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Case Series

Interfascial Analysis of Ca₁₀(PO₄)₆(OH)₂ Placement in Soft Tissues a Functional Study

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Abstract**Summary**

The softness and elasticity of the skin decreases with age and the improvement of these sensations is an important cosmetic objective. The skin is multilayered, therefore, the rheological properties related to the viscoelasticity of each of the structures are important for the sensation of softness and improvement of movement. Therefore, the indiscriminate placement of products could lead to a negative response in terms of the expected response both cellularly and structurally. A 36-year-old female patient came to the clinic with significant clinical signs of facial deflation, especially at the level of the position of the anterior mandibular panniculus, creating the appearance of sagging of the mandibular border and the middle third. The patient stated that she was attending his dermatological consultations, where Ca₁₀(PO₄)₆(OH)₂ and occasionally combined Hyaluronic Acid were frequently placed. The results of the surgical removal demonstrated an evident fibrotic situation and indiscriminate accumulation of materials. Aging intersects with changes produced by inflammation. If we additionally try to create inflammatory media, what we would be doing is contributing to generating processes that ultimately would not achieve beneficial changes.

Abstract

The smoothness and elasticity of the skin decreases with age and the improvement of these sensations is an important cosmetic objective. The skin is multilayered and therefore the rheological properties related to the viscoelasticity of each of the structures are important for the sensation of smoothness and improved movement. Therefore indiscriminate product placement could lead to a negative response in terms of both cellular and structural response. A 36 year old female patient came to the clinic with important clinical signs of facial deflation, especially at the level of the position of the anterior mandibular panniculus, creating the appearance of a lack of hanging of the mandibular border and the middle third. The patient stated that she attended her dermatological consultations, where she was frequently given Ca₁₀(PO₄)₆(OH)₂ and Hialuronic Acid, occasionally in combination. The results of the surgical lifting showed an evident fibrotic situation and indiscriminate accumulation of material. Ageing intersects with changes produced by inflammation if we additionally try to create inflammatory environments what we would be doing is contributing to generate processes that ultimately would not achieve beneficial changes.

Keywords: Calcium hydroxyapatite; Fibrosis; Inflammation; Aging

INTRODUCTION

The smoothness and elasticity of the skin decreases with age, and improving these sensations is an important cosmetic goal. The skin is multi-layered, therefore, the rheological properties related to the viscoelasticity of each structure are important for the sensation of smoothness and improved movement. Some studies have shown quantitative and qualitative age-related changes in fibrous tissues in the dermal layer [1]. Thus, it is evident that maintaining physical properties is what improves the skin. In any treatment we perform, it is essential to maintain dermal viscoelasticity. However, it is widely accepted that skin stiffness, which is one of the main mechanical parameters defining skin appearance, continuously decreases with aging. Likewise, non-invasive and minimally invasive anti-aging numerical strategies developed in recent years have mainly focused on the mechanical reinforcement of the skin related to the production of additional physiological or pathological collagen networks in the dermis [2]. When referring to pathological, this is done under the premise of the placement of biomaterials that ultimately create a fibrotic network altering the skin's viscoelasticity, leading to undesired fibrosis and inflammation. Another important specific property of facial fat is its multiple compartmental structure. Facial compartments can be subdivided into fibrous types (e.g. perioral), structural types (e.g. midface), and fat deposit types (e.g. buccal fat pad, deep temporal fat pad) [3]. Therefore, we infer that their vectorial and functional treatments should also have a different conception. It is worth highlighting the presence of Homeobox (HOX) genes known to be involved in human adipogenesis, which were strongly downregulated in facial treatment compared to abdominal adipocytes. This observation corresponds to the negative HOX gradient of the areas. Such reduction in HOX expression in adipocytes may be related to their inflammatory environment. For instance, it was reported that the application of IL-1 β caused up to a 90% reduction in the expression of some HOX genes [4], helping us understand that all adipose tissue compartments do not behave in the same way. Clearly, we see how frontal fat pads undergo atrophy, along with the supra parotid and lateral mandibular or lateral cheek compartment, unlike the nasolabial and anterior mandibular fat pads (jowls), which hypertrophy. This explains the mixed behavior they present. Therefore, the indiscriminate placement of products could lead to a negative response in terms of the expected cellular and structural response.

METHODS

This patient comes in due to significant clinical signs of facial deflation, especially at the level of the anterior jawline creating a sagging appearance of the jawline and midface, the patient reported attending medical consultations, where she was frequently given $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$ and Hyaluronic Acid occasionally combined, occasionally separately, in the medical history she reported initially feeling she had a pleasing result, probably due to the inflammatory process she was experiencing, and later feeling more sagging even heavier than what she experienced initially, reporting having a "Fat Face". The facial overfilling syndrome is an underdiagnosed aesthetic

complication due to multiple incorrect placements of fillers [5]. Facial distortion due to the overfilling syndrome can be exacerbated by facial expressions and movement worsening with tissue ptosis due to aging. The emergence of the "Facial Overfilling Syndrome (FOS)" presents a worrying trend attributed to excessive use of filler and suboptimal injection techniques. Understanding the interaction between facial aging and augmentation techniques is crucial to address and prevent FOS.

Surgical planning was carried out after a prior surgical evaluation, starting with the lifting of planes to encounter the findings presented below. In figure 1, completely calcified $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$ deposits are observed in the dashed line, causing inflammation accompanied by volumetric increase that in no case provided proprioception and support to the skin, on the contrary, we found hardened tissue and skin without tension.

In figure 2, following a survey, we observe vectorial columns of a completely hardened and encapsulated material that, due to its physical and rheological characteristics, resembles calcium deposits of $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$, which in turn create fibrotic capsules that clearly give a fibrotic appearance to the tissue.

