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Role of carbon dioxide laser in treatment of xanthelasma palpebrarum

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Abstract
Background: Xanthelasma palpebrarum (XP) is the commonest form of xanthomas which develop over eye lids. Carbon dioxide (CO_2) LASERs are considered the ideal therapy for xanthelasma.
Objectives: The aim of this work was to evaluate the efficacy and safety of CO_2 LASER in the therapy of XP.
Methods: The current work was carried out on 15 cases presented with XP to be treated by CO_2 LASER. For all cases, assessment of the degree of clinical improvement, cases' content and side effects were done.
Results: Regarding assessment of the degree of clinical improvement, 11 xanthelasma cases (173-3%) showed excellent improvement, and 4 cases (26.7%) showed very good improvement. Regarding cases' content, 8 cases (53.3%) were very contented, 4 cases (26.7%) were contented, 2 cases (13.3%) were slightly contented, and one case (6.7%) was uncontented. Regarding side effects, all the 15 cases (100%) showed pain, erythema and superficial crustation, 9 cases (60%) showed edema and 5 cases (33.3%) showed scarring, 6 cases (40.0%) post inflammatory hyperpigmentation and no cases showed recurrence of the lesions during the follow up period.
Conclusions: Carbon dioxide LASER is an excellent modality in the therapy of xanthelasma but its side effects must considered.

Keywords: Carbon dioxide LASER, xanthelasma palpebrarum, ablation

Introduction

The term xanthoma (Greek ~xanthos~ meaning yellow) describes a variety of subcutaneous lipid deposits. Xanthomas are one of the commonest manifestations of lipid metabolism disorders which are characterized by deposition of yellowish free cholesterol and cholesterol- esters in large foam cells accumulating in the skin and the tendons [1].

Xanthelasma palpebrarum (XP) is the commonest form of xanthomas, which develops over the eye lids [1]. It is commonly seen in middle aged adult individuals, with an incidence 1.1% in women and 0.3% in men. According to the severity of the symptoms and the extent to which the lesions have spread, it is divided into four distinct stages. Lesions confined to the upper eyelids (Grade 1) Lesions that reach the medial canthal region are classified as Grade (2). Medial upper and lower eyelid involvement is Grade (3), while diffuse medial and lateral upper and lower eyelid involvement is Grade (4). Grade 1 and 2 types of xanthelasma are the most commonly seen types [2].

Carbon dioxide (CO_2) LASERs are considered the ideal ablative LASER. The beam is primarily absorbed by cellular water causing vaporization and ablation of tissue. CO_2 LASER therapy ensures minimal discomfort and rapid recovery, enabling a quick return to daily routine [3]. In the case of xanthelasma, it is postulated that the heat resulted from LASER tissue ablation, destroys the foam cells, causing them to break down. Additionally, dermal coagulation of hyper-permeable capillaries could hypothetically prevent additional lipid leakage [4]. Due to the marked cosmetic and psychological impact of xanthelasma and the absence of the ideal line of therapy; we were motivated to perform this research.

The aim of this work was to evaluate the efficacy and safety of CO_2 LASER in the therapy of XP.

Methodology

This research included 15 cases presented with any grade of xanthelasma palpebrarum and did not receive any previous therapy, who were collected from the outcase clinic of Dermatology and Venereology Department, Tanta University Hospitals, during the period from January 2020 to March 2021.

Inclusion criteria

1. Cases who were presented with any grade of XP.
2. Cases who did not receive any previous therapy for XP.
3. Cases who accepted to be enrolled in the research and signed an informed consent.

Exclusion criteria

1. Current herpes simplex in the therapy area.
2. History of keloid formation.
3. Cases with unrealistic expectation.
4. Pregnancy or lactation.
5. Cases associated with any skin or general disease or receive immunosuppressive therapy.

All cases were subjected to the following before procedure

1. Complete history taking including present (onset, course and duration), and past history (any previous therapy) and family history.
2. General and dermatological examinations to exclude any systemic or dermatological diseases.
3. Local examination of lesions (site, number, size, color).
4. An informed consent was obtained from all cases after full explanation of the procedure, risks and purpose of the research.
5. Digital photographs lesions were taken for each case.
6. Laboratory investigations including complete blood picture, bleeding and coagulation time, fasting blood sugar, lipid profile, liver and renal function tests.
7. All cases were followed up monthly for 3 months to detect if there are any side effects or recurrence.
8. All cases were instructed to avoid the use of any other therapy for XP for the whole duration of the research or during the follow up period.

Carbon dioxide LASER therapy sessions

Equipment

CO_2 LASER ablation was performed using (SmartXide Dot®- LASER system, Scanner type, DEKA, Calenzano, Florence, Italy) CO2 LASER apparatus. The energy density thus produced by this system is above the ablation threshold of the skin. Ablative CO_2 LASER (Smart Pulse Emission), with 20-watt power, and DOT therapy was suggested.

