

COLLAGEN BIOSTIMULATORS IN FACIAL REJUVENATION TREATMENT

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Abstract: This study aims to investigate the efficacy and safety of collagen bio-stimulators in facial aesthetic procedures, focusing on promoting skin elasticity and firmness. The justification for this research is based on the increasing demand for minimally invasive treatments that provide satisfactory results in facial rejuvenation. The adopted methodology consists of a literature review, analyzing scientific articles, systematic reviews, and other relevant materials published in the last ten years. The discussion highlights the effectiveness of bio-stimulators, such as calcium hydroxyapatite and poly-L-lactic acid, compared to surgical treatments, as well as the importance of personalizing procedures and combining them with other aesthetic techniques. The conclusion reaffirms that the research question was positively answered and that the specific objectives were achieved, recommending further research to explore new formulations and their implications.

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INTRODUCTION

The use of collagen biostimulators in facial rejuvenation treatment has become an increasingly common practice in aesthetic dermatology, due to their ability to stimulate collagen production and improve the appearance of the skin.

Biostimulators, such as calcium hydroxyapatite (CaHA) and poly-L-lactic acid (PLLA), act in the deeper layers of the skin, promoting a controlled inflammatory response that results in neocollagenesis, that is, the formation of new collagen fibers (Luiz, 2023; Neca et al., 2022; Garcia, 2024). This approach not only improves skin elasticity and firmness, but also provides a facial volumizing effect, which is essential for restoring youthfulness lost with aging (Rodrigues et al., 2022; Matos, 2023).

Calcium hydroxyapatite, in particular, is one of the most studied and used biostimulators in clinical practice. This material not only acts as a filler but also stimulates collagen production over time, resulting in sustainable improvements in skin texture and appearance (Troczinski, 2024; Silva, 2024).

Studies show that the application of CaHA can lead to visible results that are maintained for several months, making it an attractive option for patients seeking facial rejuvenation without the need for invasive surgical interventions (Neca et al., 2022; Beserra et al., 2023).

The problem question that guides this research is: what are the effects of collagen biostimulators on facial rejuvenation and what is the available evidence on their efficacy and safety?

The rationale for this study lies in the fact that skin aging is a natural process, which results in loss of collagen, elasticity, and hydration, leading to the appearance of wrinkles and sagging. In this context, collagen biostimulators emerge as a promising alternative to promote skin regeneration and improve facial appearance. A review of the literature on this topic is essential to better understand



the benefits, mechanisms of action, and potential risks of these treatments, contributing to a more informed and safe clinical practice. In addition, the growing demand for aesthetic procedures that use products with a lower risk of adverse effects justifies the need to investigate effective and safe options, such as biostimulators.

The general objective of this article is to investigate the efficacy of collagen biostimulators in the treatment of facial rejuvenation, analyzing their properties, mechanisms of action, and clinical results. To achieve this objective, three specific objectives were established: the first is to review the existing literature on the different types of collagen biostimulators used in facial aesthetics, their formulations and indications.

The second objective is to evaluate the effects of collagen biostimulators on skin quality parameters, such as elasticity, hydration and wrinkle reduction. Finally, the third objective aims to analyze the safety and side effects associated with the use of collagen biostimulators in facial aesthetic procedures.

METHODOLOGY

The methodology used for this research will consist of a literature review with a bibliographic focus, with the objective of compiling and analyzing existing studies on the application of collagen biostimulators in facial aesthetic procedures. The review will be carried out in several stages, starting with the definition of inclusion and exclusion criteria for the selection of articles to be considered. Scientific articles, systematic reviews, theses, dissertations, and books published in peer-reviewed journals in the areas of dermatology, aesthetic medicine, and health sciences will be included.

The research will be carried out in academic databases, such as PubMed, Scopus, Google Scholar and Web of Science, using specific keywords such as “collagen biostimulators”, “calcium hydroxyapatite”, “poly-L-lactic acid”, “neocollagenesis” and “aesthetic treatments”. The search will cover publications from the last ten years to ensure the relevance and timeliness of the information.



The selected articles will undergo a critical analysis, considering the methods used, the results obtained and the conclusions presented by the authors. This analysis will seek to identify patterns and divergences in the evidence on the efficacy, safety, and possible side effects related to the use of collagen biostimulators. Additionally, the combinations of biostimulators with other aesthetic techniques, such as microneedling and radiofrequency, will be investigated to evaluate the synergy between the treatments and their impacts on aesthetic results.

The data collected will be organized into tables and summaries, allowing for a clear synthesis of the information and facilitating comparison between the different studies. The literature review will result in the elaboration of a text that addresses the evolution of the use of collagen biostimulators, their indications and contraindications, in addition to discussing the efficacy and safety of these treatments, as well as the emotional and psychological implications they may have on the self-esteem of patients.

This methodological approach aims to contribute to a deeper understanding of collagen biostimulators, providing a solid foundation for future research and clinical practices in the aesthetic area. Through the literature review, it is expected to identify gaps in current knowledge and suggest areas that need further investigations, thus promoting an advance in aesthetic practices and patient satisfaction.

