

CHEMICAL PEELING WITH TRICHLOROACETIC ACID IN SKIN TREATMENT: REVIEW STUDY

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Abstract: Trichloroacetic acid is a crystalline powder, highly soluble in water. When used for rejuvenation purposes, they are excellent for treating damaged acneic skin, as well as for scarring and deep wrinkles. It is an active ingredient widely used for superficial and medium-depth chemical peelings, with concentrations ranging from 10 to 75% in aqueous solutions. Therefore, the objective of the research was to promote a narrative literature review on the use of trichloroacetic acid and raise the importance of aesthetic pharmaceutical care in relation to its use in chemical peelings. Initially, the need to improve clinical practice was maintained, through the recognition of intellectual practice, qualified professional performance is possible and consistent with current requirements in terms of health and aesthetics in the context of pharmacists' work. This is of fundamental importance for making more scientific and dynamic decisions, because they are based on current literature. Next, chemical peeling with trichloroacetic acid was a process that initially had lower operational costs despite being a not so current technique and resulting from several factors, such as the safety of its handling in these concentrations and, practically, the non-existence of of immediate and late discomfort. Given the approach to the importance of pharmaceutical care in the face of this phenomenon of chemical peeling and complex facial treatments, it is concluded that it is essential for the exercise of the pharmaceutical profession to require effective pharmacotherapeutic care consistent with the reality of the patient's needs, whose action interferes with increasing effectiveness of the treatment.

Key words: Chemical Peeling. Skin treatment. Trichloroacetic acid. Aesthetics.

INTRODUCTION

This literature review research focuses on chemical peeling with trichloroacetic acid in skin treatment.

The choice to develop such an approach arose from the need for greater depth on the subject given the importance of pharmaceutical care in societies, especially with regard to the aesthetic sector. Without a doubt, it is believed that only with greater intellectual resources is it possible to perform qualified professional activities in line with current requirements in terms of health and aesthetics. To this end, attention must be paid to the fact that not only intuition or previous non-systematized clinical experiences are essential, but clinical reasoning and decision-making by the health professional must be based on relevant scientific evidence. This is the essence of evidence-based clinical practice. One of the main resources used to stop skin aging or improve skin quality are the treatments used by doctors and defined as chemical *peeling*, where chemicals such as glycolic acid, retinoic acid, trichloroacetic acid and phenol are used, among others that provide the skin exfoliation and subsequent cell renewal. Depending on the concentration and pH value at which they are used in the formulations, they trigger superficial, medium and deep *peeling*.

The use of these products results in an intense cell renewal process, normalizing skin pigmentation, reducing marks and minimizing wrinkles. Therefore, these formulations must be used carefully and following the recommended techniques, as well as the patient monitored to obtain maximum effectiveness. *peeling*, without major side effects. Knowledge of the advantages and disadvantages of peelings means that they can be used safely and judiciously, with due medical monitoring, avoiding toxicities and possible post-*peeling* complications, thus, the

benefits of *peelings* will be appreciated and felt by patients.

This work aims to demonstrate how Chemical *Peeling* works on human skin, focusing on its mechanism of action, as well as emphasizing the active ingredients and vehicles used in the pharmaceutical formulations of *peelings*.

To this end, research was analyzed (BAGATIN et.al 2009) ;(YOKOMIZO et.al 2013); (GASTON-MARICOURT, 1997); (CUNHA 2014) and (GARCIA et al., 2006). Ferreira (2000); (BATISTUZZO, 2006); (RUIZ et al.2008); (VELASCO et. al 2004); (ZANINI 2007); (ALMEIDA DE SÁ, 2006); Velho & Moraes (2010) and Santos et al. (2004). Faced with the main propositions of emphatically understanding the *Peelings* Chemicals constitute an accelerated exfoliation or injury to the skin induced by caustic agents that cause controlled damage, and especially with regard to trichloroacetic acid in skin treatment in which some of the main sources consulted highlight its importance due to its ease of handling and application.

The objective of this study was to carry out a bibliographical survey regarding the use of the main chemical peeling agents in facial treatments, thus demonstrating their effectiveness in the disorders in which they are applied.

