



Facial Skin Management: Strategies for High-Performance Athletes

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ABSTRACT: As high-performance athletes age, they become more prone to facial aging due to various factors such as sun exposure, oxidative stress, and intense exercise routines. This review emphasizes the significance of orofacial harmonization (OFH) using non-invasive aesthetic treatment options for athletes. To gather information on contemporary treatments for facial skin management in high-performance athletes, a narrative literature review was conducted using PubMed and EBSCO databases. Articles that involved invasive procedures, had extended post-operative periods, or required prolonged rest were excluded since athletes need to recover swiftly to sustain their training routines. The literature supports the effectiveness of non-invasive procedures such as platelet-rich plasma (PRP), topical growth factors delivery, neuromodulators, and tissue bio-stimulators in reducing wrinkles, expression lines, and skin pigmentation in athletes. These interventions also demonstrate improvements in skin elasticity and hydration. In conclusion, non-invasive OFH procedures could help reduce the effects of skin aging in high-performance athletes. However, it is essential to consider the unique needs and recovery timelines of athletes when selecting OFH treatments. Non-invasive procedures with minimal downtime are often preferred to minimize disruptions to training schedules.

KEYWORDS: bio-stimulators; facial expression; neuromodulators; photoaging of skin; oxidative stress; professional athletes; skin wrinkling; skin pigmentation.

INTRODUCTION

In orofacial harmonization (OFH), interventions are made to achieve balanced and rejuvenated facial features, enhancing individual beauty with discreet interventions in appearance, aimed at short- and long-term improvements. On the skin, OFH can reduce wrinkles and expression lines by stimulating collagen production.¹

Although physical exercise routines offer numerous health benefits, excessive practice, especially in high-performance athletes, can lead to accelerated cellular aging due to oxidative stress caused by the production of free radicals.^{2,3}

HOF can be an important adjunct in reducing the effects of photo-aging and oxidative stress in athletes, especially those exposed to high levels of free radicals, such as high-performance athletes.³ Therefore, the conduct of specific treatment for this group depends on knowledge of the routine and habits of these athletes.

To date, there are few studies in the literature dealing with specific facial treatments for high-performance athletes. This study aims to review the literature on protocols for preventing premature aging and facial rejuvenation, applicable to high-performance athletes, taking into account effective results and the shortest post-procedure time.

METHODS

The present study consisted of a narrative literature review describing contemporary treatments for skin management in high-performance athletes. The literature research covered the terms "rejuvenation", "skin pigmentation", "oxidative stress", "facial expression"; "photoaging of skin"; "skin wrinkling"; "professional athletes", "high-performance athletes", "neuromodulators" and "biomodulators", sought separately and jointly. The search for articles was conducted in the PubMed and EBSCO databases.

The search range was limited to articles published in the last fifteen years, in English, Portuguese, and Spanish.

The search included meta-analyses, systematic reviews, narrative reviews, cohort studies, clinical trials, and case-control studies that dealt with current skin management procedures, particularly in high-performance athletes. Papers including surgeries and invasive procedures that require extended post-operative periods, or prolonged rest, were excluded, as well as articles that did not align with the specified inclusion criteria. This decision was based on the imperative for athletes to recover swiftly to sustain their training routines.

The final sample consisted of 36 articles, which were analyzed qualitatively and descriptively.



LITERATURE FINDINGS

The high-performance athlete and facial aging

Most high-performance athletes are familiar with discomforts and pains due to the intense routine of exercises and training, in addition to having a high capacity to withstand pain.⁴ This often results in a loss of reference to measure certain discomforts or general physical problems, which may be discovered during the athlete's routine examination.

Oral problems in athletes can take twice as long to heal, as the body divides its efforts between fighting oral diseases and muscle recovery, depending on the injury type.⁵ Thus, if a high-performance athlete undergoes aesthetic procedures, such as OFH, recovery may also be slower. The optimal timing for the intervention is crucial since the immune responses in the athlete's body differ from those of a person who practices occasional physical activity or a sedentary person.⁶

Biological aging in high-performance athletes may be accentuated by intense exercise routines, with increased free radical production, leading to oxidative stress and accelerated cellular aging, influenced by intrinsic and extrinsic factors.^{7,8} Excessive sun exposure is an extrinsic factor that triggers individual melanogenic responses.⁹ Studies reveal low awareness among outdoor athletes regarding skin cancer risks, despite satisfactory knowledge of malignant lesions.¹⁰

