

## Research

# Treatment of Infraorbital Dark Circles with Combination of 3.75% Trichloroacetic Acid and 15% Lactic Acid

Aziz A. AlSohaimi\*

Assistant Professor of Dermatology, Faculty of Medicine, Al-Baha University, Saudi Arabia

\*Address for Correspondence: Aziz A. AlSohaimi, Assistant Professor of Dermatology, Faculty of Medicine, Al-Baha University, Saudi Arabia, Tel: 00966504417266; E-mail: aoa24@hotmail.com

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### Abstract

**Background:** Infraorbital dark circles are a very obvious and present cosmetic problem worldwide. They are challenging to treat because of complications in pathogenesis, the variety of causes and Postinflammatory hyperpigmentation after management. Available treatments include bleaching creams, topical keratolytic agents, fat transplants, pigmented laser therapy, fillers injections and surgery.

**Method:** The goal of this study was to determine the efficacy of chemical peel, a solution of 3.75% trichloroacetic acid and 15% lactic acid, for treating infraorbital dark circles (IODCs). This chemical peel was given to 42 patients with IODCs once per week for 4 weeks.

**Result:** A great improvement (mean, 85.7%) was found: one patient (2.4%) indicated the treatment provided a good response (41%- 60%), 14 (33.3%) indicated a very good response (61%-80%), and 27 (64.3%) indicated an excellent response (81%-100) based on the Statistical Package for the Social Sciences (SPSS) and chi square. The women were more satisfied compared to the men (89.6% vs 79.4%); age was not a significant factor. All patients were satisfied (either mild or moderately satisfied [8, 19%] or highly satisfied [34, 81%]).

**Conclusion:** Though IODCs are challenging and difficult to treat, weekly treatments with a solution of 3.75% trichloroacetic acid and 15% lactic acid for 4 consecutive weeks is a simple procedure that can be applied in the clinic, resulting in good outcomes.

**Keywords:** Infraorbital dark circles, Trichloroacetic acid, Lactic acid

### Introduction

Infraorbital dark circles (IODCs), also known as bilateral homogeneous hyperpigmentation, which is a common cosmetic problem that affect patients of any age, sex, and ethnicity. They worsen

with age and can be a source of sleeping disorders particularly among women [1,2]. They affect facial appearance, giving a tired, depressed, or older look [2,3]. Infraorbital hyperchromia can be

broadly divided into primary and secondary types. primary type, is characterized by bilateral pigmentation involve orbital skin and eyelid, which is not secondary to any diseases either local or systemic.[3-5].

Primary type, is defined as bilateral pigmentation involve orbital skin and eyelid, which is not due to any diseases either local or systemic. [3-5]. Secondary types are associated with known systemic or local diseases and can be induced by several etiological factors, such as family or ethnic propensity, periorbital edema, or Postinflammatoryhyperpigmentation triggered by atopic, allergic dermatitis, medication or systemic disease [5,6]. Other known factors are fatigue, lead-containing eye liners, smoking, prolonged exposure to the sun, superficial positioning of the vasculature of the eyelids, weeping from depression and shadowing due to skin laxity [5,7]. These factors can act in combination but in many cases, hyperchromia in the orbital region's cutaneous layer is not correlated with underlying diseases, and it can affect those who are completely normal [7]. Laser therapy, chemical peel, carboxytherapy, injectable filler ,autologous fat transplant, and surgery [6,8] are known therapies. Chemical peeling is considered basic in patient medical procedure that results in controlled skin damage that triggers tissue regeneration and do rejuvenation during the healing process [9,10]. Skin damage after peeling can be categorized as one of three specific forms based on the histological extent of injury: superficial, medium, or deep peeling. Superficial peeling impacts the epidermis at the basal layer only, whereas medium peeling affects the papillary portion of the dermis, and deep peeling can reach the reticular dermis [10,11]. Chemical peels are commonly low in concentration or used in conjunction with other topical agents for depigmentation [12,13]. In this research, to study the efficacy and protection of a new surface chemical peel at a concentration that achieved satisfactory penetration without adverse effects such as scarring and permanent depigmentation [14].

