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New Indication for Calcium Hydroxyapatite: Safe Rejuvenation of the Dorsum of the Foot Based on Anatomy

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Abstract: Introduction: For religious reasons, there is a portion of the population that does not expose their bodies, showing only the feet. Objective: The objective of this study was to meet the demand for treatments for rejuvenation of the dorsum of the feet, observing the safety of the use of calcium hydroxyapatite and its results, and discussing the anatomy of the region. Methods: We selected 60 women with an average age of 63 (between 40 and 74 years old; Graph 1) with phototypes ranging from I to VI: five patients with phototype I; 13 with II; 11 with III; 2 with IV; 21 with V; and 8 with phototype VI. With regard to the classification of the type of aging of the dorsum of the feet, we only treated patients with types between III and VI. For the treatment of biostimulation of the skin of the dorsum of the feet, calcium hydroxyapatite was chosen and the volume injected ranged from 0.75 ml to 3 ml per patient in a single session (Graph 2). Results: The results were considered good to very good according to the stage of aging of the dorsum of the feet. Complications were limited to local edema and erythema. Follow-up was from six months to one year. Conclusion: Injection of calcium hydroxyapatite into the dorsum of the feet based on knowledge of the anatomy of this region and correct volume can be considered a body area treatment.

Key words: calcium hydroxyapatite; foot; anterior compartment syndrome; collagen

1. Introduction

Although the majority religion in Brazil is Christianity, there is a growing community of Muslims, some of whom are radical. The demand for procedures on the dorsum of the feet began with requests from this segment of the population to rejuvenate the part of the body that is exposed beneath the traditional clothing or burkas. This demand, both in Muslim-majority countries and in others, showed the need for a body treatment based on an anatomical study of the dorsum of the feet. Knowledge of this technique has sparked interest among Brazilian patients who have high expectations regarding body beauty.

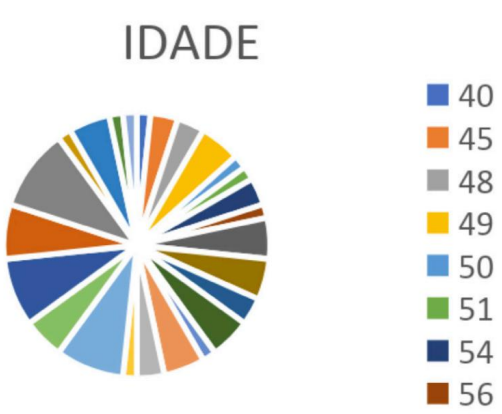
Anatomical studies of the dorsal region of the feet [1, 2] focusing on the injection of biostimulants and fillers have not been carried out frequently. A better understanding of the local anatomy to avoid compartment syndrome and the triggering of vascular lesions leads us to know the ideal injection plan. In addition, following the global trend, there is priority in choosing injection techniques with cannulas.

2. Objective

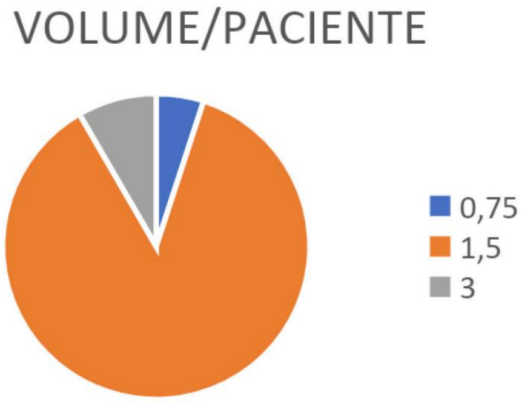
The objective of this study was to meet the growing and unusual demand for treatment in an unusual area, and to observe its safety and results based on an assessment of local anatomy.

3. Methods

Sixty women with an average age of 63 years (range 40-74 years old; Graph 1) and phototypes I to VI were selected: five patients with phototype I; 13 with II; 11 with III; 2 with IV; 21 with V; and 8 with phototype VI. Regarding the classification of the type of aging of the dorsum of the feet, we treated only patients with types between III and VI. For the biostimulation treatment of the skin on the dorsum of the feet, calcium hydroxyapatite was chosen and the injected volume varied between 0.75 ml and 3 ml per patient, in a single session. (Graph 2).



Graph 1. Distribution of patients by age group.



Graph 2. Volume of calcium hydroxyapatite per patient.

As a selection criterion, patients without arterial insufficiency, who were not using anticoagulants, without chronic disease or pain when walking and without any other systemic disease that could contraindicate any aesthetic treatment to rejuvenate the dorsum of the feet were included. The patient should be able to understand the procedure and its possible complications, report any complications and follow the instructions to massage the treated area every four hours during the first day after the procedure, in addition to wearing comfortable shoes until complete recovery of possible edema.