Duarte et al.¹⁰ assessed the knowledge of 2159 outdoor runners about skin cancer and their behavior concerning protection and sun exposure. Surprisingly, the authors found that only 23.5% of these professionals adopted adequate sun exposure and protection behavior, with a higher proportion among women compared to men (33% versus 17%). Outdoor sports enthusiasts, experiencing increased skin photosensitivity due to sweating and immunosuppression due to intense physical activity, are at a higher risk of developing skin cancers.^{6,11}

Determining skin phototypes is valuable for identifying athletes prone to alterations due to sun exposure, with light-skinned individuals exhibiting a more intense response to lower doses of UV radiation than dark-skinned individuals.¹² Melanin production through the process of melanogenesis, contributes to skin alterations like melasma.⁹ This inflammatory condition is identified by the presence of uneven brown patches, primarily in individuals with a higher photo type (dark-skinned), impacting exposed areas of the skin, particularly the forehead and cheek regions. This skin alteration is more commonly observed in women with higher phototypes, and the most crucial triggering factor for its onset is sun exposure (without sunburn)⁹, with major risk in individuals engaged in outdoor sports. Alcantara et al.⁹ noted that various types of radiation (UVA, UVB, and visible light) could elicit personalized responses in melasma-affected skin. Effective control of melasma can be achieved through treatments such as peeling, micro-needling¹³, and the application of specific dermo-cosmetics.¹⁴

Facial aging results from a combination of genetic and environmental factors, including inflammation, glycation, mutagenic changes, metabolic decline, and oxidative stress.^{7,15,16,17,18} Physiologically, the body possesses an antioxidant system to neutralize free radicals, crucial for maintaining cellular homeostasis and overall health. Reactive oxygen species (ROS) induced by oxidative stress contribute to solar elastosis and structural damage to the basal membrane, leading to skin aging.^{20,21} Fibroblast senescence further accelerates skin aging by secreting senescence-associated secretory proteins (SASPs) increasing the activity of matrix metalloproteinases (MMPs), that break down collagen and elastin.⁸ Diverse risk factors, including age, gender, ethnicity, air pollution, nutrition, smoking, and sun exposure, contribute to different skin-aging phenotypes. Molecular mechanisms like those that telomere shortening, micro-RNA expression, cytokine production, autophagy control, and the microbiome also affect skin aging.^{8,16,18} In high-performance athletes, excessive free radical production can lead to oxidative stress, enhanced by exposure to UVA, UVB, infrared, and visible light.^{16,17,18,19}

Maintaining a balanced antioxidant system is essential for overall health, with antioxidant-rich foods, sufficient sleep, stress management, and regular physical activity contributing to a robust defense against free radicals.²¹ Antioxidants, including vitamins E, A, and C, glutathione, niacin, carotenoids, pycnogenol, and EGCG (the active substance in Green Tea), neutralize ROS, protecting cells from damage.^{20,21,22} Adequate intake through diet or supplementation is crucial for cell protection.^{20,21,22} High-performance athletes, experiencing accelerated physical wear and tear due to daily training, seek aging prevention therapies.

Internal measures, such as supplementing with antioxidants and hydrolyzed collagen, are recognized among athletes. A study by de Miranda et al.²³ demonstrated the effectiveness of hydrolyzed collagen in reducing wrinkle depth, improving skin elasticity, and enhancing skin hydration after a 90-day intake. Another study explored fermented pomegranate extracts as a functional supplement and cosmetic ingredient for skin rejuvenation, revealing effective protection against oxidative stress and a slowdown in the aging



process.²⁴ These findings highlight the increasing importance of diverse approaches, encompassing internal and external measures, in addressing the unique aging challenges faced by high-performance athletes.