FROM QUESTION TO SOLUTION: CHEMICAL PEELING WITH TRICHLOROACETIC ACID IN SKIN TREATMENT

This section explains the problem that guides this research, as well as the materials and methods used (subitem 2.1 **Problem, objective, materials and methods**). Next, but still in this subdivision, references are arranged and analyzed in an attempt to resolve the questions raised (subitem 2.2 **Chemical Peeling with Trichloroacetic Acid in Skin**

Treatment).

PROBLEM, OBJECTIVE, MATERIALS AND METHODS

Having approached the topic in the previous section, we begin by exposing the problem proposed in this investigation. Two questions were chosen, elaborated as follows: a) what do chemical peels consist of? and b) how must pharmaceutical attention be given to skin treatments with trichloroacetic acid? Therefore, the objective of the research was to review the literature on the topic of chemical peelings in relation to skin treatments with trichloroacetic acid.

Given the complexity of the study, in its composition we sought to follow appropriate parameters without, however, carrying out the research with an exploratory, quantitative or mixed approach. The choice not to conduct the study based on these approaches was due to the limited time required to carry it out compared to the operational requirements required. Therefore, we preferred to produce this article as literary research. Leopardi (2002) mentions, in terms of health research methodology, that the literature review is a fundamental step in the construction of knowledge, when one wishes to explore the subject of interest. In view of the above, the production of this article was based on a review of narrative or traditional literature. This type of scientific investigation, when compared to a systematic review, does not require a rigid protocol – defined methodological procedure – for its organization and, because of this, the search for bibliographies is not pre-determined and specific, and may be less comprehensive, with high interference from the researcher's subjective perception (CORDEIRO; OLIVEIRA, 2007). Thus, the following were used as sources of information: books, articles and documents. The first two and the last are physical and virtual works

owned by the researcher, as well as obtained, for the most part, from *online* repositories.

The articles were tracked on the Scielo, Surgical & Cosmetic Dermatology platform and other websites available on the internet. To search for them, descriptors were used such as: chemical peelings, Trichloroacetic Acid, facial treatment, caustic agents, rational use of medicines, therapeutic and aesthetic use, pharmaceutical care, drug interactions, skin aging, rejuvenation.

This screening strategy was used because the keywords, report Borba, Van-Der-Laan and Chini (2012), are like integrations for retrieving scientific articles and synthetically represent the content of the work. The collection of information sources took place from February 5th to April 10th, 2018. The results are arranged in sequence, with due analysis and weighting.

CHEMICAL PEELING WITH TRICHLOROACETIC ACID IN SKIN TREATMENT

Initially (RUIZ et al.2008) understands that the eternal search for beauty and facial youthfulness makes countless patients unhappy with their aesthetic conjecture seek Plastic Surgery Clinics for aesthetic treatments. The arsenal that Plastic Surgeons have to combat these complaints is vast, and we are bombarded by the media daily with some new “revolutionary” treatment, which is not always truthful.

According to (Guerra et al. 2013) human skin is a boundary between organism and environment, and protects the body both from the loss of substances and against external influences, in addition to controlling or preventing the penetration of substances. Histologically, the skin barrier is made up of three types of structures: a lipid mantle, the stratum corneum, and the spinous layer.

Still seeking to reinforce the idea that the

skin has an essential organic function:

The skin's main function is to act as a protective barrier for the body against aggression from the external environment; in addition to also having an important role in self-esteem, social relationships and the quality of life of human beings. Having a youthful, healthy and beautiful appearance, we feel more confident and secure to face everyday life and also be better accepted by the whole society (SCOTTI,2003 p.8).

For (BORGES, 2010), skin aging due to sun exposure is known as “photoaging” and leads to changes in elastic and collagen fibers, the appearance of pigmented spots and the occurrence of pre-malignant and malignant lesions. Acids are all substances that have a pH lower than that of the skin, transforming it into an acidic region, providing a chemical peeling (exfoliation) that can be very superficial, superficial, medium or deep depending on its percentage and its Ph.

To this end, a greater focus will be placed on skin aging due to sun exposure:

In extrinsic aging [...] ultraviolet rays (UVA, UVB and UVC) cause structural damage to the skin, altering skin pigmentation, causing wrinkling, causing premature aging and also forming reactive free radicals. To date, UVA and UVB rays are the most worrying in cosmetological care, due to their incidence on the Earth's surface (SCOTTI, 2003, p.11).

