



Major considerations of clinical findings of eye aesthetic and skin treatment with the use of dietary therapy, plasma, and coenzyme Q10: a systematic review

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Abstract

Introduction: A balanced diet plays an important role in the skin. Bioactive substances, i.e. vitamins, minerals, fatty acids, polyphenols, and carotenoids, with a particular focus on their effects on skin condition. The spotlight is on the skin regeneration technique using plasma. Plasma sublimation leaves an intact and dehydrated epidermis layer that acts as a natural biological dressing. Coenzyme Q10 (CoQ10) is a natural constituent of foods and is also often used in functional foods and supplements. **Objective:** It was to present a systematic review highlighting the main considerations of clinical findings of ocular aesthetic skin treatment such as blepharoplasty with the use of dietary therapy, plasma, and coenzyme Q10. **Methods:** The systematic review rules (PRISMA) were followed. The search was carried out from February to March 2023 in the Scopus, PubMed, Science Direct, Scielo, and Google Scholar databases, using scientific articles from 2003 to 2023. The quality of the studies was based on the GRADE instrument and the risk of bias was analyzed according to the Cochrane instrument. **Results and Conclusion:** A total of 154 articles were found. A total of 58 articles were fully evaluated and 52 were included in this systematic review. Considering the Cochrane tool for risk of bias, 42 studies with a high risk of bias and 24 studies that did not meet the GRADE were removed. Most studies showed homogeneity in their results, with $X^2 = 95.7\% > 50\%$. The symmetrical funnel plot does not suggest a risk of bias between small sample-size studies. **Results and Conclusion:** It was concluded that promoting healthy eating habits can benefit the

appearance of the skin, delay aging processes and reduce the risk of skin cancer. It is necessary to differentiate the substances that protect and restore the epidermal barrier, ensuring an adequate level of skin hydration and protecting against external factors and damage induced by inflammation (omega-3 and omega-6 fatty acids). Antioxidants and other phytonutrients that scavenge reactive oxygen species and alleviate oxidative damage to the skin also play an important role in preventing and caring for skin aging. It was inferred that the plasma technique enabled the modeling of the eyelids that should be sculpted, reducing excess skin, improving the appearance of the eyelids, rejuvenating the eyes, and reducing eyelid weight, mainly with the concomitant use of coenzyme Q10. Longwave plasma radiofrequency ablation is an effective treatment for non-surgical blepharoplasty. Plasma application has great potential in ocular aesthetics, however, more clinical and histopathological studies are needed to support previous findings and address some safety and efficacy issues.

Keywords: Skin aesthetics. Eye aesthetics. Diet therapy. Plasma. Coenzyme Q10.

Introduction

The condition of the skin largely depends on the general state of health of the individual. A balanced diet plays an important role in the skin. Bioactive substances, i.e. vitamins, minerals, fatty acids, polyphenols, and carotenoids, with a particular focus on their effects on skin conditions such as elasticity,

firmness, wrinkles, senile dryness, hydration, and color, and define their role in the aging process of the skin [1].

In this context, many authors emphasize the relationship between a properly balanced diet and the appearance and functioning of the skin [2-5]. The intake of essential nutrients in the daily diet is extremely important for the biological processes that occur in both young and aging skin [6]. The skin is a tissue with high proliferative potential, which is why the adequate intake of proteins, carbohydrates, and fats is so important [6-8]. The general condition of the skin, such as surface texture, color, and physiological properties, results from factors such as hydration, that is, the presence of an adequate amount of water in the stratum corneum, sebum content, and surface acidity.

Furthermore, the natural hydration factor, consisting mainly of amino acids, plays an important role in hydration and acidity [3,9]. Specific fatty acids are also important for maintaining the skin's barrier function and the integrity of the stratum corneum [10]. Functional antiaging ingredients in foods include substances involved in the synthesis and metabolism of skin components (protein peptides and essential fatty acids) and those that inhibit the breakdown of skin components and maintain their structural integrity (substances that regulate the expression of enzymes such as matrix metalloproteinases and activator protein 1 (AP-1) [6].

In this sense, due to their ability to protect the skin from the harmful effects induced by ultraviolet rays through their antimutagenic, antioxidant, and free radical scavenging properties, some dietary vegetables can be useful supplements for the care of mature skin [1]. These include carotenoids and polyphenols such as apigenin (a flavonoid that occurs in many herbs, fruits, and vegetables), quercetin (a flavonol found in onion skin and apple skin), curcumin (obtained from turmeric rhizome), silymarin (an extract standardized test of flavonolignans from milk thistle), genistein (an isoflavone from soy), proanthocyanidins (from grape seeds), and resveratrol (a polyphenol found in grapes, peanuts, berries, red wine, and blackberries). Other key elements of an anti-aging diet are vitamins and minerals with antioxidant properties [6].