Current non-invasive treatments for skin cell aging

Platelet-rich plasma (PRP), recognized as a wound repair elixir for being rich in growth factors and cytokines, has emerged as a complement to conventional skin treatments due to its easy application.²⁵ Topical or injected PRP aims to boost local growth factors, facilitating healing through chemotactic pathways. Its parallels with skin regeneration make it promising for post-skin resurfacing recovery.²⁵ Research confirms PRP's collagen synthesis induction, countering collagenases, reducing inflammation, and highlighting its potential as a collagen bio-stimulator.²⁵ PRP can stand alone or synergize with techniques like microneedling, a minimally invasive procedure that also promotes collagen production and facilitates drug delivery.²⁶

Dermal fillers have emerged as a popular aesthetic treatment for nasolabial folds, offering a minimally invasive approach to restore volume and smooth out wrinkles. Stefura et al.²⁷ evaluated the aesthetic outcomes and safety profile of dermal filler injections for nasolabial fold treatment. Their research indicated a substantial improvement in nasolabial fold severity with dermal fillers, and these positive effects persisted for a year. Despite being well tolerated, dermal fillers exhibited some adverse effects, commonly temporary complications such as sensitivity, swelling, and bruising that resolved quickly, but may limit its use in high-performance athletes who need fast recovery.

Tissue bio-stimulators are a class of injectable treatments that have emerged as a promising approach to combating skin aging and restoring a youthful appearance. Unlike traditional dermal fillers that simply add volume to the skin, bio-stimulators such as hyaluronic acid (HA) or hyaluronan hybrid cooperative complexes (HCC) work by stimulating the body's natural collagen and elastin production, leading to long-lasting improvements in skin texture, elasticity, and overall tone. These products cater to diverse skin types, providing personalized results tailored to individual needs, especially in cases of photo-aging skin.^{28,29} They diminish sagging, enhance radiance, and contribute to gradual facial volume replenishment, boosting skin elasticity, firmness, tone, and hydration.^{28,29} Suitable for all skin types, including sensitive skin, tissue bio-stimulators excel in treating photo-aged skin resulting from sun exposure. Overall, they present a safe, effective, and enduring solution for addressing visible signs of skin aging, and restoring a youthful, revitalized appearance.^{28,29}

Hertz-Kleptow et al.²⁸ conducted a study affirming the efficacy and safety of a cohesive poly-densified matrix HA, the CPM®-HA20G (CPM-HA20, Belotero Revive®, Merz Pharmaceuticals GmbH), for treating early signs of facial skin aging. The research on women with aging signs revealed significant improvements in gross skin elasticity, firmness, tone, radiance, and hydration, and reductions in skin fatigue, redness, and roughness over time. The study confirmed CPM®-HA20G's satisfactory safety profile as an injectable HA for skin revitalization.

De Wit et al.²⁹ further supported CPM®-HA20G's efficacy and introduced HCC complexes (HCC Profhilo®, IBSA Pharmaceuticals) as an alternative for enhancing skin quality. Evaluating both products in healthy women, the study found positive effects on surface hydration, reduced trans-epidermal water loss, and decreased melanin levels. CPM®-HA20G specifically improved water content, while Profhilo® reduced pore count and affected hemoglobin levels, indicating enhanced skin oxygenation and nutrient delivery.

Kleine-Börger et al.³⁰ added support to CPM®-HA20G's efficacy by investigating its impact on the viscoelastic biomechanical properties of the skin. Microinjections of CPM®-HA20G significantly improved skin elasticity and its ability to absorb and dissipate energy, particularly with multiple treatments. The findings align with previous studies, suggesting that multiple CPM®-HA20G treatments may yield more significant and sustained improvements in skin viscoelasticity and overall quality.

Noormohammadpour et al.³¹ investigated the effectiveness of Profhilo® in combination with type A botulin toxin (Dysport®, Ipsen Biopharm) for neck rejuvenation. The study involved a randomized controlled trial comparing the outcomes of two treatment groups: Group A - Dysport® injection alone and Group B - Dysport® injection followed by Profhilo® injection two weeks later. The combination of Dysport® and Profhilo® demonstrated superior wrinkle reduction in the neck area compared to Dysport® alone. The addition of Profhilo® significantly enhanced skin elasticity in the neck, leading to a firmer and more youthful appearance. The combined treatment significantly improved neck skin elasticity, yielding a firmer, more youthful appearance, addressing both wrinkles and skin laxity comprehensively. Profhilo® gel proved valuable in conjunction with Dysport®, especially for patients ineligible or averse to surgical neck lifts. The study highlighted that the combined treatment significantly outperformed Dysport®



alone in enhancing neck wrinkles, skin elasticity, and overall appearance, particularly benefiting those unsuitable for surgical neck lift procedures.