Figure 3 shows more vectors in deep planes and perpendicular to the line of ligaments, which evidently limits facial movement, increasing the condition of expressionlessness that patients often display.

In figure 4, we observe again the same clinical behavior as in the previous patient now on the masseteric ligament surrounding the area accompanied by hardening, discoloration and whitish appearance due to the fibrosis it undergoes.

In figure 5, evidence of encapsulation of the ceramic material forming a hardened and isolated conglomerate without apparent integration into the tissue leading to hardening of the area.

DISCUSSION

The need for customized evaluation and treatment plans should precede filler injections, which include muscle evaluation, observation of facial movements during injection, and ultrasound imaging of fat layers [6]. An understanding of anatomical layers, as well as molecular and cellular knowledge, is crucial for operators to make decisions. Understanding the aging process in facial tissues is essential, as fillers cannot completely reverse aging manifestations. In filler injection sites, an inflammatory response occurs, leading to a spectrum of outcomes ranging from tissue regeneration to fibrosis and filler encapsulation. It is important to note that the resulting inflammatory pathway may be predetermined by the injected biomaterial [7]. This clarification is crucial because operators often lack knowledge of the true mechanism of action of these products, leading to potential harm in susceptible patients with poorly understood medical histories. It is known that facial fillers typically remain in place for a long time and may not always have the desired effect.

In a study it was histologically demonstrated that $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$

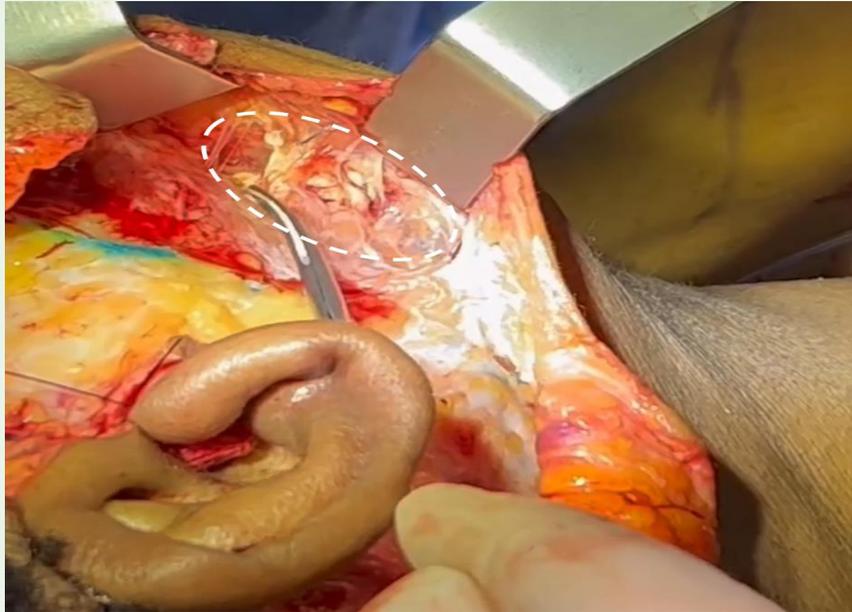


Figure 1: Survey of the plane and pre-visualization of the area calcified by the presence of HaPCa deposits



Figure 2: The arrows indicate areas of deposit and fibrosis produced by the placed material.



Figure 3: The arrows indicate the perpendicular extension of the vector carried out with HaPCa.



Figure 4: Area of the masseteric ligament with fibrotic appearance and limited distension of the dissected area for surgical purposes.



Figure 5: Area of the masseteric ligament with fibrotic appearance and limited distension of the dissected area for surgical purposes.

showed a foreign body reaction with numerous giant cells and histiocytes, some plasma cells, and lymphocytes. Within this inflammatory reaction, a non-polarizing exogenous material was identified consisting of numerous round, uniformly sized, yellowish extracellular deposits with a crunchy appearance. Although many authors claim that $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$ does not induce any foreign body reaction, we found a series of similar histopathological images in studies describing test sites in the auricular area in animals or humans or even in reports of lip nodules, which are a well-known adverse effect after injection of this filler in this site. This histopathological appearance is particularly distinctive and easily recognizable by dermatologists and dermatopathologists [8]. It is fully demonstrated that this type of biomaterial creates a foreign body reaction that in this case has been clinically evidenced by the lifting of planes, which is verifiable even by palpating the tissue in a fragmented manner. It is important to note these types of responses and inform the patient of the possibility of experiencing them since they obviously, despite the fibrosis they generate, are not the solution to the aging symptoms that the patient is experiencing. In recent years, epigenetic dynamics and immunometabolic reprogramming are linked to alterations in cellular response to intrinsic and extrinsic stimuli, representing current hotspots, as they not only (re)shape individual cell identity, but also imply cell destiny decisions. This review focuses on current findings and emerging concepts in epigenetic, inflammatory, and metabolic regulations and the consequences of the aging process. Possible therapeutic interventions targeting cellular senescence and regulatory mechanisms are also discussed using vanguard techniques [9]. It is evident that aging intersects with changes produced by inflammation, and if we additionally seek to create inflammatory environments, we would be contributing to generating processes that would ultimately not achieve beneficial changes.

CONCLUSION

The true need to change the stratigraphic condition of patients with aging processes requires a deep understanding of facial anatomy, the biological aging process, and the material that would be decided to use in their procedure. Current biomaterials called collagen biostimulators are generally derived from ceramics, plastics, and hybrids, great care must be taken in their placement due to what we clearly observe. It is important to open paths of research that allow unbiased opinions to be issued on these patients responses to avoid generating negative changes in patients with high expectations.

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