Aging of the dorsum of the feet was classified into types I to VII (Figure 1), where type I represents a young dorsum of the foot, without changes in the skin and subcutaneous tissue and without visualization of veins; type II presents a slight decrease in subcutaneous tissue and discrete visualization of the vascular network; type III clearly presents the vascular network, with or without visualization of tendons; type IV has visible loss of subcutaneous tissue in addition to the previous characteristics; type V presents skin with melanosis and occasional changes in the subcutaneous tissue; type VI shows signs of venous stasis and/or vascular insufficiency; and type VII has complete vascular alterations, as well as aging and atrophy of the skin, which appears parchment-like or with sequelae of stasis, such as ochre dermatitis.

Figure 1. Types of aging of the dorsum of the feet from I to VII.

Only patients with dorsum of the foot aging types III to VI were treated. Simple digital photographic documentation was performed before treatment, immediately after treatment and 30 days after the procedure. Improvement was assessed according to the table of types of foot aging by a dermatologist who did not participate in the treatment and by the patient.

Technique used:

a) Antisepsis with alcoholic chlorhexidine solution;

b) 1.5 ml of calcium hydroxyapatite diluted in 5 ml of 1% lidocaine;

c) Light tourniquet placed on the ankle to visualize the largest veins on the back of the feet;

d) 1% lidocaine with 1:200,000 adrenaline to anesthetize the cannula entry point with a 23G or 18G needle, depending on the type of cannula used for treatment: 27G × 4 cm or 22G × 5 cm, respectively;

e) The volume of calcium hydroxyapatite used per patient was 0.75 ml to 3ml;

f) The cannula entry port was located at a single point in the distal region of the third metatarsal, directing the cannula proximally towards the ankle, in a fan-shaped pattern, distributing the suspension as evenly as possible;

g) After the injection, vigorous massage was performed to spread the suspension over the area of the dorsum of the feet.

In the immediate post-procedure period, the patient was asked to rest with her limbs elevated as much as possible for at least two days and to massage the treated area every two hours during the first day (except at night); three times a day on the second day; and at least once a day for seven days (a total of 10 days of massage). We asked the patients not to use ice or cold compresses, but cool ones if necessary, and to avoid extreme exercise for three days. The patients were also instructed to avoid swimming, sauna use, or any other type of activity that could cause contamination to prevent local infection, as well as to avoid compression or tight footwear on the dorsal area of the feet during the first month. Reassessment visits were scheduled at 2 months, 6 months, and one year.

4. Results

Calcium hydroxyapatite was injected in an average volume of 1.6 ml per patient, ranging from 0.75 ml to 3 ml. Although in some cases the volume was small, the results reported by the patients ranged from good (n = 54 patients), when the improvement occurred with a visible change between the types of aging, to very good (n = 6 patients), when there was improvement in two types of aging, according to the classification mentioned above. The result reported by the dermatologist was no improvement in one patient, very good improvement in two patients and good in the others.

In the post-treatment period, one patient had no complaints; 30 had mild edema, erythema and mild pain; and 26 had mild to moderate pain. Three patients reported grade 4 pain (intense), requiring a prescription for oral analgesics. Mild local pain after the procedure was considered normal due to the infiltration of the suspension. The patients did not present complications other than local edema and erythema, which occurred in 100% of cases and lasted from one to three days after treatment.

A two-month follow-up was performed, when the patients were questioned about the results and also evaluated by the dermatologist. There were also follow-ups after 6 and 12 months, with no evidence of adverse events. All patients confirmed that they would repeat the procedure. In the one-year follow-up, the results were maintained. Figures 2 and 3 demonstrate patients before and after treatment with a very good response (Figures 2, 3).

Figure 2. Pre-treatment, immediate post-procedure and follow-up after two months.

Figure 3. Two-month pre- and post-treatment.

5. Discussion

Based on the anatomy and the fact that the superficial layer, fascia and fat on the dorsum of the foot are very thin, we inserted the bevel of the needle facing the dermis, allowing the cannula to enter the safe plane between the superficial and deep fascia (very similar to the dorsum of the hands). There are no reports of the use of biostimulators on the dorsum of the foot, except for the article published by Cotofana [1].

The plane between the superficial layer and the superficial fascia, located with the help of ultrasound, could be even better, as the cannula would slide easily, without obstacles and painlessly. The anatomy of the dorsum of the foot is very interesting. It should be noted that, for the rejuvenation of the dorsum of the foot, we selected ideal patients without deformities and without comorbidities so that there would be no type of questioning, biomechanical alteration of the foot or predisposition to thrombotic phenomena.

It is useful to perform dissections of the dorsum of the foot not only to assess the blood vessels, nerves and tendons, but also to define the planes between the structures and to observe whether there would be a safer space between the fascia for the introduction of cannulas and infiltration of biostimulators. This assessment has the function of minimizing complications and possible compartment syndrome.

