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International Journal of Current Research
Vol. 10, Issue, 07, pp.71413-71419, July, 2018

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

A COMPARATIVE EVALUTATION OF EFFICACY OF SURGICAL STRIPPING, CO2 LASER, DIODE LASER AND ELECTROCAUTRY FOR THE TREATMENT OF GINGIVAL HYPER-PIGMENTATIONS- A CLINICAL STUDY

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ARTICLE INFO

Article History:
Received 27th April, 2018
Received in revised form
19th May, 2018
Accepted 17th June, 2018
Published online 30th July, 2018

Key Words:
Gingiva, Hyperpigmentation, Melanin, Laser.

ABSTRACT

Background: The aim of the study is to evaluate and compare the effectiveness of Surgical Stripping, Electrocautry, Carbon dioxide and Diode laser for treatment of Gingival melanin hyperpigmentation. **Method:** 30 patients of both sexes, in the age group 18-50 years with bilateral physiologic gingival melanin hyperpigmentation in maxillary and mandibular anterior region, were treated. Random allocation of the sites was done. The clinical parameter assessed were Dummett oral pigmentation index, Hedin melanin index, gingival index, visual analogue scale, gingival wound healing. Dummett oral pigmentation index, hedin melanin index and gingival index were assessed at baseline, 1 month and 3 month. Visual analogue scale and gingival wound healing was assessed 1 day postoperative and at 7 days. **Result:** Significant ($p<0.001$) reduction seen in gingival index and visual analogue scale from baseline to 3 months. Intergroup comparison show no significant difference in hedin melanin index. **Conclusion:**It can be concluded that Surgical stripping, electrocautry, cardon dioxide and diode laser proved to be highly effective in treatment of gingival melanin hyperpigmentation. Surgical stripping remains the Gold standard. However, carbon dioxide and diode laser provides added advantages.

Citation: ***Dr. Girish Deshmukh and Dr. Arvind Shetty*, 2018.** "A comparative evalutation of efficacy of surgical stripping, co2 laser, diode laser and electrocautry for the treatment of gingival hyper-pigmentations- a clinical study.", *International Journal of Current Research*, 10, (07), 71413-71419.

INTRODUCTION

The increasing awareness and the demand for cosmetic gingival surgery have led to an evolution of various procedures through the years. Gingival depigmentation is the treatment modality used to remove the melanin hyperpigmentation for esthetic concerns. It is a procedure which has been carried out from several years, with the first procedure dating back to 1950s.Several techniques have been employed for this purpose. Surgery in the form of surgical stripping, bur abrasion, Cryosurgery, Gas expansion systems, Topical chemical therapy using escharotic agents such as phenol and alcohol, Electrosurgery, Free gingival grafts, Lasers , Acellular Dermal Matrix grafts have been used, as reported by several authors. Each technique has its own advantages and inadequacies.

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DOI:https://doi.org/10.24941/ijcr.31616.07.2018

In this dissertation, the case study describes Gingival depigmentation using Surgical stripping, Electrocautry, CO_2 laser and Diode laser in the Indian Subpopulation. It is a premier kind of study which will compare all the four treatment modalities in the same patient. The word LASER is an acronym for Light amplification by Stimulated Emission of Radiation. The laser consists, in general of an active medium and a pumping medium enclosed in an optical cavity. The stimulation of the active medium generates a light beam that is Monochromatic, Collimated and Coherent. As a result of this property, the laser light is able to concentrate energy on target tissues at an energy level much lower than that of ordinary light. The discovery of lasers was first done by Theodre Maiman in 1960s.Only in 1985, first documented use of laser in periodontal surgery was published. The commonly used lasers for gingival depigmentation are the CO_2, Nd:YAG lasers. However the use of Diode laser for depigmentation has gained increasing importance in recent years. Laser treatment is used to remove melanin pigment by ablating epithelial tissues up to the supra-basal and basal layers of the epithelium