LITERATURE REVIEW

Different types of collagen biostimulators used in facial aesthetics, their formulations and indications

Collagen biostimulators are consolidating themselves as an essential tool in facial aesthetics, presenting a minimally invasive alternative for skin rejuvenation. These products act on the deep layers of the dermis, stimulating collagen production and thus improving the elasticity and firmness of the skin. Among the most commonly used biostimulators, calcium hydroxyapatite (CaHA) and



poly-L-lactic acid (PLLA) stand out, each with specific characteristics in terms of formulation and clinical indications.

Calcium hydroxyapatite, widely used, is a material that combines biocompatibility and biodegradability, working both as a filler and as a biostimulator. Its application triggers a controlled inflammatory response that induces neocollagenesis, or the formation of new collagen fibers. Research indicates that CaHA is effective in restoring facial volumes and improving skin texture, with results that can last for up to 18 months after application (Luiz, 2023; Neca et al., 2022; Troczinski, 2024). In addition, calcium hydroxyapatite is considered safe, with a low incidence of adverse effects, which makes it a popular choice among aesthetic professionals (Miranda & Lopes, 2023; Araújo et al., 2022).

On the other hand, poly-L-lactic acid is a biostimulator that, when injected, also promotes collagen production, although its mechanism of action is somewhat different. This compound is recognized for its ability to induce collagen formation over time, with results becoming more evident after a few weeks and can last up to two years (Farina & Mota, 2023; Nogueira & Silva, 2022). PLLA is often used in areas that require a gradual increase in volume, such as the cheeks and jawline, and is especially indicated for patients looking for a subtle and natural effect (Jacintho, 2023; Zaragoza, 2023).

In addition to calcium hydroxyapatite and poly-L-lactic acid, other biostimulators have gained relevance in aesthetic practice. Hyaluronic acid, traditionally used as a filler, also has biostimulatory properties when applied in specific concentrations and in combination with techniques such as microneedling (Machado, 2023; Pires & Ribeiro, 2021). The use of hyaluronic acid can not only fill in furrows and wrinkles, but also improve skin hydration and elasticity, contributing to a younger and healthier appearance (Rodrigues et al., 2022; Lima & Soares, 2020).

Collagen biostimulators are often integrated into combined protocols, where different substances are used together to maximize aesthetic results. For example, the association of calcium hydroxyapatite with microneedling has shown promising results in the treatment of sagging skin, since microneedling enhances the absorption of biostimulators and further stimulates collagen production



(Farina & Mota, 2023; Sinigaglia & Führ, 2019). This integrated approach not only improves skin texture but also promotes a lifting effect, which is highly desired by patients looking for facial rejuvenation.

The selection of the appropriate biostimulator must consider several factors, such as the patient's skin condition, their expectations, and the place of application. The experience of the professional responsible for the procedure is essential to ensure satisfactory results and minimize the risk of complications (Beserra et al., 2023; Veloso, 2023). In addition, prior assessment of the patient's health and discussion of possible side effects are essential steps for safe and effective treatment (Matos, 2023; Seabra & Silva, 2022).

It is important to note that collagen biostimulators are not exempt from contraindications. Patients with autoimmune diseases, active infections in the area of application or allergies to product components should be carefully evaluated before any procedure. Personalization of treatment, taking into account the individual characteristics of each patient, is crucial for the success of the aesthetic intervention (Araújo et al., 2022).

Poly-L-lactic acid, as well as calcium hydroxyapatite, stands out as an effective biostimulator. When injected, it activates fibroblasts, cells responsible for collagen production, promoting a thickening of the skin that becomes visible after a few weeks (Farina & Mota, 2023; Miyashiro et al., 2022).

The combination of both biostimulators can enhance the results, offering a synergistic effect that improves skin quality in a comprehensive way (Farina et al., 2022; Araújo et al., 2022). The use of minimally invasive techniques, such as the injection of biostimulators, is revolutionizing the field of aesthetics, allowing patients to obtain satisfactory results with a reduced recovery time (Matos, 2023; Silva et al., 2022).

Collagen biostimulators are considered safe, with a minimal side effect profile, which makes them a popular choice among healthcare professionals and patients (Lima & Soares, 2020; Araújo et al., 2022). The biocompatibility and biodegradability of these materials are characteristics that favor their acceptance in the aesthetic market, allowing treatments to be performed with confidence



(Veloso, 2023; Beserra et al., 2023). Personalization of treatments, taking into account the specific needs of each patient, is essential to maximize results and minimize risks (Pires & Ribeiro, 2021; Araújo et al., 2022).

The efficacy of collagen biostimulators in facial rejuvenation is supported by a wide scientific literature. Studies show that the application of biostimulators not only improves the appearance of the skin, but also contributes to patients' self-esteem, an aspect often neglected in discussions about aesthetic treatments (Rodrigues et al., 2022; Beserra et al., 2023). Facial harmonization, which includes the use of biostimulators, represents a holistic approach that aims to restore individuals' natural beauty and confidence, reflecting the importance of aesthetics in mental and emotional health (Pires & Ribeiro, 2021; Silva et al., 2022).

In addition to the aesthetic benefits, the use of collagen biostimulators can be analyzed from the perspective of regenerative medicine. The ability of these materials to promote skin regeneration and the formation of new collagen aligns with current trends that seek not only to improve appearance but also to restore skin health at the cellular level (Trocinski, 2024; Veloso, 2023; Papiordanou et al., 2022)

This opens up new possibilities for the use of biostimulators in other areas of aesthetic medicine, such as the treatment of scars and sagging (Farina & Mota, 2023).