In a brief description of the anatomy of the area to be treated, we can describe the layers of the dorsal region of the foot: just below the skin, lifting it, is the superficial lamina and then the superficial fascia. Below the superficial fascia is the dorsal lamina, where we find a relatively thin layer of subcutaneous tissue. After its proximal dissection, the retinaculum is found. Below this layer of subcutaneous tissue of the dorsal lamina, the flexor tendons of the toes are lifted en bloc because they are encompassed by the lamina. Under this plane are the dorsal artery and vein of the foot, together

with the nerve branches, especially the deep fibular, involving the metatarsals and phalanges, [3] as shown in the diagram with the anatomical planes shown in Figure 4. Exact knowledge of the planes is essential to avoid vascular channeling and, mainly, compartment syndrome, [4] our greatest concern. To avoid these complications, [5] the ideal technique is to infiltrate the biostimulators just below the skin, where the needle that opens the port for the cannula to enter should be introduced as superficially as possible, trying to keep the injection in a position higher in relation to the upper plane of the intermediate dorsal lamina, preferably between the skin and the superficial fascia. In these planes, the cannula slides easily, without encountering obstacles. If the patient has superficial veins, the delicate passage of the cannula in these areas prevents the formation of ecchymosis or hematomas. Keeping the cannula in a superficial position, in the ideal plane, there are no accidents with the superficial venous network (Figure 4).

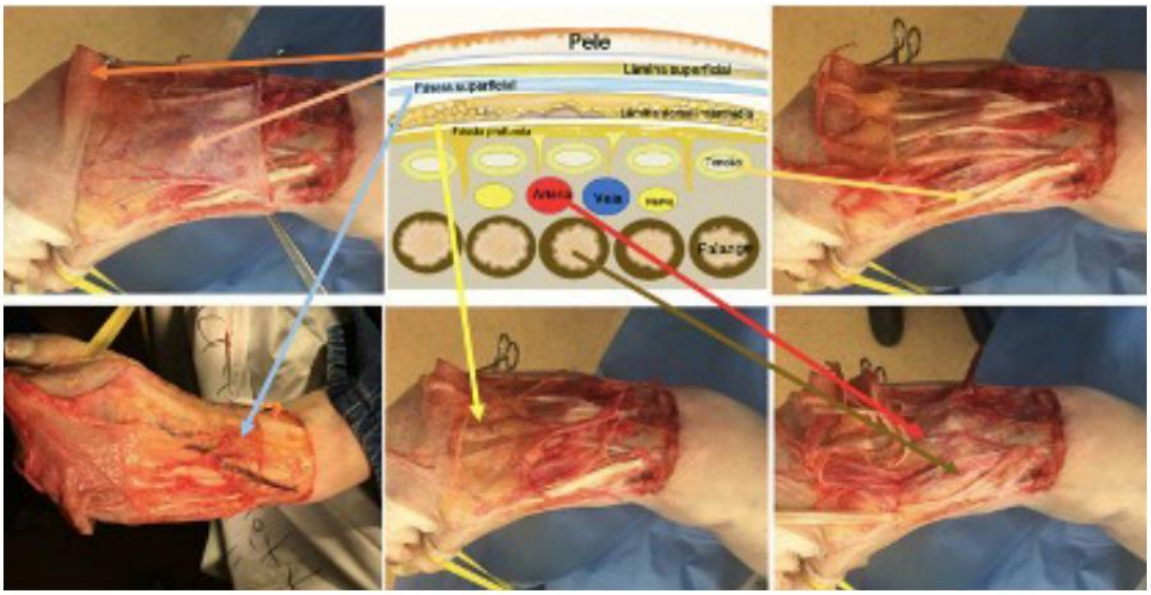


Figure 4. Graphic demonstration of the anatomical layers of the dorsum of the foot and the arrows indicating each layer made by our dissection. Following in order from skin to depth, viewed from above the dorsum of the foot, we find the skin, the superficial lamina, the superficial fascia, the intermediate dorsum lamina, the deep fascia, the tendons, the vascular and neural system, and the metatarsals.

Swelling of the dorsum of the foot is expected after the procedure, but careful selection of the anatomical plane and a small total volume of no more than 1.5 ml per foot/side prevent compartment syndrome. To prevent accumulation of product, the cannula was distributed in a fan motion rather than in a bolus motion. This movement is recommended so that, during the massage, the product can be distributed evenly throughout the area to be treated. It is also important for the patient to participate in the massages during the first few days after the procedure.

6. Conclusion

The injection of collagen biostimulants into the dorsum of the feet, based on an adequate classification of the aging of this region, in-depth anatomical knowledge and use of adequate volume, can open up promising perspectives for the treatment of this new body area.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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