Technique

The hand piece was held perpendicular to the lesion and the foot pedal was pressed to fire the LASER. The lesion was vaporized in coiled, whorled centrifugal pattern. Flat lesions were vaporized from the top, and removed with a curette.

Post-operative care

All cases were instructed to apply topical antibiotic cream twice daily for a week after ablation, avoid sun for 10 days after ablation, avoid contact with dust, and allow the formed crusts to fall on own.

Evaluation of the clinical efficacy of carbon dioxide LASER in xanthelasma

- **Degree of clinical improvement:** Excellent improvement (>75%) as compared to before therapy, very good improvement (50% to 75%), good improvement (25% to <50%) and fair improvement (<25%).
- **Cases' content:** Cases were asked at the final visit to rate their content compared to the pre-therapy condition. They were asked to fill up a questionnaire about their overall content for each side of xanthelasma as follows: Not contented, slightly contented, Contented, Very contented.
- **Side effects:** It included the assessment of the occurrence of early post therapy complaints within one week after each therapy session (Crustation or exfoliation, Burning pain, infection, ulceration) and late post therapy complications one month after last therapy session (Infection, Hyperpigmentation, Atrophic scars, Hypertrophic scars).

Statistical analysis

IBM SPSS version 20.0 (Armonk, NY: IBM Corp) was used to analyze the data that was fed into the computer. The quantitative information was summarized as a mean accompanied by a standard deviation. The Chi-square test was used to examine qualitative data presented as numbers and percentages. The obtained results were deemed significant at the 5% level.

Results

Demographic and clinical data of the studied cases

- **Age:** The cases' age ranged from 27.0 - 60.0 years with a mean age of 43.91±9.72
- **Gender:** The cases included in this research were 12 females (80%) and 3 males (20%).
- **Fitzpatrick's skin photo typing:** 5 cases (33.3%) were skin type III, and 10 cases (66.7%) were skin type IV.
- **Duration:** It was ranged from 1 to 5 years with a mean of 2.78≠1.30
- **Clinical grades of xanthelasma palpebrarum:** 6 cases (40%) had grade I XP, 4 cases (26.7%) had grade II XP, 2 cases had grade III XP (13.3%) and 3 cases had grade IV XP (20%).
- **Family history:** 13 cases (86.6%) had negative family history, and 2 cases (13.4%) had positive family history of xanthelasma palpebrarum
- **Course:** 9 cases had stationary course (60%) and 6 cases had progressive course (40%).
- **Lipid profile of the studied cases:** Regarding cholesterol level, 7 cases (46.6%) had normal level of serum cholesterol < 200 mg⁄dl and 8 cases (53.4%) had high level of serum cholesterol. Serum triglycerides level and high-density lipoprotein was normal in all cases. Regarding low density lipoprotein level, 11 cases (73.3%) had normal serum level of low-density lipoproteins <160 mg⁄dl and 4 cases had high serum level of low density lipoproteins >160 mg⁄dl. (Table 1)

Therapy assessment

- **Regarding the degree of clinical improvement:** all the studied 11 xanthelasma cases (173-3%) showed excellent improvement, and 4 cases (26.7%) showed very good improvement (Table 2).
- **Regarding cases' content,** 8 cases (53.3%) were very contented, 4 cases (26.7%) were contented, 2 cases (13.3%) were slightly contented, and one case (6.7%) was uncontented. Table 3.
- **Regarding side effects:** All 15 cases (100%) showed pain, erythema and superficial crustation, 9 cases (60%)

showed edema and 5 cases (33.3%) showed scarring, 6 cases (40.0%) post inflammatory hyperpigmentation or hypopigmentation (PIH) and no cases showed recurrence of the lesions during the follow up period. Table 4.

Table 1: Lipid profile of the studied cases (n = 15)

Lipid Profile (mg/dl)	Mean ± SD
Serum cholesterol	214.7±45.97
Serum triglycerides	106.7±34.04
Serum LDL	127.7±29.35

Table 2: Degree of clinical improvement in response to ablative carbon dioxide LASER (n = 15)

Degree of clinical improvement	No (%)
Fair improvement	0 (0%)
Good improvement	0 (0%)
Very good improvement	4 (26.7%)
Excellent improvement	11 (73.3%)

Data are presented as frequency (%). GAIS: Global Aesthetic Improvement Scale

Table 3: Degree of cases' content after carbon dioxide LASER (n = 15)

Cases' content	No (%)
Not contented	1 (6.7%)
Slightly contented	2 (13.3%)
Contented	4 (26.7%)
Very contented	8 (53.3%)

Data are presented as frequency (%).