Continued research on collagen biostimulators is vital to better understand their applications and optimize treatment protocols. Current literature suggests that, although the results are generally positive, the experience of the practitioner and the choice of the appropriate product are crucial for the success of the treatment (Beserra et al., 2023; Araújo et al., 2022). The training and updating of health professionals who perform these procedures are essential to ensure the safety and efficacy of treatments (Jacintho, 2023; Matos, 2023).

The evolution of techniques and products in facial aesthetics, particularly in relation to collagen biostimulators, demonstrates a growing commitment to the safety and efficacy of treatments. With new studies conducted, it is essential for healthcare professionals to stay up-to-date on best



practices and innovations in the field. This update not only improves patient outcomes but also strengthens public confidence in cosmetic procedures.

The scientific literature suggests that combining biostimulators with other aesthetic approaches, such as lasers or topical treatments, can lead to significant improvements in skin quality and patient satisfaction. For example, the application of biostimulators after laser treatments can enhance the regenerative effects on the skin, favoring a faster and more effective recovery (Rodrigues et al., 2022; Araújo et al., 2022).

Another important factor is patient education. Informing patients about what to expect from collagen biostimulator treatments is key to setting realistic expectations and ensuring satisfaction with the results. It is crucial to discuss with patients the required number of sessions, the duration of effects, and post-procedure care as part of the initial consultation (Matos, 2023; Veloso, 2023). This approach helps reduce anxiety and promotes better adherence to the professional's recommendations.

Personalization of treatment is also an essential aspect. Each patient has unique characteristics that influence the choice of biostimulator and the technique to be used. Considering factors such as age, skin type, severity of sagging, and patient expectations is essential to achieve satisfactory results (Beserra et al., 2023; Farina et al., 2022). Individualized treatment protocols can maximize the effectiveness and safety of procedures.

Ethics in aesthetic practice must be prioritized. Professionals have the responsibility to ensure that interventions are carried out in accordance with ethical and legal guidelines, always prioritizing the patient's well-being. Transparency in discussions about the expected outcomes and risks associated with treatments is crucial to promote responsible practice (Seabra & Silva, 2022; Troczinski, 2024).

Additionally, research on collagen biostimulators is expected to continue to expand, exploring their use in treatments for scars, stretch marks, and other aspects of skin health. The possibility of using biostimulators not only for aesthetic purposes, but also to promote skin health and regeneration in different contexts, is a promising field that deserves attention and investigation (Papaiordanou et al., 2022; Silva et al., 2022).



In summary, collagen biostimulators represent a revolution in facial aesthetics, offering effective and safe solutions for skin rejuvenation. The combination of scientific research, ethical practices, and personalization of treatment will be critical to the future of aesthetic medicine, ensuring that patients can benefit from advances in this area with confidence and safety.

Collagen biostimulators are becoming a fundamental tool in aesthetic medicine, especially in the context of facial harmonization and skin rejuvenation. Among the main biostimulators, poly-L-lactic acid (PLLA), calcium hydroxyapatite (CaHA) and polydioxanone (PDO) stand out. Each of these materials has distinct characteristics that influence their application and effectiveness in promoting neocollagenesis, that is, in stimulating collagen production by the skin.

Poly-L-lactic acid is a biodegradable polymer that, when injected into the junction between the dermis and the subcutaneous, stimulates fibroblasts to produce collagen. This results in a volumizing effect that becomes noticeable after about two months and can last up to two years (Farina & Mota, 2023). This biostimulator is widely used in treatments for sagging and loss of facial volume, and is considered safe and effective in various aesthetic applications (Rodrigues et al., 2022; Zaragoza, 2023). PLLA's ability to induce collagen production is one of the key factors that make it a popular choice among aesthetic professionals (Farina et al., 2022).

On the other hand, calcium hydroxyapatite, which has a mineral composition similar to that of human bones, is used both as a filler and as a biostimulator of collagen (Neca et al., 2022; Diaz et al., 2022). This compound is known to offer immediate results in volumization and to stimulate the gradual production of collagen. Studies indicate that calcium hydroxyapatite can improve skin texture and restore lost volumes, being a safe and minimally invasive option for aesthetic procedures (Moura, 2023; Troczinski, 2024).

Its effectiveness is associated with the activation of fibroblasts, which promote the formation of new collagen fibers, contributing to the elasticity and firmness of the skin (Vasconcelos et al., 2022).

Although less discussed compared to PLLA and CaHA, polydioxanone also plays an important role in collagen induction. This material is often used in support threads that, when inserted



into the skin, create a controlled inflammatory response that stimulates collagen production (Dias et al., 2022). The collagen induction technique with PDO threads has been shown to be effective in treating sagging and improving skin texture, providing results that can last from one to two years (Zaragoza, 2023; Dias et al., 2022).

The classification of collagen biostimulators can be made based on their permanence and absorption by the body, categorizing them as temporary, semi-permanent, or permanent (Araújo et al., 2022). Poly-L-lactic acid and calcium hydroxyapatite are considered semi-permanent, while polydioxanone is seen as a temporary material due to its faster absorption (Nogueira & Silva, 2022). This classification is crucial for aesthetic professionals, as it guides the choice of the most appropriate biostimulator, taking into account the needs and expectations of patients.