Topical growth factors like epidermal growth factor (EGF) and fibroblast growth factor (FGF) regulate skin cell processes, enhancing collagen production and promoting skin regeneration.¹⁴ Transdermal delivery methods, including microneedling and liposomes, maximize their penetration for improved effectiveness.¹⁴ Quinlan et al.¹⁴ provide compelling evidence supporting the efficacy of topical growth factors and transdermal delivery in skin rejuvenation, showing significant improvements in skin texture and reduced wrinkles, redness, and brown spots after a three-month regimen of topical growth factors with transdermal delivery.

Li et al.³² studied corilin, a *Psoralea corylifolia*-derived flavonoid, discovering its anti-aging potential through inhibiting oxidative stress and activating the Keap1-Nrf2 pathway. Corilin effectively enhanced antioxidant enzyme production, proposing preventive capabilities against skin aging.

Additionally, Zhang et al.³³ explored the peptide AIVAEVNEAAK from oyster enzyme hydrolysates. In HaCaT cells, it significantly reduced UV-induced cytotoxicity and inhibited matrix metalloproteinase 1 (MMP-1) expression, indicating promise as an anti-photoaging agent by minimizing UV damage and mitigating MMP-1 effects.

Formulating skincare products requires considering stability and absorption. Berry et al.³⁴ emphasized compatibility and stability, especially when combining multiple topicals. Hydroquinone, a skin-lightening agent, may interact with retinoids, potentially causing irritation. Vitamin C, an antioxidant, enhances photo-protection but can be unstable in certain formulations. Niacinamide pairs well with retinoids, reducing irritation. Alpha-hydroxyl acids (AHAs) exfoliate the skin; when used with retinoids, careful scheduling avoids over-exfoliation. New ingredients need careful consideration for stability, absorption, and compatibility with existing regimens. Understanding these factors allows formulators to create products that deliver optimal results while minimizing the risk of adverse effects³⁴.

DISCUSSION

There is a clear upward trend in the search for skin care and treatments to prevent or delay aging among athletes, particularly those in high performance. Previously focused predominantly on the physical appearance of the body, athletes are now showing a growing interest in facial care, especially when it comes to details such as expression lines, wrinkles and other signs of skin aging. This interest is driven by several factors that contribute to premature skin aging in this specific group.^{7,8} Details such as expression lines, wrinkles, creases, "Chinese mustache" and, especially, the "marionettes", are perceived more prominently by these sportspeople, due to the various factors contributing to premature aging and the aged appearance of the skin in these professionals.^{7,8}

Some current skin treatments have been widely accepted and shown to be effective, as well as presenting a safer and less restrictive post-procedure.^{14,25,26,28-31} This is especially relevant for high-performance athletes, considering the need to maintain a daily training routine. The fact that these procedures allow for faster recovery and fewer restrictions is crucial to meeting the specific demands of this group, which depends on consistency in training to achieve the desired performance.

Platelet-rich plasma (PRP), for example, has shown promise as a standalone or combined therapy, being associated with techniques such as laser or microneedling to enhance facial rejuvenation.^{25,26} This approach is considered safe, generating positive results by increasing epidermal thickness.²⁵ Microneedling, on the other hand, is a simple technique that stimulates collagen production and is highly effective and safe.²⁶ In high-performance athletes, where injuries and wear and tear of the skin can be common, PRP can be an option to promote efficient recovery and improve skin health.

The use of topical growth factors, combined with transdermal delivery of these factors, is beneficial in improving skin texture and reducing wrinkles and other imperfections, as evidenced by studies such as that by Quinlan et al.¹⁴. Their ability to stimulate collagen production, reduce inflammation, and enhance skin repair makes them valuable tools for addressing the visible signs of aging, particularly in high-performance athletes who are at increased risk of photoaging due to their frequent outdoor activities and exposure to ultraviolet radiation. The combination of topical growth factors and transdermal delivery, which can be associated with PRP, emerges as a promising alternative for treating photoaging in high-performance athletes without compromising their training or performance.

Athletes' exposure to diverse environmental conditions and temperature variations makes them prone to individualized melanogenic responses, as highlighted by Alcantara et al.⁹ These professionals are subject to exposure to intrinsic and extrinsic factors, especially in outdoor sports. The studies mentioned by Snyder et al.¹¹ reveal that outdoor sports practitioners face substantially higher



exposure to ultraviolet radiation, regularly exceeding the recommended limits. The research by Kliniec et al.⁶ adds a layer by highlighting that although knowledge about the risks of malignant lesions is satisfactory among athletes practicing outdoor sports, they may not be sufficiently aware of these risks. Taken together, these studies highlight the critical importance of awareness, education, and implementation of specific preventive measures for outdoor athletes, such as the use of photo-protectors, aimed at reducing the risks of photo-aging and other conditions such as melasma or skin cancer.