## Materials

This study was performed on 42 patients with IODCs recruited from the Out-Patient Clinic of Dermatology at the Al-Baha Salem Medical Care Center from August 2019 to February 2020. Inclusion criteria were: a new diagnosis that was otherwise clinically safe and no IODC treatments in the last 6 months. Exclu-

sion criteria were: a history of keloid scarring, bleeding disorders, photosensitivity and hypersensitivity to the components of the chemical peel. Informed consent was obtained from each patient after complete clarification of the study process and its risks. Extensive histories were recorded, then comprehensive general and dermatological assessments were performed and included a skin type evaluation.after and before treatment, depending on the form of IODCs (i.e., either it was disorder of pigmentation [brown in color], vascular disease [pink, blue or purple in color], or mixed), each patient was evaluated. IODC grade was assessed based on the surrounding skin [10]. Grade 0, the skin color matched other areas of facial skin; Grade1, mild hyperpigmentation was evident in infraorbital fold (bilateral); Grade 2, a darker pigmentation was pronounced; Grade 3, the color was dark black and included all 4 lids; and Grade 4, Grade 3 was present and pigmentation extended beyond the infraorbital fold. After treatment, change was rated as poor (0% to 20%), fair (21% to 40%), good, (41% to 60%), very good (61% to 80%), or excellent (81% to 100%) by physician and patient observation. Patient satisfaction was self-rated on the same scale. Patients were also asked to rank their satisfaction with the clinical results as unsatisfied, slightly satisfied, moderately satisfied, or highly satisfied.

## Procedure

A solution was prepared and consisted of two peeling agents, 3.75% trichloroacetic acid (TCA) 15% lactic acid (LA). It was applied to the infraorbital areas of each patient for about 5 minutes each week for 4 successive weeks. Each application was neutralized with 5% sodium bicarbonate. Each patient was advised not to rub the periorbital region, to use sunscreen and to wear sunglasses. Follow up is after 1-2 week(s) after the forth session to see final outcome. Photos by high resolution digital canon camera were done before treatment, weekly after each session and one week after last session to evaluate improvement. Statistical analysis was performed using the Social Sciences Statistical Package (SPSS) version 20. Qualitative data were compared across two or more groups using the chi-square test [15]. Differences in results were compared based on age, sex, and overall improvement.

The sample of 42 patients (16 men, 26 Female) ranged in age from 16 to 60 years. The length of IODCs ranged from 2 to 13 years. In



Figure 1A



Figure 1B

**Figure 1: Patient with IODC as seen before (A), and after (B), showed excellent improvement.**



Figure 2A



Figure 2B

**Figure 2: Patient with IODC as seen before (A), and after (B), showed a good improvement**

this sample, 15 patients had type III skin, 18 (42.8%) had type IV skin, and 9 (21.4%) had type V skin. Skin types included the pigmented form of IODCs. Skin pigment change was noted in most cases after the first treatment session. The change in IODCs grade was significant ( $P = 0.02$  Table 1). All patients were satisfied with the therapy (Figure &2), and none indicated that posttreatment IODCs deterioration. Dermatologist and patient determined that the degree of progress was excellent in 64.3% of patients, very good in 33.3%, good in 2.4% (Table 1A). Patients were highly satisfied (81%), moderate satisfied (17%), or slightly satisfied (2%) (Table 1B). Finally, the procedure was tolerated: 64.3% experienced excellent global tolerance, 33.3% very good tolerance, and 2.4% good tolerance. Several participants (over 97%) tolerated the mild

side effects: tingling during the peeling procedure. On the other hand, a few patients felt slight itching and burning sensations. Peeling, the incidence of exfoliation was most evident at 24 to 48 hours. The above symptoms persisted for a small period of time and did not need further care. The overall improvement based on sex and age is shown in Table 2.