In addition to the individual characteristics of each biostimulator, the combination of different techniques and products has shown promise in maximizing aesthetic results. For example, therapy that combines microneedling and biostimulators can enhance the effectiveness of the treatment, promoting a more robust and comprehensive collagen induction (Farina & Mota, 2023; Tired, 2023).

The literature suggests that integrated approaches, which use multiple stimulation methods, can result in significant improvements in the appearance of the skin, addressing not only sagging but also other aesthetic concerns, such as wrinkles and fine lines (Veloso, 2023).

The safety and efficacy of collagen biostimulators have been widely documented in clinical studies, which show positive results in terms of patient satisfaction and minimization of side effects (Moura, 2023; Pogere et al., 2021). Calcium hydroxyapatite, for example, is recognized for its biocompatibility and low risk of complications, making it a frequent choice among aesthetic health professionals (Oliveira et al., 2021; Bordalo, 2024). Similarly, poly-L-lactic acid is considered safe, with a generally mild and temporary adverse effect profile (Farina & Mota, 2023; Zaragoza, 2023).

In addition to the evidence that proves the safety and efficacy of biostimulators, it is essential to emphasize the importance of continuous training of health professionals involved in aesthetics. Updating on new techniques, products, and protocols is crucial to ensure that procedures are performed



safely and to maximize aesthetic results. Professionals should be informed about the latest research and trends, as well as improve their skills in patient assessment and treatment planning (Matos, 2023; Jacintho, 2023).

Personalization of treatment is another vital factor that should not be disregarded. Each patient has unique characteristics that influence the choice of biostimulator and the technique to be used. It is essential to assess the patient's age, skin type, severity of sagging, and expectations to achieve satisfactory results (Beserra et al., 2023; Farina et al., 2022). Therefore, designing an individualized treatment plan not only increases effectiveness but also promotes greater patient satisfaction.

Ethics play a significant role in aesthetic practice. Professionals must ensure that procedures are performed in accordance with ethical and legal guidelines, always prioritizing the patient's well-being. In addition, transparency in discussions about the expected outcomes, the limitations of treatments, and the associated risks is essential for responsible practice (Seabra & Silva, 2022; Troczinski, 2024).

Considering the emotional and psychological impact that aesthetic treatments can have on patients is also relevant. Improvement in the appearance of the skin often results in an increase in self-esteem and self-confidence, factors that must be taken into account when approaching aesthetic treatment (Rodrigues et al., 2022; Beserra et al., 2023). This holistic perspective is essential for understanding the role of collagen biostimulators in the mental and emotional health of individuals.

In addition, research on collagen biostimulators should continue to expand, exploring new indications and therapeutic combinations. Investigating innovative uses, such as the treatment of scars and stretch marks, can open up new opportunities for the application of these products in aesthetic medicine (Papaiordanou et al., 2022; Silva et al., 2022).

In summary, collagen biostimulators represent a true revolution in aesthetic medicine, offering effective and safe solutions for facial rejuvenation. The integration of scientific research, ethical practice, personalization of treatment and continuous training of professionals will be fundamental for the future of aesthetics. In this way, patients will be able to benefit from advances in this area



safely and confidently, leading to results that not only improve appearance, but also positively impact self-esteem and quality of life.

Effects of collagen biostimulators on skin quality parameters such as elasticity, hydration, and wrinkle reduction

Collagen biostimulators have gained notoriety in aesthetics, especially with regard to the improvement of skin quality parameters, such as elasticity, hydration, and wrinkle reduction. These agents work by promoting the production of collagen, a protein that is essential for maintaining skin structure and firmness. The natural degradation of collagen with aging results in sagging, wrinkles, and loss of elasticity, leading many individuals to seek aesthetic interventions to reverse these effects (Machado, 2023; Santos et al., 2023; Neca et al., 2022).

Biostimulators, such as calcium hydroxyapatite (CaHA) and poly-L-lactic acid (PLLA), have been shown to be effective in promoting neocollagenesis, which is the formation of new collagen fibers. CaHA, for example, acts as a filler that offers immediate volume, while stimulating collagen production over time, resulting in firmer and more elastic skin (Neca et al., 2022; Troczinski, 2024; Silva, 2024). Studies indicate that the application of these biostimulators can result in significant improvements in skin texture, with visible results that can last for up to two years after treatment (Farina & Mota, 2023; Matos, 2023).

In addition to calcium hydroxyapatite, hyaluronic acid (HA) is widely used in aesthetic procedures. HA not only improves skin hydration but also plays an important role in stimulating fibroblasts, which are responsible for the production of collagen and elastin (Machado, 2023; Santos et al., 2023). The combination of HA with other biostimulators has shown potential to maximize aesthetic results, promoting a more comprehensive facial rejuvenation (Santos et al., 2023; Farina & Mota, 2023).

Skin elasticity is one of the main parameters affected by aging and exposure to environmental



factors such as UV radiation. The application of collagen biostimulators can help restore this elasticity, since collagen production is essential for the structure of the dermis (Seabra & Silva, 2022; Silva, 2023). Research suggests that oral collagen supplementation may also contribute to improving skin elasticity, as well as reducing the appearance of wrinkles and fine lines (Carvalho et al., 2023; Miyashiro et al., 2022).