where melanocytes reside. Laser requires melanocytes to lie within its range of penetration and to contain melanin in order to absorb and convert light energy into heat by photothermolysis. The use of lasers has several advantages to their credit, but if used injudiciously, can also be of great disadvantage. Laser safety in the form of protective eyewear, prevention of beam reflection etc., is of paramount importance during its use. Nevertheless, they have shown great advantages over cold surgical procedures in the form of bloodless, painless, sterile field, with minimal or no anesthesia, less surgical time and higher patient acceptance.The existing literature shows limited studies on the use of lasers for gingival depigmentation. It is known that scalpel surgery for depigmentation is a time tested technique which is carried out from several years. It ensures complete removal of the pigment, however causes significant bleeding during and after the procedure. The surgical technique; however remains to be the "Gold Standard" in periodontal therapy.

This dissertation aims to compare Surgical stripping, Electrosurgery, CO_2 laser, Diode laser which are lasers with two different properties. There are no reported studies in the literature which have compared these four treatment modalities for gingival depigmentation, also, done in the same patient. Also none of the studies have compared the healing, patient preferences after depigmentation with above techniques. Further the comparison between CO_2 laser and Diode laser for the purpose of gingival depigmentation has also not been reported in literature. Thus on the above basis, this study has been undertaken to compare the effectiveness of Surgical stripping, Electrocautry, CO_2 laser and Diode laser for the treatment of gingival melanin hyperpigmentation, when used Clinically, with due importance given to the patient considerations.

MATERIALS AND METHODS

Study design: The study will be a Randomized, Comparative, Split-mouth, Clinical trial. The sample for the study comprised of 30 patients of both sexes, in the age group 18-50 years.30 patients with bilateral physiologic gingival melanin hyperpigmentation in the maxillary and mandibular anterior region were treated with all the four different techniques: Surgical stripping, Electrocautry, Carbon dioxide laser, Diode laser. Random allocation of the sites was done into one of the following groups with coin toss in front of an independent observer. Each of the patient treated received all four treatment modalities in random allocation for the maxillary and mandibular area. The region to be treated was the anterior gingiva extending from the distal of the right canine to the midline and midline to distal of the left canine, in the

Pre-Operative Assessments:

Dummett oral pigmentation index (dopi)[5]: for intensity of pigmentation.

The index is based on the following scale

0- Pink tissue (no clinical pigmentation).
1-Mild light brown tissue (Mild clinical pigmentation).
2-Medium brown or mixed brown and pink tissue (Moderate clinical pigmentation).
3-Deep brown/blue-black tissue (Heavy clinical pigmentation).

HEDIN MELANIN INDEX[4]: for extent of pigmented area: The index classified pigmentation as follows:

0 - No pigmentation.
1 - One or two solitary units of pigmentation in the papillary gingiva without the formation of a continuous ribbon between solitary units.
2 - More than three units of pigmentation in the papillary gingiva without the formation of a continuous ribbon.
3 - One or more short continuous ribbons of pigmentation.
4 - One continuous ribbon including the entire area between the canines.

Total scores of upper and lower jaws are used for analysis.

Gingival index (loe and silness): The gingival index assesses the condition of the gingiva. The tissue surrounding each tooth was divided into 4 gingival scoring units: distofacial papilla, the facial margin, mesiofacial papilla and entire palatal margin. The scores around each tooth were totalled and divided by four to determine the gingival index for the tooth. Totalling all the indices and dividing it by the number of teeth examined provided the gingival index for the segment where the treatment was performed.

Post-operative evaluation: After the depigmentation procedure was completed with, the patient was subsequently called the next day and at seven days and following parameters was evaluated:

Assessment of pain: Assessment of pain was done the next day and after one week by questioning the patient. For assessment of pain:

The visual analog scale (vas): The VAS was used to retrospectively measure the intensity of pain experienced during treatment. Pain was assessed on a 100mm horizontal, continuous interval scale where the left end point was marked "no pain" and the right end point marked "worst pain". The patient did not assign a number to the pain but simply placed a mark to coincide with the level of pain experienced.The mark placed by the patient was then measured and recorded.