Melasma, a common skin condition characterized by hyperpigmentation, can significantly affect an individual's appearance and self-esteem. While topical therapies are the mainstay of melasma treatment, their effectiveness is often limited. The study by Bailey et al.¹³ supports the efficacy and safety of microneedling as an adjunct to topical melasma therapies. This minimally invasive approach offers a valuable addition to the melasma treatment options, particularly for individuals who have not achieved satisfactory results with topical therapies alone. This treatment is particularly beneficial for female athletes, who are potentially susceptible to melasma due to their increased exposure to UV radiation.

Environmental factors, such as harmful UV radiation exposure and environmental pollutants, along with the physical demands of training, can contribute to premature skin aging in high-performance athletes, due to increased oxidative stress.^{11,17} Hydrolyzed collagen and fermented pomegranate extracts are natural compounds that have demonstrated efficacy in reducing wrinkles, improving skin elasticity, and protecting against oxidative stress.^{23,24} For high-performance athletes, supplementation with these natural compounds offers a valuable tool to maintain skin health and counteract the negative effects of environmental factors and training, offering a convenient and non-invasive approach to combat skin aging and maintain health.

The search for treatments aimed at slowing down facial aging has increased significantly. Various interventions are carried out to harmonize the face and prevent aging, using techniques such as bio-modulators, collagen stimulators, support threads, surgical procedures, and radiofrequency therapies, among others. Stefura et al.²⁷ systematized available data on the aesthetic results and safety of treating the nasolabial fold region with dermal fillers. The results of the analysis indicated that dermal filler injections provide a safe and effective means of improving nasolabial folds. However, athletes should be aware of the potential for temporary complications and plan their treatment accordingly to minimize disruptions to their training or performance schedules.

One of the most required procedures by athletes includes wrinkle treatments with botulinum toxin, aimed at promoting muscle relaxation and minimizing expression lines. Neuromodulators, such as botulinum toxin, work by temporarily relaxing facial muscles, reducing the appearance of dynamic wrinkles and expression lines. This minimally invasive treatment can effectively address crow's feet, forehead furrows, and other signs of aging caused by facial muscle contractions. Swift et al.³⁵ emphasize the importance of precise neuromodulator injections, targeting only the muscles responsible for the desired aesthetic effect. This targeted approach minimizes the risk of affecting adjacent muscles that may have different or antagonistic functions, preventing unwanted side effects and preserving natural facial expressions. Treatment with botulinum toxin can help minimize expression lines and is an option for athletes who want a non-surgical approach to maintaining a more youthful facial appearance. However, it is crucial to administer these treatments with precision, considering individual aesthetic needs and avoiding interference with facial expressions.

Tissue bio-stimulators, such as hyaluronic acid-based (HA and HCC) and poly-L-lactic acid (PLLA) injections, can be used to treat skin imperfections, reduce sagging, improve youthfulness, and promote the gradual replenishment of facial volume^{28,29} which can be beneficial for athletes exposed to rigorous conditions such as sun exposure and intense training. When considering tissue bio-stimulator treatments for athletes, it is crucial to evaluate their effectiveness in the context of rapid recovery needs.

HA in its different forms and associations can contribute to visible improvements in skin elasticity, firmness, and hydration.^{28,29,30,31} The study by Hertz-Kleptow et al.²⁸ highlights CPM®-HA20G as an effective and safe injectable HA treatment for addressing early signs of facial skin aging. The treatment's ability to improve skin elasticity, firmness, tone, radiance, and hydration, while reducing skin fatigue, roughness, and redness, makes it a valuable option for individuals seeking to revitalize their skin and restore a youthful appearance. The study by de Wit et al.²⁶ corroborates the findings of Hertz-Kleptow et al.²⁸ and expands the options for skin rejuvenation with the introduction of HCC Prophilo®. Both HA and HCC have shown positive effects on various skin parameters, including surface hydration, elasticity, melanin, and water content, improving skin quality, and addressing signs of aging. The study by Noormhammadpour et al.³¹ provides compelling evidence supporting the efficacy of Prophilo® in combination with botulin toxin A (Dysport®) In athletes who may face challenges such as exposure to wind, sun, and extreme temperatures, these benefits can be valuable.