Skin hydration is another critical aspect that can be improved with the use of biostimulators. Proper hydration is vital for maintaining the skin's barrier function and preventing premature aging. Stimulating collagen production helps to lock in moisture, resulting in smoother, healthier skin (Papaiordanou et al., 2022; Miyashiro et al., 2022). The combination of topical and injectable treatments can enhance these effects, offering a holistic approach to skin rejuvenation (Marinho, 2023).

In addition to the aesthetic benefits, collagen biostimulators are considered safe and minimally invasive, making them an attractive option for many patients. The biocompatibility and biodegradability of these products favor their acceptance in the aesthetic market (Araújo et al., 2022; Zaragoza, 2023). Studies show that adverse effects are minimal and usually limited to mild injection site reactions, such as swelling and redness (Neca et al., 2022; Silva, 2024).

The effectiveness of collagen biostimulators is supported by a number of clinical studies that demonstrate significant improvements in skin quality. Research suggests that the combination of different biostimulators can result in synergistic effects, maximizing aesthetic results and prolonging the durability of the effects (Matos, 2023; Veloso, 2023; Nogueira & Silva, 2022). Personalization of treatments, taking into account the individual needs of patients, is essential to optimize patient outcomes and satisfaction (Seabra & Silva, 2022; Lima & Soares, 2020).

In summary, collagen biostimulators represent an innovative and effective approach in the treatment of skin aging, positively impacting elasticity, hydration, and wrinkle reduction. Continuous research and development in this area promises to expand the available options and further improve aesthetic results, contributing to the self-esteem and well-being of individuals who seek these



treatments (Machado, 2023; Farina & Mota, 2023; Veloso, 2023).

The popularity of collagen biostimulators has driven the increase in clinics and professionals offering these treatments, reflecting a growing acceptance and demand in the aesthetic market. With an increasing number of individuals seeking minimally invasive interventions to enhance their appearance, the need for information and adequate training for professionals in the field becomes even more crucial. Continuous education not only ensures that professionals are up-to-date on best practices and techniques, but also fosters patient confidence in available treatments (Matos, 2023; Jacintho, 2023).

The evolution of injection technologies, along with the introduction of new products in the market, expands the possibilities of personalization of treatments. The combination of biostimulators with different techniques, such as microneedling, can enhance the results, providing a synergistic effect that favors collagen production and improves skin texture (Farina & Mota, 2023; Tired, 2023). This integrated approach allows aesthetic professionals to offer more comprehensive solutions, meeting the diverse needs of patients.

Pre-treatment evaluation is essential to determine the most appropriate protocol for each patient. This involves a detailed analysis of the patient's skin condition, medical history, and expectations. A well-structured treatment plan not only increases the effectiveness of procedures but also helps minimize potential risks and side effects (Seabra & Silva, 2022; Veloso, 2023). In addition, clear communication about the expected outcomes and limitations of treatments is essential to ensure patient satisfaction and establish a trusting relationship between the professional and the client.

The growing concern about the health and safety of aesthetic treatments underscores the importance of following ethical and legal guidelines. Professionals should always prioritize the well-being of patients, ensuring that procedures are performed in appropriate environments and under safe conditions (Trocinski, 2024). Transparency regarding potential risks and expectations of results is also critical to the responsible practice of aesthetic medicine.

With the advancement of research on collagen biostimulators, it is expected that new



applications and formulations will be developed. This may include investigations into the use of biostimulators in areas beyond facial aesthetics, such as in the treatment of scars, stretch marks, and body sagging (Papaiordanou et al., 2022; Silva et al., 2022). The future of collagen biostimulators looks promising, with the potential to offer innovative solutions that not only enhance appearance but also contribute to skin health at a cellular level.

In summary, collagen biostimulators have established themselves as a powerful tool in aesthetic medicine, providing significant benefits in terms of elasticity, hydration, and wrinkle reduction. As research advances and techniques evolve, these treatments are expected to become even more effective and affordable, meeting the rising expectations of patients seeking facial rejuvenation and wellness. The combination of science, technique, and ethics will be critical to continued success in this expanding field.

Collagen biostimulators have stood out as a promising alternative for the treatment of sagging and loss of skin elasticity, conditions often associated with aging. The effectiveness of these agents in promoting skin elasticity is supported by a number of clinical studies demonstrating their beneficial effects on dermal structure. For example, calcium hydroxyapatite is a widely used biostimulator, which stimulates collagen production, resulting in significant improvements in skin elasticity over time (Neca et al., 2022; Seabra & Silva, 2022).

The skin aging process is multifactorial and results in decreased collagen and elastin production, which leads to a loss of firmness and elasticity (Machado, 2022). The introduction of biostimulators, such as poly-L-lactic acid, has shown positive results in neocollagenesis, which is the formation of new collagen, essential for the recovery of skin elasticity (Farina & Mota, 2023; Zaragoza, 2023). Studies indicate that the effects of these treatments can be noticed after a few weeks, with results that can last up to two years, depending on the type of biostimulator used and the individual characteristics of the patient (Farina & Mota, 2023).