Based on these nutritional aspects and the scenario of ocular plastic surgery, blepharoplasty (BP) is one of the most common surgical procedures in the world. BP promotes the improvement of the appearance of the upper and lower part of the eyelids, enhancing the expression of the eyes and rejuvenating the areas around the eyes. Still, the main functional indications include dermatochalasis (laxity and

redundant skin of the eyelid) when it impedes the peripheral vision, eyelid entropion (the inward turn of the edge of the eyelid), irritating the ocular surface and blepharoptosis (drooping of the eyelids) [11,12].

In this sense, there is a growing demand for non-invasive and effective procedures and safe technology for eyelid aesthetic treatments. Thus, ablative laser treatments, in particular carbon dioxide (CO₂) or erbium lasers, have been used for various indications in aesthetic medicine, but as a consequence of epidermal removal and injury, there is a significant risk of side effects during the procedure of reepithelialization such as prolonged erythema and edema, risk of bacterial and viral infections, ectropion, hypertrophic scar formation, and post-inflammatory pigmentary changes, especially in patients with darker Fitzpatrick skin phototypes [12].

In this regard, the spotlight is on the skin regeneration technique using plasma, given that it was already used for the treatment of xanthelasma palpebrarum, complete facial rejuvenation and photoaging, facial acne and fine lines, and acne scars. In this context, it is noteworthy that plasma sublimation leaves an intact and dehydrated epidermis layer that acts as a natural biological dressing, avoiding damage to the deeper layers of the skin and predisposing it to better healing with better aesthetic results. The highlighted points of the sublimation technique leave spared columns that help even more in healing, with an even faster recovery [13-18].

In this context, the mechanism of action of plasma on the skin involves two steps, immediate tissue contraction, and thermal rupture. Denaturation of collagen and other proteins in the dermis following the thermal effect of plasma induces an immediate and clinically observed tissue contraction. The neocollagenization cascade is stimulated by thermal disruption of dermal solar elastosis, fibroblast activation, and deeper dermal migration and cytokine release. Also, plasma is more uniform than ablative resurfacing lasers, including carbon dioxide (CO₂) resurfacing lasers, as it is not dependent on interaction with a particular target. Regarding the plasma and tissue energy level, high-energy plasma induces shedding in the upper epidermis and dermis, while low-energy plasma induces shedding only in the upper part [12,19].

Also, as a potentiating and catalytic effect of plasma applications, Coenzyme Q10 (CoQ10) is a natural constituent of foods and is also frequently used in functional foods and supplements. It is a common ingredient in cosmetics, and it is believed to reduce signs of skin aging. CoQ10 represents an endogenously synthesized fat-soluble antioxidant that is crucial for

cellular energy production but decreases with age and under the influence of external stressors in human skin. Thus, it is necessary to complement or supplement CoQ10 to optimize aesthetic procedures [1,20].

Therefore, the present study aimed to present a systematic review highlighting the main considerations of clinical findings of ocular aesthetic skin treatment such as blepharoplasty with the use of dietary therapy, plasma, and coenzyme Q10.

Methods

Study Design

The present study followed a concise systematic review model (PRISMA - Transparent reporting of systematic review and meta-analysis - www.prisma-statement.org/). The search strategies for this systematic review were based on the keywords (MeSH Terms): *Skin aesthetics. Eye aesthetics. Diet therapy. Plasma. Coenzyme Q10.* The search was carried out from February to March 2023 in Scopus, PubMed, Science Direct, Scielo, and Google Scholar databases. Scientific articles from the last 20 years were selected. A combination of keywords with the Booleans “OR”, “AND” and the operator “NOT” was used to direct the scientific articles of interest, in the years 2003 to 2023.