The term *peeling* originates from the English *to peel* = to peel, to peel, referring to the application of a chemical agent to the skin, which can cause controlled destruction not only of part or all of the epidermis, but also of part of the dermis, leading to to exfoliation with removal of lesions, followed by the regeneration of new tissues (YOKOMIZO et.al 2013, p.58).

Chemical peelings are not as new as we imagine, not only observing the applicability of the techniques and compounds used, which are currently vast and full, but also

understanding that there is a story to be told. (YOKOMIZO et.al 2013).

History of use and manipulation very well defined by YOKOMIZO et.al:

Chemical *peels* were initially described in Egyptian medicine, in the Ebers papyrus, in 1550 BC. Reports are also found in ancient Greek and Roman literature. Over the past centuries, some formulas were passed down by gypsy populations. Dermatologists began to show interest in peels in the 19th century. In 1874, in Vienna, dermatologist Ferdinand Von Hebra used the technique to treat melasma, Addison's disease and ephelides. In 1882, in Hamburg, Paul G. Unna described the actions of salicylic acid, resorcinol, trichloroacetic acid (ATA) and phenol on the skin. His early work was followed by many others. (2013, p.59).

Still on the historical path of chemical peelings, we can also note other chemical resources that have emerged and are currently used techniques as transcribed below:

The use of phenol was developed after World War I in France. In England, Mac Kee had previously worked with phenol for the treatment of scars, but did not publish his results until 1952. Meanwhile, in the United States during the 1940s, Eller and Wolff provided the first systematic description of the use of phenol, salicylic acid, resorcinol and carbon dioxide for the treatment of scars. The modern era of peelings began in the 1960s with the development of modified phenol solutions (addition of croton oil, septisol and water) by Baker and Gordon, and histological evaluation of results, comparing effects between phenol and ATA. The scientific basis for ATA treatments was expanded in the 1970s and early 1970s by comparing the histological effects between three concentrations of ATA. At the same time, alpha-hydroxy acids (AHA) were developed by Van Scott and Yu for more superficial peelings indicated for the treatment of hyperkeratosis. Peeling with glycolic acid was later developed. The description of combinations of two substances by Brody and Hailey, and later by

Monheit to achieve medium depth effects, provided progress in the use of peelings. The most recent development is the use of lipohydroxy acid (LHA). (YOKOMIZO et.al 2013, p.59).

For (BAGATIN et.al 2009, p.37) Chemical peels constitute an accelerated exfoliation or injury to the skin induced by caustic agents that cause controlled damage, followed by the release of cytokines and inflammation mediators, resulting in thickening of the epidermis, deposition of collagen, reorganization of structural elements and increase in dermal volume. Still for Rotta (2008), this type of treatment has several applications, including: cases of wrinkles, melanosis, actinic keratosis, melasma, post-inflammatory hyperpigmentation, acne and its sequelae, atrophic scars, stretch marks, keratosis pilaris and for lightening the skin. However, it is contraindicated in cases of inadequate photoprotection, pregnancy, stress or neurotic abrasions. The characteristics of stability, penetration and toxicity are widely recognized for most agents, as highlighted (BAGATIN et.al 2009, p.38). Peelings that are reported as superficial are:

Trichloroacetic acid (ATA) 10% to 20% in aqueous solution or in other vehicles, which is low cost, stable, non-toxic and versatile. At a concentration of 35%, it is usually combined with prior application of Jessner's solution or 70% glycolic acid⁶⁴ for *medium peeling*; focal use can be made with higher concentrations, from 50% to 90%.

To do so, it is necessary to observe other factors that are still referenced (BAGATIN et.al 2009, p.38) Thus, any classification is approximate. The most used divides peelings into: very superficial (horny and granular layers), superficial (epidermis), medium (papillary dermis) and deep (reticular dermis). The depth depends on the skin type, previous treatments, anatomical location, degreasing, application technique, agent, etc. (BAGATIN

et.al 2009, p.38).