Table 4: Distribution of the studied cases according to side effects evaluation (n = 15)

Side effects evaluation	No (%)
Pain	15 (100%)
Erythema	15 (100%)
Edema	9 (60%)
Superficial crustation	15 (100%)
Scar	5 (33.3%)
PIH	6 (40%)
Ecchymosis	0 (0%)

Data are presented as frequency (%). PIH: Post inflammatory hypo or hyperpigmentation

Fig 1: Bilateral xanthelasma palpebrarum (Grade I); (A): Before therapy. (B): After Carbon dioxide LASER therapy with excellent improvement

Fig 2: Bilateral xanthelasma palpebrarum (Graade IV); (A): Before therapy. (B): After Carbon dioxide LASER therapy with good (25-50%) improvement

Discussion

The present research revealed that the majority of cases (70%) were above 40 years. Nair *et al*. [5] reported that, the age of onset of xanthelasma ranges from 15 to 73 years, with a peak incidence between 30 and 50 years.

In our research, the majority of cases were females (86.7%), which agreed with the studies done by Jain *et al*. [6] and Kavoussi *et al*. [7]. This female predominance may be explained by the fact that females are more conscious from cosmetic point of view. However, few studies done by Dey *et al*. [8] and Dwivedi S *et al*. [9] reported a predominance of xanthelasma palpebrarum (XP) in males. While Sharma *et al*. [10] and Schou *et al*. [11] reported equal xanthelasma prevalence in both sexes.

In our research, 13.4% had positive family history. This finding agreed with Jain *et al*. [6], Tursen *et al*. [12], and Ribera *et al*. [13] who reported a positive family history in 12.1%, 22%, 9.8% of cases respectively. This suggests that genetic factors may take part in the pathogenesis of xanthelasma.

Regarding the site of xanthelasma lesions, this research found that majority of the cases had lesions on the upper eye lids and may extend to medial canthus. Govorkova *et al*. [14] and Zak *et al*. [15] reported predominance of xanthelasma lesions in upper eyelids which is in agreement with our research. The reason why these lesions develop only in the eyelids and not in other sites of the body still remains obscure [16]. However, Jain *et al*. [6] explained xanthelasma plaques formation as follows; the vasculature of the eyelids is exceedingly rich, laxity and frequency of movement are much higher in the eyelids, so fluid may accumulate early in the dermis of the eyelids in systemic diseases and the excessive movement of eye lids may be sufficient to cause increased vascular leakiness.

The present research showed that 53.3% of the cases had lipid profile abnormalities. Khode *et al*., [17] found that 52% of their xanthelasma cases showed abnormal lipid profile, and they concluded that xanthelasma plaque formation may be due to increasing heat, physical action, and friction all contributed to the release of lipids from blood vessels into the surrounding tissue. Multiple studies have suggested that reduced cholesterol clearance from tissues due to low HDL levels contributes to the development of xanthelasma lesions in normolipidemic cases [15, 18]. This finding agreed with previous studies done by Tursen *et al*. [12], Ribera *et al*. [13], and Wang *et al*. [19] which reported that the percentage of cases present with XP and have normal lipid profile, ranges from 20%to 70% and they seek therapy for cosmetic reasons.

Regarding the degree of clinical improvement, there was statistically noticeable clinical improvement, where 73.3%% of cases showed excellent response and 26.7 showed very good improvement. Our results are nearly comparable to the results of Mourad *et al*. [20] who compared the efficacy and tolerability of CO_2 LASER versus different concentrations of trichloroacetic acid in therapy of XP. They concluded that with the CO_2 LASER, the lesions can be carried off layer by layer under perfect visual control. In addition Esmat *et al*., [21] treatment for XP using ablative super-pulsed CO2 LASER against fractional CO2 LASER, assessing both methods for efficacy and safety in a randomized clinical trial. Super-pulsed CO2 LASER treatment for lesions resulted in statistically significant improvements and higher case content compared to fractional CO2 LASER treatment. However, fractional CO2 LASERs had a higher rate of scarring and recurrence than ablative CO2 LASERs.

Regarding cases` content, according to the rating given by the cases in their final visit about their overall content compared to the pre-therapy condition, Cases were contented with their results, rating them from good to excellent

The adverse effects reported were pain, erythema, superficial crusting in (100%) of cases, edema in (60%) of cases, post LASER therapy scarring and post inflammatory hyperpigmentation or hypopigmentation in (40%) of cases. This finding agreed with the studies of Mourad *et al*. [20], Esmat *et al*. [21], Ullmann *et al*. [22], Apfelberg *et al*. [23] and Delgado *et al*. [24]. Mourad *et al*. [20] reported post LASER CO_2 therapy side effects as: erythema in 5 cases, edema in 5 cases, hyperpigmentation in 2 cases and hypopigmentation in 3 cases. Delgado *et al*. [24] reported post therapy palpebral edema and erythema in 2 cases and post inflammatory hypopigmentation in 3 cases which was the most frequently reported side effect and it was mainly related to the pigmentation of the skin and increased with dark-skinned individuals. [24]

Conclusions

CO_2 LASER is an excellent modality in the therapy of xanthelasma, but it has some limitations, with reported variable incidence of adverse events such as ulceration, scarring or hyperpigmentation. Further studies on larger scale populations are recommended.

Conflict of Interest

Not available

Financial Support

Not available

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