Study Quality and Risk of Bias

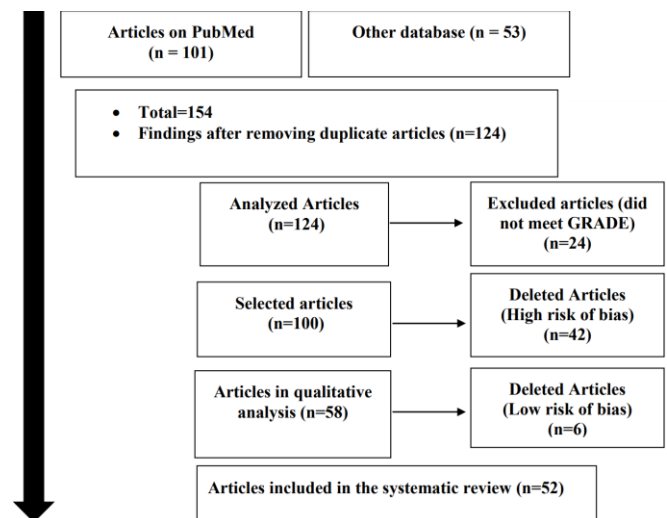
Study quality was based on the GRADE instrument. The highest rankings were for controlled clinical studies with a statistically significant sample size (n>30 patients). The risk of bias was analyzed according to the Cochrane instrument, based on the effect size of each study versus the sample size.

Results and Discussion

Summary of Findings

A total of 154 articles were found. Initially, duplication of articles was excluded. After this process, the abstracts were evaluated and a new exclusion was performed, removing the articles that did not include the theme of this article, resulting in 124 articles. A total of 58 articles were evaluated in full and 52 articles were included and developed in this systematic review study (Figure 1). Considering the Cochrane tool for risk of bias, the overall assessment resulted in 42 studies with a high risk of bias and 24 studies that did not meet GRADE. According to the GRADE instrument, most studies showed homogeneity in their results, with $\chi^2=95.7\%>50\%$.

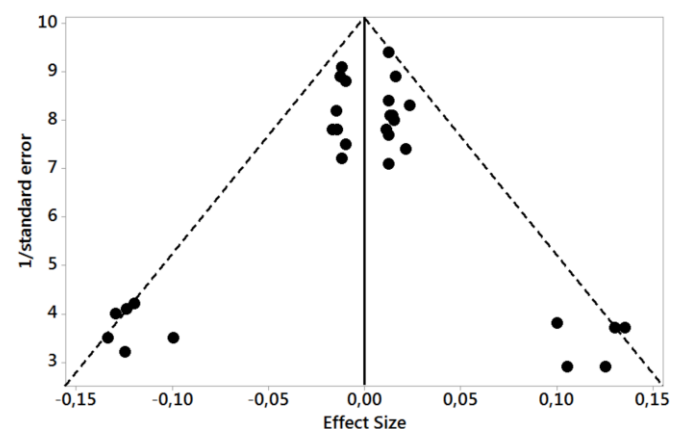
Figure 1. Flowchart showing the article selection process.



Source: Own authorship.

Figure 2 presents the results of the risk of bias of the studies through the Funnel Plot, showing the calculation of the Effect Size using the Cohen Test (d). Precision (sample size) was indirectly determined by the inverse of the standard error (1/Standard Error). This chart had a symmetrical behavior, not suggesting a significant risk of bias, both between studies with small sample sizes (lower precision) that are shown at the bottom of the chart and in studies with large sample sizes that are shown at the top.

Figure 2. The symmetrical funnel plot does not suggest a risk of bias among the small sample size studies that are shown at the bottom of the plot. High confidence and high recommendation studies are shown above the graph (n=52 studies).



Source: Own authorship.

Major Outcomes

In the aesthetic scenario, the skin is a sensitive indicator of nutritional deficiencies. A well-balanced diet significantly affects the skin's aging process. It is necessary to differentiate the substances that protect and restore the epidermal barrier, ensuring an

adequate level of skin hydration and protecting against external factors and damage induced by inflammation (e.g. omega-3 and omega-6 fatty acids). Antioxidants and other phytonutrients that scavenge reactive oxygen species (ROS) and alleviate oxidative damage to the skin also play an important role in preventing and caring for skin aging, as do substances that protect the skin against the negative effects of radiation ultraviolet light (including vitamins A, C, and E, selenium, zinc, copper, silicon, polyphenols, and carotenoids). The inclusion of these substances in the daily diet can be a useful approach to anti-aging interventions [13].

In this regard, nutricosmetics combine the benefits derived from food supplementation with the advantages of cosmetic treatments to improve the beauty of the skin, optimizing the intake of nutritious microelements to meet the needs of the skin and skin appendages, improving its conditions and delaying aging. Studies have shown a significant correlation between the adequate intake of these supplements, the improvement of skin quality (aesthetic and histological), and the acceleration of wound healing [14].