It is a *peeling* widely used by doctors, due to its lack of systemic toxicity, being requested in formulations whose concentration varies between 10 and 80% (GASTON-MARICOURT, 1997) in the research “Trichloroacetic Acid Peeling: Manipulation in Pharmacies”. Still for (CUNHA 2014) who highlights in his monographic research “Chemical Peeling: Pharmaceutical Preparations for Cellular Renewal” such processes are nothing more than preparations used to exfoliate and peel the skin. Its purpose is to remove layers of the skin in a controlled manner with the aim of renewing epidermal and dermal tissues, and for each peel there is a type of recommendation. Despite the huge variety of current aesthetic treatments such as lasers, etc. the *peeling* resists in a unique way as stated:

The great heterogeneity of studies, with so many variables, does not allow for statistical analysis and precise conclusions. In any case, one has the impression that chemical peelings will survive the era of equipment, but more clinical studies of good methodological and reproducible quality are needed so that updated management protocols can be established (BAGATIN et.al 2009, p. 43).

Ferreira (2000) highlights that trichloroacetic acid is a crystalline powder, highly soluble in water. When used for rejuvenation purposes, they are excellent for treating damaged acneic skin, as well as for scarring and deep wrinkles. It is an active ingredient widely used for superficial and medium-depth chemical peelings, with concentrations ranging from 10 to 75% in aqueous solutions.

According to (BATISTUZZO, 2006) Trichloroacetic acid, also known as trichloroethanoic acid or TCA, is an analogue of acetic acid in which the three hydrogen atoms of the methyl group have been replaced

by chlorine atoms. It is an aqueous acid substance with great cauterizing power and has been widely used in biochemistry for the precipitation of macromolecules such as proteins, DNA and RNA. Its sodium salt is used as an herbicide and solutions containing trichloroacetic acid as ingredients are used for the treatment of warts, including genital warts. It is considered safe to use for this purpose during pregnancy. The discovery of trichloroacetic acid by Jean-Baptiste Dumas in 1840 presents an important step in the then slow development of theorization involving organic radicals and valences. The theory was contrary to the beliefs of Jöns Jacob Berzelius, starting a long dispute between Dumas and Berzelius. To this end, the persistence of ATA stands out, confirming that there is no other agent with so many positive characteristics, particularly for medium *peeling*. (BAGATIN et.al 2009, p.43). Besides, for application Trichloroacetic acid peeling, this substance allows superficial, medium and deep peelings to be carried out according to (YOKOMIZO et.al 2013, p.64:65):

- ATA 10% – superficial *peeling*.
- ATA 10 to 30% – medium *peeling*.
- ATA 35 to 50% – deep *peeling*.

There is a great risk of scar formation when applying concentrations above 50%, which is not recommended. To prepare a 30% solution, use 30 grams of ATA crystals with water until 100ml is obtained. Solutions can be applied with cotton swabs or gauze, and 10 to 20% pastes can be applied with spatulas. Application method: after degreasing the skin with alcohol, apply the product with slightly moistened gauze. Start with the frontal region, followed by the nose, malar regions, perioral region and eyelids. Evenly distribute the solution, especially on the edges, to avoid demarcation lines. The objective is to achieve uniform *frosting*. Reinforce the application in areas where

flaws appeared.

It is necessary to observe the presence of tears, to prevent the dilution of the acid and prevent it from flowing into areas that must not be reached, such as the cervical region, for example. It is interesting to use a fan on the patient's face to make the application more bearable. Intense hydration and sun protection are recommended throughout the peeling phase. ATA precipitates epidermal proteins causing coagulation necrosis. It is a very versatile peeling with excellent action in rejuvenating and improving scars, treating actinic keratosis and melasma. Does not cause systemic toxicity.

In the study "Trichloroacetic acid gel - A new technique for an old acid" (ZANINI 2007) states that the use of ATA despite being a somewhat old technique and even in the face of the emergence of new techniques in the treatment of conditions indicated for the use of ATA, its practicality, effectiveness and low cost allow us to affirm that this agent is far from medical disuse. Both for (ZANINI 2007) and for (REBELLATO et.al 2015) In general, ATA *peeling* in aqueous solution is carried out through successive applications, interposed for standardized time intervals, after which the level of damage is checked. (frosting) caused by previous applications. To this end, these assumptions are further reinforced as follows:

The effect of ATA is protein denaturation, clinically evidenced by the formation of frosting (whitening) and changes in skin turgor. These two elements serve as clinical parameters in evaluating the depth of ATA peeling. Regarding the intensity of frosting: 1) Superficial or epidermal – diffuse erythema with light blanching; 2) Medium or superficial dermis – moderate and uniform whitening and 3) Deep – intense and uniform whitening is indicative of penetration up to the papillary-reticular dermis transition. A grayish-yellow frosting indicates penetration into the reticular dermis. There is a time lag between the

application of the acid and the development of frosting. For the same anatomical unit, the higher the acid concentration, the shorter the time lapse. This is an important fact to note with ATA solution, as inadvertent reapplication will cause the acid to deepen. As for skin turgor, as the peeling deepens, the edematous appearance of the skin becomes wrinkled or parchment-like with a papery sensation. (ZANINI 2007 p.14).