In addition, the combination of different techniques, such as microneedling associated with biostimulators, has been explored to enhance aesthetic results. This approach not only stimulates



collagen production but also improves skin texture, contributing to more comprehensive facial rejuvenation (Farina & Mota, 2023). The safety and efficacy of biostimulators are often highlighted in studies, which emphasize the minimally invasive nature of these procedures, making them an attractive option for patients who want to improve skin elasticity without resorting to surgery (Neca et al., 2022; Miranda & Lopes, 2023).

Biostimulators are classified into different categories, such as temporary, semi-permanent, and permanent, based on their durability and absorption by the body (Miranda & Lopes, 2023). Calcium hydroxyapatite, for example, is considered a semi-permanent filler that not only provides volume, but also stimulates collagen production, offering results that can last from 18 months to five years (Miranda & Lopes, 2023). This characteristic is especially relevant for patients who seek long-lasting results without the need for multiple treatment sessions.

The effectiveness of biostimulators on skin elasticity is also corroborated by studies showing significant improvements in skin firmness and texture after treatment (Zaragoza, 2023; Veloso, 2023). The use of biostimulators, such as poly-L-lactic acid and polycaprolactone, has shown promising results not only in reducing wrinkles, but also in improving skin thickness and elasticity (Veloso, 2023). These results are particularly relevant in a context where the demand for effective and safe aesthetic solutions is constantly growing.

In addition to the aesthetic benefits, the use of biostimulators also has positive implications for the self-esteem and psychosocial well-being of patients. Improvement in the appearance of the skin can lead to a significant increase in confidence and personal satisfaction, factors that are often underestimated in discussions about aesthetic treatments (Machado, 2022). The search for treatments that not only treat sagging, but also promote global skin rejuvenation, reflects a change in patients' expectations regarding aesthetic care.

In this way, biostimulators represent a class of treatments that not only address sagging skin but also offer a holistic approach to facial rejuvenation. The combination of different techniques and products, such as the association of biostimulators with procedures such as microneedling, can



maximize results and provide a more satisfactory experience for patients (Farina & Mota, 2023). The future of aesthetic treatments looks promising, with the continuous research and development of new formulations and techniques that aim to improve the efficacy and safety of biostimulators.

The current literature suggests that the choice of biostimulator should be individualized, taking into account the specific characteristics of the patient's skin, their expectations, and the type of sagging to be treated (Morais, 2023). Personalization of treatment is key to ensuring optimal outcomes and patient satisfaction. Additionally, it is crucial to educate patients about the different types of biostimulators, their durability, and effects, so that they can make informed decisions about their aesthetic treatments (Miranda & Lopes, 2023).

Lastly, ongoing research into the effectiveness of biostimulators on skin elasticity is vital for advancing aesthetic practices. Future studies should focus not only on clinical efficacy, but also on long-term safety and patient satisfaction, ensuring that the treatments offered are effective, safe, and sustainable (Velooso, 2023). The integration of new technologies and innovative approaches in the field of biostimulators can result in even more remarkable results, solidifying its position as a preferred solution for facial rejuvenation.

The demand for aesthetic treatments with collagen biostimulators is growing as more people look for effective ways to combat the signs of aging. Awareness of the benefits and safety of these products is increasing, resulting in increased acceptance among the public. Therefore, it is essential that aesthetic professionals strive to provide accurate and evidence-based information about biostimulators, highlighting their properties, modes of action, and expected results.

The personalization of treatments goes beyond the simple choice of the type of biostimulator, also encompassing the adaptation of application techniques according to the individual needs of each patient. This can include decisions about the depth of injections, the amount of product to be used, and the combination with other treatment modalities. This holistic approach tends to provide more satisfactory and long-lasting results, in addition to increasing patients' confidence in the effectiveness of the procedures (Farina & Mota, 2023; Miranda & Lopes, 2023).



In addition to their application in facial treatments, biostimulators are also being investigated for use in body areas, such as the treatment of flaccidity in regions such as the abdomen, arms and thighs. The application of these products to different parts of the body can offer aesthetic results that go beyond facial rejuvenation, meeting the growing demand for solutions that promote skin firmness and elasticity in various areas (Papaiordanou et al., 2022; Silva et al., 2022).

Research on biostimulators should also focus on exploring new formulations that may offer additional benefits. For example, combining biostimulators with ingredients that promote hydration or that have antioxidant properties can enhance the positive effects on the skin. This synergy between different agents can result in a more effective and comprehensive approach to skin rejuvenation (Marinho, 2023; Carvalho et al., 2023).

Collaboration between professionals from different areas, such as dermatologists, estheticians, and nutritionists, can enrich aesthetic practice. This multidisciplinary approach can contribute to the development of more effective treatment protocols, which consider not only aesthetic aspects, but also skin health and the patient's overall well-being (Machado, 2022; Neca et al., 2022).

Transparency in aesthetic practices is essential. Patients should be informed about all aspects of each treatment, including benefits, risks, and realistic expectations. Informed consent is a crucial component of aesthetic care and should be prioritized by all professionals (Seabra & Silva, 2022; Troczinski, 2024). Clear communication not only improves patient satisfaction but also helps build a relationship of trust between the practitioner and the client.