It is emphasized in this context that exogenous stimuli can determine wounds, skin aging, inflammatory dermatoses, or skin carcinogenesis. Damage to the skin barrier determines the inflammatory response, which provides tissue repair and infection control. Initially, keratinocytes and innate immune cells (eg, leukocytes, dendritic cells, and mast cells) are activated [15] and successively produce cytokines (eg, IL-1 α , IL-6, and TNF- α) that attract the immune cells to the site of injury. Finally, ROS, elastase, and proteinases are produced [15]. Thus, inflammation is involved in the pathogenesis of acne and determines pain, swelling, and redness in the skin. Licorice root, turmeric, oats, chamomile, and walnuts are some food plants with anti-inflammatory activity [16,17]. **Table 1** below highlights the main herbal medicines for skin aesthetic purposes.

Table 1. Foods in skin aesthetic preparation.

❖ Green Tea [18,19]
❖ Coffea Arabica [20,21]
❖ Vitis vinífera [22]
❖ Pomegranate [23]
❖ Soybeans [24]
❖ Aloe vera [25]
❖ Citrus limon [21]
❖ Opuntia ficus indica [26]

❖ Ficus carica [27]
❖ Cynara scolymus [28]
❖ Carica papaya [29]
❖ Glycyrrhiza glabra [30]
❖ Theobroma cacao [31]
❖ Prunus dulcis (Almonds) [32]
❖ Coconut [33]

Source: References from 18 to 33.

Plasma and Skin Aesthetics

The plasma sublimates the surface layers of the skin without causing high thermal injuries by coagulating the dermal vessels, using a high breakdown voltage of about 5 kV, which is placed between the tip of the device and the patient's skin and maintaining a distance of 2 mm. between the tip and the skin (this constant distance is provided by a specific applicator), the spark discharge is generated [11]. To generate the spark discharge, the air, which contains free electrons, absorbs a large amount of energy, collapsing, that is, it ceases to be an insulator and starts to conduct electric current, generating the discharge [34-40].

Each cell has a potential across its membrane (the difference in electrical potential between the two sides of the membrane). The inner side of the membrane has a negative charge, the outer side has a positive charge. As the skin ages, electrical charge is unevenly distributed across the membrane and the electrical voltage across the membrane changes [41]. The membrane potential is created and influenced by potassium and sodium cations. It is difficult for sodium cations to pass through the cell membrane, whereas potassium cations can easily cross them (**Table 2**) [42].

Table 2. Main effects of plasma on cells.

❖ Significant increase in collagen type I;
❖ Reduction of keloid fibroblasts in cicatricial areas;
❖ Increased intracellular Ca;
❖ Increase extra-extracellular K;
❖ Up to Increased Chemotaxis;
❖ Increased growth factors, as well as increased concentration of nitrogen oxide;
❖ Increased migration of fibroblasts and their proteosynthesis;
❖ Increases skin permeability, decreases the permeation of positively charged ions and soluble compounds;

❖ **The new orientation of newly created or formed collagen fibers in the direct current direction;**

❖ **Reduction of pain at the application site and increased healing speed.**

Source: Sotiriou and Nantia, 2018 [42].

In this sense, studies have shown that the use of plasma can promote regeneration, lifting, improvement of flaccidity, collagen and elastin production, optimization of anti-inflammatory and antibacterial drugs, the transdermal drug delivery system (TDDS - Transdermal Drug Delivery System), sterilization and skin remodeling [43]. The number of plasma treatment sessions varies according to the purpose of the treatment and generally between 1 and 3 sessions are required. This amount must be evaluated and indicated by the physician before starting treatment [44,45].

For patient comfort, a topical or injectable anesthetic may be applied before the procedure. During the session, the doctor or his assistant performs a series of impacts with the equipment, which forms sublimation crusts on the skin, which induces instantaneous retraction of the treated area. These scabs remain in the area for an average of 5 days and should not be manipulated to be naturally eliminated [46].

Based on this information, as well as knowing that blepharoplasty is one of the most common plastic surgical procedures in the world, the growing demand for non-invasive, effective procedures and safe technology for aesthetic treatments of the eyelids has driven the search for new strategies for treatments marked by good efficacy and fewer side effects when compared to surgical procedures, especially in regenerative processes. In this sense, a study evaluated the effectiveness of radiofrequency plasma ablation in non-surgical blepharoplasty (BP) performed with the DAS Medical device (Technolux), a tool that works with the principles of longwave plasma radiofrequency. Ten patients suffering from aesthetically unpleasant dermatochalasis, excess tissue, and fine wrinkles of the eyelids were enrolled for non-surgical BP with a longwave plasma radiofrequency ablation device with 2 sessions 30 days apart. The study showed that the treatments were well tolerated by all patients, without adverse effects, and with excellent aesthetic results. Therefore, the plasma technique enabled the modeling of the eyelids that should be sculpted, reducing excess skin, improving the appearance of the eyelids, rejuvenating the eyes, and reducing eyelid weight. Longwave plasma radiofrequency ablation is an effective treatment for non-surgical BP [47].