It states (VELASCO et. al 2004) in the study entitled "Skin rejuvenation by chemical peeling" that the same indications as superficial peeling, in addition to being indicated in epidermal lesions. In the procedure, combinations of TCA (trichloroacetic acid) with CO₂, TCA with Jessner's solution, TCA with glycolic acid or just TCA and resorcinol are used as active substances. Like superficial peeling, medium resurfacing reached greater popularity in the 1980s. In this procedure, peelings are also usually repeated to obtain and maintain better results. They are more suitable when the skin already presents roughness such as keratoses (pre-cancerous lesions) and more pronounced wrinkles (ALMEIDA DE SÁ, 2006) in the monographic research "TCA Peeling".

Santos et al. (2004) carried out a study involving TCA and microcurrent in 36 rats, concluding that in optical microscopy analysis, the fibroblasts from the group stimulated by the previous use of TCA had a significantly better response compared to the group that was stimulated by microcurrent. Zanini (2007) "Trichloroacetic acid gel - A new technique for an old acid" carried out a study containing 100 patients, aged between 23 and 74 years, 91% of whom were female. These patients underwent facial and body peelings with trichloroacetic acid (TCA) gel. The author concluded that the use of the gel was very safe, as it does not run and is easily removed with gauze. Thus, this tells us that its application has surpassed all other forms

of application of TCA. Positive results were obtained regarding the effective use of this acid. Just as Velho & Moraes (2010) describe in their study “Superficial chemical peeling for the maintenance treatment of rosacea” the use of ATA in patients with rosacea, initially applying four outpatient and weekly applications of increasing concentrations of ATA 10 to 20% with slightly damp gauze. Among the advantages of ATA peelings are the low cost, the ease and safety of handling in these concentrations and, practically, the absence of immediate and late discomfort. Concluding that this superficial chemical peeling is, therefore, a good option in the maintenance treatment of patients with rosacea. (RUIZ et al.2008) carried out a study where 12 patients were selected and treated, with rhytides or sequelae of facial acne, Glogau 2 to 4, Fitzpatrick 1 to 3, female, aged between 25 and 68 years (average of 47), with the indication of carrying out a medium peeling on the face, the proposed procedure was chemical abrasion with 30% ATA, in a sufficient number of layers to carry out the uniform frost medium depth peeling on the entire face. All patients received prior treatment with retinoic acid and hydroquinone, for at least 4 weeks, daily, at night. Before carrying out the procedure, the facial skin was “degreased” with a solution of 96% alcohol and sulfuric ether, in a proportion of 50% each. Both this solution and ATA 30% peeling were applied with cotton gauze.

Regarding the principles of regeneration, several studies such as those by (ZANINI 2007), (YOKOMIZO 2013), (RUIZ et al.2008) state the regeneration of the dermis for such aesthetic purposes and reinforce the fact that the procedure is relatively low-cost. And also about regenerative principles:

It promotes dermal regeneration, collagen remodeling and an increase in the number of elastic fibers. It does not present systemic

toxicity and can be used together with other acids to perform associated chemical abrasion, such as retinoic or pyruvic acids and Jessner’s solution (RUIZ et al.2008 p.70).

The medium *peeling* with ATA 30% is certainly one of these. It has low toxicity, results similar to dermabrasion at a lower cost. (RUIZ et al.2008 p.70).

When it comes to pain caused during the application of the methods:

Although pain after medium-depth peelings is common, there are few studies published in the literature on this topic, especially regarding its topical use. The use of topical anesthetic gel showed some improvement in reducing pain after chemical abrasion with ATA 35%¹⁵, but had the important side effect of deepening the thickness of the peeling in some cases. (RUIZ et al.2008 p.70).