In summary, collagen biostimulators are establishing themselves as a valuable solution for facial and body rejuvenation. As research and development continue to advance, new techniques and products must be introduced, expanding the options available to aesthetic professionals. The integration of science, technology, and a patient-centered approach will be critical to the continued success of biostimulators in the field of aesthetic medicine. This evolution will not only provide better aesthetic results but will also contribute to the emotional well-being and self-esteem of patients, reflecting the importance of aesthetics in contemporary life.



Safety and the Side Effects Associated with the Use of Collagen Biostimulators in Facial Aesthetic Procedures

The use of collagen biostimulators in facial aesthetic procedures has become a common practice in dermatology and aesthetic medicine, due to their ability to stimulate collagen production and improve the appearance of the skin. Products such as calcium hydroxyapatite (CaHA) and poly-L-lactic acid (PLLA) act on the deeper layers of the skin, promoting neocollagenesis and providing visible results over time (Neca et al., 2022; Araújo et al., 2022; Farina et al., 2022). Calcium hydroxyapatite, for example, not only acts as a filler but also induces a controlled inflammatory response that results in collagen production, contributing to skin revitalization (Silva, 2024; Troczinski, 2024; Oliveira et al., 2021).

Collagen biostimulators are often used in facial harmonization procedures, with the aim of restoring lost volume and improving skin texture (Araújo et al., 2022; Veloso, 2023; Seabra & Silva, 2022). The popularity of these treatments stems from their minimally invasive nature, offering a less risky alternative compared to more invasive surgical procedures (Matos, 2023; Jacintho, 2023).

In addition, the safety of these products is often highlighted, since they are considered biocompatible and biodegradable, resulting in minimal side effects (Araújo et al., 2022; Jacintho, 2023; Farina et al., 2022). However, it is essential that these procedures are performed by qualified professionals, as the application technique and the choice of product can significantly influence the results and safety of the treatment (Beserra et al., 2023).

Despite the benefits associated with using collagen biostimulators, it is important to consider the potential side effects. Among the most common adverse effects are inflammatory reactions, bruising, and, in rare cases, more serious complications, such as infections or allergic reactions (Jacintho, 2023; Veloso, 2023; Beserra et al., 2023). The literature indicates that, although most adverse reactions are mild and temporary, the occurrence of serious side effects may be related to



the application technique, the quality of the product used, and the experience of the professional (Jacintho, 2023; Beserra et al., 2023). Thus, careful selection of the biostimulator and evaluation of the patient's conditions are essential to minimize risks.

In addition, individual response to treatment can vary significantly, influenced by factors such as age, skin type, and underlying health conditions (Seabra & Silva, 2022; Veloso, 2023). Studies show that the effectiveness of collagen biostimulators can be maximized when combined with other techniques, such as microneedling, which increases product absorption and improves aesthetic results (Farina & Mota, 2023). This combination of techniques can result in a synergistic effect, providing a more significant improvement in sagging and skin texture (Farina & Mota, 2023).

Research on collagen biostimulators continues to evolve, with the development of new products and techniques that seek to maximize the efficacy and safety of aesthetic treatments. Calcium hydroxyapatite and poly-L-lactic acid, for example, have been the subject of studies investigating their mechanisms of action and their applications in different aesthetic contexts (Trocinski, 2024; Araújo et al., 2022; Oliveira et al., 2021). In addition, the search for more natural alternatives, such as autologous biostimulators, is gaining prominence, as they offer similar results with potentially lower risks (Jacintho, 2023; Seabra & Silva, 2022).

The growing acceptance of collagen biostimulators in the aesthetic market has driven the diversification of available treatments. As more professionals adopt these techniques, continuous training and updating become essential to ensure the safety and effectiveness of the procedures. It is essential that health professionals are well informed about the various options for biostimulators, their indications and contraindications, in addition to developing practical skills to perform appropriate applications (Matos, 2023; Jacintho, 2023).

Ongoing research on biostimulators is also investigating the effectiveness of product combinations and techniques. For example, the use of biostimulators together with technologies such as radiofrequency or ultrasound can enhance the results, offering additional improvements in skin firmness and elasticity (Farina & Mota, 2023). This integrated approach not only improves treatment



effectiveness but also provides patients with a more complete and satisfying experience.

The growing concern about the sustainability and safety of aesthetic treatments is generating a greater demand for products that are effective and also minimize their environmental impact. Autologous biostimulators, which are obtained from the patient himself, are receiving prominence for offering a more natural alternative with a lower risk of adverse reactions (Seabra & Silva, 2022; Jacintho, 2023). This trend reflects a change in the perception of patients, who are increasingly looking for solutions that respect their health and the environment.

Another point to consider is the psychological and emotional impact that aesthetic treatments can have on patients. The improvement in the appearance of the skin, provided by biostimulators, often results in an increase in self-esteem and confidence, which can have a positive effect on quality of life. This aspect emphasizes the importance of approaches that consider not only aesthetic outcomes but also the emotional well-being of patients (Machado, 2022).

Finally, the continuity of research on collagen biostimulators is vital for the advancement of aesthetic practices. Future studies should focus on evaluating long-term efficacy, safety, and patient satisfaction. This will ensure that the treatments offered are not only effective but also safe and sustainable (Velooso, 2023). The combination of technological innovations with the personalization of treatments will allow aesthetic professionals to meet the growing expectations of patients, solidifying the role of biostimulators as a preferred option for facial and body rejuvenation.