In this context, dermatochalasis (DC) is part of the aging process of the eyelids, characterized by excess,

loose, redundant, and protruding eyelid skin. A prospective study of 17 patients evaluated the efficacy and safety of a new non-invasive radiofrequency microplasma technology for upper eyelid DC. Subjects were treated by controlled sparking from a single tip leading to superficial ablation and coagulation in the treatment area. One to three treatment sessions were performed at an interval of 2 months. Three "blinded" observers evaluated photographs taken at baseline and the follow-up visit 6 to 8 months after the final treatment session. Treatment effectiveness was assessed using a 4-point rating scale. A total of 7 of 17 patients (41%) treated for DC by the single spark showed a 2-grade improvement on a 4-point DC scale. 10 of 17 (59%) patients showed a single-grade improvement on a 4-point CO scale. No adverse side effects were observed [48].

In this context, the eyes are an important component of facial aesthetics. They are in the center of an anatomical area of the face, very important for rejuvenation procedures, the so-called "periorbital region". Therefore, the appearance of the eyes has a decisive impact on the aesthetic perception and aging of the entire face. At a young age, the skin of the periorcular area is elastic and tonic, without sun damage; the brow is full, well defined and does not droop, there is a clear visible crease of the upper lid, with minimal dermatochalasis, the lower lid is taut and well positioned [49-51].

Ubiquinone (Coenzyme Q10) and Skin Aesthetics

In the context of plasma for non-surgical aesthetic eye treatments, it is presented that coenzyme Q10 (CoQ10), is a natural constituent of foods and is also frequently used in functional foods and supplements. It is also a common ingredient in cosmetics, where it is believed to reduce signs of skin aging [8,9]. However, existing data on the effect of dietary CoQ10 intake on skin parameters and conditions are sparse. To gain insight into this issue, a double-blind, placebo-controlled trial was performed with 33 healthy subjects. The objective was to investigate the effects of 12 weeks of daily supplementation with 50 and 150 mg of CoQ10 on skin parameters and conditions. The study was performed with a water-soluble form of higher bioavailability CoQ10 (Q10Vital®). Intake of CoQ10 limited seasonal deterioration in viscoelasticity and reduce some visible signs of aging. It was concluded that wrinkles and micro-relief lines were significantly reduced and we improved the smoothness of the skin. However, CoQ10 supplementation did not significantly affect skin hydration and dermal thickness [41,52].

Also, CoQ10 represents an endogenously synthesized fat-soluble antioxidant that is crucial for cellular energy production but decreases with age and under the influence of external stressors in human skin. Topical Q10 treatment is beneficial concerning effective CoQ10 replenishment, increased cellular energy metabolism, and antioxidant effects. The application of formulas containing CoQ10 significantly increased levels of this quinone on the skin surface. In the deeper layers of the epidermis, the level of ubiquinone increased significantly, indicating effective supplementation. Simultaneous elevation of ubiquinol levels suggested metabolic transformation of ubiquinone resulting from increased energy metabolism. Incubation of cultured human keratinocytes with CoQ10 concentrations equivalent to treated skin showed a significant increase in energy metabolism. Results have shown that stressed skin benefits from topical CoQ10 treatment by reducing free radicals and increasing antioxidant capacity [8,9,52].

Conclusion

It was concluded that promoting healthy eating habits can benefit the appearance of the skin, delay aging processes and reduce the risk of skin cancer. It is necessary to differentiate the substances that protect and restore the epidermal barrier, ensuring an adequate level of skin hydration and protecting against external factors and damage induced by inflammation (omega-3 and omega-6 fatty acids). Antioxidants and other phytonutrients that scavenge reactive oxygen species and alleviate oxidative damage to the skin also play an important role in preventing and caring for skin aging. It was inferred that the plasma technique enabled the modeling of the eyelids that should be sculpted, reducing excess skin, improving the appearance of the eyelids, rejuvenating the eyes, and reducing eyelid weight, mainly with the concomitant use of coenzyme Q10. Longwave plasma radiofrequency ablation is an effective treatment for non-surgical blepharoplasty. Plasma application has great potential in ocular aesthetics, however, more clinical and histopathological studies are needed to support previous findings and address some safety and efficacy issues.

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Ethical Approval

Not applicable.

Informed consent

Not applicable.

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Data sharing statement

No additional data are available.

Conflict of interest

The authors declare no conflict of interest.

Similarity check

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