Complications may occur as a result of such methods, in general, these are related to incorrect indication of the procedure, deficient instructions or those not followed by the patient and/or poor application technique, among which we can mention: carrying the agent to areas not treated with risk of scars, dilution of the agent by tears, conjunctivitis and corneal ulcers, abrasions leading to infections and hyperpigmentation, acneiform eruption, hypopigmentation, lines of demarcation, irritant or allergic contact dermatitis, persistent erythema or pruritus, atrophic or hypertrophic scars and effects toxic (GUERRA et al 2013). The prescription of medications and, consequently, their promotion, can be mistakenly thought of as necessary in a context of change to a healthier lifestyle. (VASCONCELOS et al., 2005). The most common complications of a chemical peel are tears running down the neck (taking the chemical along with it), premature exfoliation, infection, acneiform eruptions, ecchymosis, post-inflammatory hyperpigmentation, hypopigmentation,

allergic reactions, persistent erythema and fibrosis. In most cases these complications are reversible (ALMEIDA DE SÁ, 2006). Occasional adverse reactions are blisters, crusting, severe burning or redness, skin edema, darkening or lightening of the skin, hot or stinging sensation, peeling of the skin may occur after a few days of treatment (KOROLKOVAS, 2008).

(GARCIA et al., 2006) warns about the use of chemical peels in specific conditions and is contraindicated in cases of pregnancy, due to the lack of studies regarding safety. If you have a history of hypertrophic scars and keloids, medium and deep peels must be avoided. Patients using isotretinoin must wait at least one year after stopping the medication, as it causes re-epithelialization of the skin. Radiotherapy promotes reduction of re-epithelialization. Previous surgical procedures wait at least three months for peeling (laser and electrolysis). People with active acne lesions, herpes, active inflammatory processes, flat warts, seborrheic and atopic dermatitis, rosacea, immunosuppressive diseases must not undergo this type of peeling.

These approaches were taken, which involved discussing the first question of this research when seeking to answer the initial questions (what do chemical peels consist of?). To this end, research was analyzed (BAGATIN et.al 2009) ;(YOKOMIZO et.al 2013); (GASTON-MARICOURT, 1997); (CUNHA 2014) and (GARCIA et al., 2006). Already responding to the subsequent question (how must pharmaceutical attention be given to skin treatments with trichloroacetic acid?). The research that provided support for this was Ferreira (2000); (BAGATIN et.al 2009) ;(YOKOMIZO et.al 2013); (BATISTUZZO, 2006); (RUIZ et al.2008); (VELASCO et. al 2004); (ZANINI 2007); (ALMEIDA DE SÁ, 2006); Velho & Moraes (2010) and Santos et al. (2004).

CONCLUSION

In this review, we sought to promote a narrative literature review on the subject of chemical peeling with trichloroacetic acid in skin treatment and raise the importance of its mechanism of action, as well as emphasizing which are the active principles and vehicles used in the formulations. pharmaceutical companies for peelings.

Initially, the need to improve clinical practice was maintained, through the recognition of intellectual practice, qualified professional performance is possible and consistent with current requirements in terms of health and aesthetics in the context of pharmacists' work. This is of fundamental importance for making more scientific and dynamic decisions, because they are based on current literature.

Next, chemical peeling with trichloroacetic acid was a process that initially had lower operational costs despite being a not so current technique and resulting from several factors, such as the safety of its handling in these concentrations and, practically, the non-existence of of immediate and late discomfort.

Given the approach to the importance of pharmaceutical care in the face of this phenomenon of chemical peeling and complex facial treatments, it is concluded that it is essential for the exercise of the pharmaceutical profession to require effective pharmacotherapeutic care consistent with the reality of the patient's needs, whose action interferes with increasing effectiveness of the treatment. Based on the fact that the population is more concerned about skin health, peelings have become a very well-accepted treatment, as long as they are applied by professionals qualified to do so. Having expertise (mainly in pharmacoesthetics), possessing language communication skills, guiding prescribers and educating the population are challenges posed to their performance, fundamentally

when it comes to the aspect of the skin, which is increasingly important for a greater number of people, and the pharmaceutical industry focuses a lot on this, bringing increasingly

advanced cosmetic products and treatments to the market every day aimed at improving and rejuvenating the skin.

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