In summary, collagen biostimulators not only offer an effective solution to sagging and loss of skin elasticity, but also represent a holistic approach that meets the growing demand for safe and personalized aesthetic treatments. As research advances and new techniques are developed, these treatments are expected to continue to evolve, benefiting more and more individuals looking to improve their appearance and well-being.



DISCUSSION

The discussion about the use of collagen biostimulators in facial aesthetic procedures shows a growing acceptance and demand for these treatments, supported by a series of studies that demonstrate their effectiveness in promoting skin elasticity and firmness. The literature review reveals that biostimulators, such as calcium hydroxyapatite (CaHA) and poly-L-lactic acid (PLLA), stand out for their ability to stimulate neocollagenesis, resulting in visible improvements in skin appearance over time (Neca et al., 2022; Farina et al., 2022).

One of the most relevant aspects identified in the literature is the minimally invasive nature of these procedures, which provides an attractive alternative to more invasive cosmetic surgeries. The popularity of biostimulators is due not only to their efficacy, but also to their safety, with many studies favoring the biocompatibility and biodegradability of these products, which result in generally mild and temporary side effects (Araújo et al., 2022; Jacintho, 2023). This safety is a crucial factor that can influence patients' choice when considering aesthetic treatments.

However, the review also highlights the need for a careful assessment of patients' conditions before the application of biostimulators. The response to treatment can vary significantly between individuals, being influenced by factors such as age, skin type, and underlying health conditions (Seabra & Silva, 2022; Veloso, 2023). The literature suggests that the personalization of treatments is essential to optimize results and increase patient satisfaction, which implies meticulous planning that takes into account individual characteristics and expectations regarding the treatment.

In addition, the combination of biostimulators with other aesthetic techniques, such as microneedling and radiofrequency, has been widely discussed. These combinations can generate synergistic effects, enhancing aesthetic results and offering a more comprehensive approach to facial rejuvenation (Farina & Mota, 2023). This integrated treatment strategy is increasingly recognized as an effective way to maximize the effectiveness of biostimulators, promoting significant improvements in sagging and skin texture.



Another important point highlighted in the literature is the consideration of the emotional and psychological implications of aesthetic treatments. The improvements in the appearance of the skin, provided by biostimulators, can have a positive impact on patients' self-esteem and confidence. This aspect is often overlooked, but it represents an important motivation for many who seek aesthetic interventions (Machado, 2022). Thus, aesthetic practices must consider not only the physical outcomes, but also the emotional well-being of patients.

Lastly, the discussion on collagen biostimulators should include the need for ongoing research to explore new formulations and techniques that can further enhance the efficacy and safety of these treatments. The search for more natural alternatives, such as autologous biostimulators, is becoming more common, reflecting a trend towards options that minimize risks and offer comparable results (Seabra & Silva, 2022; Jacintho, 2023).

In summary, the reviewed literature indicates that collagen biostimulators are an effective and safe solution for facial rejuvenation, but highlights the importance of personalization of treatment, careful assessment of patients' conditions, and consideration of the emotional aspects associated with aesthetic procedures. Continuous development in research and application techniques may result in significant improvements in aesthetic practices, meeting the growing demand for treatments that promote not only beauty, but also the integral well-being of patients.

CONCLUSION

The present study analyzed the use of collagen biostimulators in aesthetic procedures, highlighting their contributions to skin revitalization and the promotion of satisfactory results in a minimally invasive way. The proposed objectives, which included understanding the efficacy of biostimulators and their implications for aesthetic practice, were fully contemplated.

The literature review showed that products such as calcium hydroxyapatite and poly-L-lactic acid are effective in stimulating collagen production, contributing to significant improvements in skin



elasticity and firmness over time. In addition, the safety of these treatments, often attested by studies, reinforces their acceptance both by professionals in the field and by patients seeking less invasive alternatives to surgical procedures.

The problem question, which addressed the efficacy and safety of collagen biostimulators in comparison with other aesthetic procedures, was also adequately answered. The results indicate that the individualization of treatments is a crucial factor to optimize results and ensure patient satisfaction. The analysis of personal factors, such as age, skin type, and health conditions, is essential to minimize risks and enhance the benefits of aesthetic treatments.

Suggestions for future work include conducting more comprehensive comparative studies between different types of biostimulators and their combinations with other aesthetic techniques. In addition, investigating the longevity of outcomes from different treatment protocols could provide valuable information for clinical practice. The exploration of the psychological and emotional impact of aesthetic interventions on patients' quality of life also presents itself as a promising area for research, contributing to a broader understanding of consumers' needs and expectations.

Finally, the combination of biostimulators with other aesthetic techniques, such as microneedling and radiofrequency, presents itself as a promising approach, capable of enhancing results and offering a more comprehensive experience to patients. Continuous research and innovation in this field are vital for the advancement of aesthetic practices, allowing professionals to stay up-to-date with the best options available and the growing expectations of consumers. In this way, collagen biostimulators are consolidated as an effective and safe choice, reflecting a significant evolution in the care of aesthetics and skin health.

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