The findings of Li et al.³² highlight the potential of corilin as a therapeutic target for preventing skin aging and age-related skin diseases. Its ability to modulate oxidative stress suggests its potential to prevent skin aging and promote skin rejuvenation.³² The findings of Zhang et al.³³ provide evidence supporting the potential of an oyster peptide as a novel ingredient for skin rejuvenation and photoaging prevention. The peptide's ability to protect against UV damage and inhibit MMP-1 expression makes it a promising candidate for further investigation in developing effective anti-photoaging skincare products.³³ The prevention of aging and resistance to photo-oxidation presented by compounds such as corilin and oyster peptides^{32,33} could be promising treatments for athletes exposed to challenging environmental conditions. However, the practical applicability and feasibility of these compounds in athletes need to be assessed, considering possible interactions with other substances.

While individual therapies can offer significant improvements, combining different approaches can provide synergistic benefits and address a wider range of skin concerns. Combining microneedling with PRP facilitates the delivery of PRP's regenerative factors deeper into the skin, maximizing their effectiveness.^{25,26} Formulations containing peptides and growth factors can be combined with other treatments, such as micro-needling or neuromodulators, to provide additional benefits.³⁴ Neuromodulators, such as Dysport® botox and other toxins, are commonly used to relax facial muscles and reduce wrinkles. HA, a naturally occurring substance in the skin, provides hydration, improves skin elasticity, and plumps up wrinkles. Combining neuromodulators with HA injections, such as Prohilo® or CPM®-HA20G, addresses both muscle-related wrinkles and skin volume loss, resulting in a smoother, more youthful appearance.^{28,29,30,31} Neuromodulators and tissue bio-stimulators could offer valuable non-surgical approaches to skin rejuvenation for high-performance athletes. These treatments can effectively address expression lines, improve skin texture, and restore facial volume, contributing to a more youthful and rejuvenated appearance. However, careful consideration should be given to the precision of neuromodulator injections and the recovery time associated with tissue bio-modulator treatments to ensure they align with the specific needs and schedules of athletes. Therefore, professionals should be attentive to medication prescriptions for inflammation and pain control in athletes, especially during sports competitions, to avoid the risk of positive results in anti-doping tests, as the World Anti-Doping Agency (WADA) prohibits some medications commonly used for these purposes.³⁶

CONCLUSION

HOF aimed at high-performance athletes must be a personalized treatment whose objective is not to promote a radical transformation, but rather to carry out discreet and gradual interventions aimed at short-, medium- and long-term improvements. Although the exercise routine is known to benefit the athlete's health, excessive exercise can generate oxidative stress and, consequently, skin aging. In addition, factors such as age, gender, ethnicity, air pollution, nutrition, sun exposure, and the practice of certain sports subject the athlete to intrinsic and extrinsic factors, triggering individualized melanogenic responses and premature aging.

Athletes can benefit from supplementation, including hydrolyzed collagen and the use of nutraceuticals cosmetics with antioxidants, and sunscreen boosters. They also have benefits with combined therapies such as micro-needling with PRP or formulas containing peptides and growth factors, treatments with neuromodulators (Dysport® botox and other toxins), which can be combined with HA (Prohilo®) or HCC (CPM®-HA20G). These techniques, which are considered safe and quick to perform (they can be carried out during breaks such as "time-lunch"), can provide effective results, increasing epidermal thickness, reducing expression lines, and minimizing post-procedure care time, allowing the athlete to maintain their training routine.

Determining the procedures for OFH depends on knowing the athlete's specific routine and habits. It is crucial to consider the safety, efficacy, and practical applicability of these treatments, taking into account the particularities of their intense training and competition routine. The individualization of treatments, prior assessment, and medical follow-up. An open communication about expectations is fundamental. High-performance athletes require a personalized approach, with careful assessment of the risks and benefits, taking into account their unique needs and the intense nature of their activities.

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Financial Disclosure

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.



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Cite this Article: Christiane Colombo dos Santos, Kenedy Vinicius Batista Souza Kuhn, Marília Teixeira Costa, Suzy Elaine Rodrigues de Lima Guedes Morais, Ana Cláudia Garcia Rosa (2023). Facial Skin Management: Strategies for High-Performance Athletes. International Journal of Current Science Research and Review, 6(12), 8555-8562