the patient was satisfied with the result at 6 months from the last session. Although plasma exeresis has been described in the past for several other noninvasive procedures of the skin, this is the first report of its kind for the correction of minor cartilage reshaping.

INTRODUCTION

Darwin’s tubercle (DT) is a congenital outer ear deformity characterized by posterior thickening of the auricular helix. This trait may be unilateral or affect both ears but carries only vestigial significance. Nevertheless, unknown to many surgeons, it is particularly common in certain ethnic groups, namely 10% of Spaniards, 2 40% of Indians,3 and 58% of Swedes.4 Additionally, it has been recognized as a possible cause for prominent ears.5 Though most individuals with DT are unaffected by it, some may complain about its psychological impact, warranting surgical correction.6 Traditionally, DT hypertrophy has been corrected by remodeling the cartilage excess through surgical resection and placement of sutures.7 Though effective, this aggressive approach may cause skin necrosis and pathologic scarring, and surgery may even leave residual cartilage defects if performed unattentively.8 Recently, cartilage reshaping has been achieved with laser irradiation and radiofrequency heating, without cutting, suturing, or visible scars.9–11 However, these approaches require expensive instrumentation and can cause burns, infections, and scars.12 All these techniques are effective tools but carry downsides, which could potentially be overcome by using a different approach. The aim of this case report is to describe a noninvasive aesthetic medicine procedure based on plasma exeresis, that can be safely implemented to correct hypertrophic DTs.

CASE PRESENTATION

A standardized approach was implemented, with 60-day intervals between treatments. Written informed consent was obtained from the patient whose case is portrayed in this study. After each session, pain intensity was assessed using a visual analog scale,13 a standard unidimensional method used to measure patient’s recording of pain progression. Patient satisfaction was recorded using the Global Aesthetic Improvement Scale (GAIS),14 which

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has been validated for the assessment of response to treatment in aesthetic medicine.

A 28-year-old female patient with Fitzpatrick skin phototype III complained of her right ear’s appearance, due to DT hypertrophy, which caused psychological distress. DT had a 3-mm diameter. Before beginning the treatment, a galenic formulation of local anesthetic creams (lidocaine 20%, procaine 5%, and tetracaine 5%) was topically applied on the surface of the auricle, letting it sit for 15–20 minutes. The treatment was conducted using the PLEXR Plus device (GMV S.r.l., Rome, Italy), which delivers a microplasma ray heating the treated surface. The medium power handheld device (output of 11 Vcc) was selected for this patient. Treatment was applied with each spot delivered 1 mm away from the next. The patient was instructed to sleep supine or with her head lying on the unaffected side, to cleanse the treated area with lukewarm water daily, and to apply Neoviderm emulsion cream (Istituto Ganassini S.p.A., Milano, Italy) to reduce swelling and redness after treatment. No ear manipulation was recommended, but Sinema supplement (Judìfarm S.r.l., Naples, Italy) was prescribed to help reduce the swelling in the first 30 days. We recommended SPF 50 sunscreen twice a day over the treated area for protection from potential sun damage until the skin fully healed. She underwent three treatments that lasted 5 minutes each, with 60-day intervals between sessions. Pain level during treatment was a 2 out of 10. Follow-up was uneventful, and at 6 months from the last session, we asked the patient to express her satisfaction with the result, which was “very much improved” on the GAIS (Fig. 1).

**DISCUSSION**

Voltaic arc dermabrasion (or plasma exeresis) consists in using the differences in voltage in the device-skin interface to ionize gases in the space between the instrument’s tip and treated tissues. This generates a small electrical arc, which sublimes fluids contained in superficial tissues, forming a plasma, which causes controlled thermal damage used for skin resurfacing and rejuvenation. The thermal effect causes excess cartilage to progressively flatten and shrink. This effect is distributed on the superficial-most structures, without unwanted heat transmission to the adjacent tissues, therefore averting the risk of ear cartilage necrosis and/or frailty. The principle behind plasma exeresis is considerably different from other minimally-invasive technologies: conventional lasers can be diffracted, absorbed, or scattered, increasing the potential risk of permanently damaging surrounding areas when improperly used.

Plasma exeresis is also different from other devices such as Renuvion/J-Plasma (Apex Medical, Clearwater, Fla.), which uses radiofrequency energy and helium to generate plasma. Renuvion/J-Plasma has been cleared by the Food and Drug Administration for cutting, coagulation, and ablation of soft tissue during open and laparoscopic surgical procedures, but not for any aesthetic skin procedure. This is particularly relevant because their improper use has been associated with potentially life-threatening adverse events, including second/third-degree burns, infections, and bleeding.

PLEXR devices have been successfully used for several noninvasive procedures, including nonsurgical blepharoplasty, treatment of rhytids, scars, acne, and benign skin lesions. The advantage is that patients leave without incisions or sutures, with fast delivery of treatments and low morbidity. The controlled damage affects superficial-most soft tissues and usually heals within 10–15 days. However, cartilage reshaping is not immediate and occurs progressively over the following weeks. Although we reported no complications, treatments with PLEXR can still present adverse events, including skin retraction, scarring, and pigmentation (postinflammatory hyperpigmentation or hypochromia), which are rare occurrences, though more common in nonwhite ethnicities. Scarring is a setback for which the treatment is contraindicated in patients with a propensity for keloids and hypertrophic scars. This is the first report of PLEXR being used for minor nonsurgical ear cartilage reshaping. Although the result is encouraging, PLEXR's cartilage reshaping properties are limited: it causes superficial tissue retraction but cannot remodel thicker ear cartilage, where the heat would not reach all the way through. In fact, plasma exeresis would be ineffective if used for nonsurgical otoplasties, unlike other technologies, which have already been described for that purpose. In fact, 1540 nm Er/Glass laser has been used to correct prominent

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**Fig. 1.** Clinical presentation of a 28-year-old patient with hypertrophic Darwin’s tubercle: (A) at two months and (B) at 6 months from initial treatment (C) using PLEXR plasma exeresis device.
ears,23 though it requires costly equipment and can be associated with beam hazards or other side effects,24 which is why new technological innovations must be explored.

CONCLUSION

We believe that plasma exeresis is an interesting tool for the correction of hypertrophic DT, with the potential of delivering fast treatments while keeping morbidity low.

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