### Discussion

Topical phenolic or non-phenolic bleaching agents, in particular hydroquinone and tretinoin, are used to treat hyperpigmentation. Most bleaching agents 'mechanism of action is inhibit tyrosinase enzyme ,and which prevents conversion of dopa to melanin, end by decrease melanin content in the epidermis. Hydroquinone ef-

**Table 1A: Degree of improvement after 4 weeks.**

3.75% TCA with 15% L.A		
%	No.	Degree of improvement
0	0	Poor response (0%-40%)
2.4	1	Good Response(41%-60 )
33.3	14	Very good response (61%-80%)
64.3	27	Excellent response (81%-100%)

**Table 1B: Degree of Patient satisfaction after 4 weeks.**

3.75% TCA with 15% L.A		
%	No.	Patient satisfaction
2	1	Mild
17	7	Moderate
81	34	High

**Table 2: Relationship between age, sex and degree of improvement.**

	Mean of Improvement (%)	P Value
Sex		
Male	79.40 %	
Female	89.62%	0.04*
Total	85.71%	
Age		
<20	88.33% (6)	
20-39	86.17%(29)	0.409*
40-60	80%(7)	

\*Statistically significant at  $p \leq 0.05$

fect is typically becoming obvious after 20 to 28 weeks of therapy, so care should be provided for at least 12 weeks. Acute side effects frequently observed includes slight irritation, itching of skin, Post-inflammatory hypo or hyperpigmentation and long-term use can result in ochronosis. Azelaic acid (1,7- heptane dicarboxylic acid) was originally formulated as a topical keratolytic for acne but was later used in the management of disorder of pigmentation like melasma because of its effect on inhibit tyrosinase activity. This action involves the suppression of mitochondrial enzymes and DNA synthesis and activities, leading to strong cytotoxic effects on the melanocyte.

Glycolic acid is an alpha hydroxy acid commonly used for orbital region. 20 percent glycolic acid give good result in management of intermittent hyperpigmentation [16]. Fifteen percent of lactic acid was used by Vavouli, et al. [17] 36 in periorbital hyperpigmentation in conjunction with trichloroacetic acid (TCA) 3.75 percent showed extensive cosmetic improvement. It is better to expand the skin to the entire face to prevent post-peel demarcation for treatment of periorbital hyperpigmentation in medium to darker skin. Priming with a hydroquinone 4 % and keratolytic agent is recommended for 15 to 30 days before receiving a chemical peel for optimal outcome. Postinflammatory hyperpigmentation can be the most common side effect of chemical peels. With the help of priming agents such as tretinoin, and hydroquinone this can be minimized [13,16]. Lasers have been primarily used in cosmetic dermatology in recent years. Infraorbital hyperpigmentation has been treated successfully with specific non-invasive lasers targeting pigment and vascularity. Specific lasers used to improve orbital pigmentation include switched alexanderite laser, Q switched ruby laser (694 nm), and Nd: Yag laser (1064nm) [16]. In this sample of patients, 85.7% found the treatment resulted in a great improvement, and women found greater improvements compared to the men. Side effects were minor and temporary because TCA and LA applied to the skin causes damage to the epidermis, coagulation of the skin proteins, and dispersion of melanin. Skin cells then regenerate with increased collagenformation, leading to an increase in volume in the epidermis and dermis [17-20]. Many factors affect the extent of skin necrosis: TCA and LA concentration, permeability of the surface, the number of skin layers affected in a single session, length of contact, number of previous

treatments, length of treatment regimen and skin type. A chemical peel has many advantages for those with IODCs: greater skin penetration without requiring a greater concentration, fewer harmful effects such as scarring and permanent depigmentation (a consequence of the low concentration), enhanced tissue regeneration, and shorter subsequent recovery time [11,14,21]. This chemical peel is a reliable and effective treatment for IODCs, particularly the pigmented form, and it is simpler than other approaches. It provides the benefits of good homogenization and safety, and it is well tolerated. These features satisfy both the patients and the doctors [22,23].

## Conclusion

Combination peels have many advantages: Allowing to leverage the different properties of each agent for optimal performance, (ii) reducing the risk of complications by using low concentration, (iii) increase tissue regeneration and subsequent recovery time, and (iv) expanding the range of chemical peeling process applications. Treatment approaches by 3.75%TCA with 15%LA were similarly successful in management of IODCs, with good improvement of IODCs from the first session. Chemical peeling was much easier in the pigmented IODCs style procedure, with few tolerated adverse effects. It is inexpensive and is showed to be an easy technique and has a great outcome compared to other modalities in treatment of IODCs.

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