Gingival wound healing:

Gingival wound healing was based on the following criteria (Ishii2002, Kawashima et al 2003):

A: Complete epithelialization
B: Incomplete or partial epithelialization
C: Ulcer
D: Tissue defect or necrosis

Patient preference: The patients were questioned on the post-operative visits at 1 day and 7 days about the preference of the treatment modality used for the procedure of gingival depigmentation. The patients were asked to assign the number according to their choice of treatment as follows:
Surgical stripping:

Diode laser:
CO2 laser:
Electrocautry:

Figure 1. Preoperative

Figure 2. Gingival depigmentation with Scalpel

Figure 3. Gingival depigmentation with CO2 laser

Figure 4. Gingival depigmentation with Diode laser

Figure 5. Gingival depigmentation with Electrocautry

Figure 6. 1 day postoperative

Figure 7. 1 week postoperative

Figure 8. 3 months postoperative

As the patients visited for the treatment, the following procedure was carried out:

Visit 1: On the first visit the patient was motivated and explained the procedure. The patient proforma was filed with respect to the general history and the chief complaint, past dental history. Routine blood examination was carried out and a written consent obtained from each patient.Phase I therapy included scaling to get healthy periodontal tissues. The patients were recalled after a week for the treatment.

Visit II: After 2 weeks of completion of phase I therapy, patient was recalled and DOPI, Hedin melanin index, and Gingival index were recorded. On the subsequent day, patients were called for treatment. Random allocation of sites was done for each treatment modality, which was decided by the toss of a coin in front of an independent observer.

Visit III (1 day post-operatively): The treated area was visually inspected and checked for signs of bleeding, inflammation. The patients were asked about discomfort, pain, bleeding or any other symptom. The scoring pattern was used for assessment of Visual analogue scale and pain criteria and assessed for gingival wound healing. Patients were also asked about their comfort during treatment and the type of treatment they preferred.

Visit IV (1 week post-operatively): Evaluation of Visual Analogue Scale, and assessment of healing was carried out after seven days. Any area of residual pigment was checked and was recorded as left out areas of pigmentation.

Visits at 4 and 12 weeks post-operatively: Patients were recalled and all the indices and measurements of variables were recorded i.e. the DOPI, Hedin melanin index, gingival index, recurrence and extent of repigmentation, Post-operative photographs were taken. Patients were then put on further recall and maintainence and importance of oral hygiene was stressed.

Techniques used for depigmentation:

Surgical stripping: After allotment of the site for surgical treatment, local anesthetic lignocaine hydrochloride 1:1, 00,000 was administered by infiltration of the desired area. The area to be operated was demarcated by an incision placed peripheral to the area of pigmentation. With the surgical blade no.11/15 held parallel to the gingival surface, the epithelium and a portion of the lamina propria (partial thickness flap) was gently dissected out with the help of tissue holding forceps, following the contour of the gingiva. The entire pigmented area was removed in the form of a strip. While doing so, care was taken not to tear away the tissue, not to expose the underlying bone nor leave any pigmented spot behind. The papillae if pigmented were also deepithelized using no. 15 blade, Castro-Viejo ophthalmic scissors or tissue nippers (Fig 1). The tissue tags left near the margin and the mucogingival junction were also removed with the same to avoid "migration" effect of the melanocytes, which would lead to repigmentation. If marginal gingiva was not pigmented, it was not deepithelized and finally flushed with the rest of the treated area with the no. 11/15 blade. Following this procedure, careful inspection of the exposed connective tissue surface was done to confirm the thoroughness of the procedure. The surgical site was irrigated with normal saline and gauze pressure pack was given to control the bleeding. After completion of the procedure, no periodontal dressing was placed over the operated area. Post-operative instructions were given to the patient. The patient was instructed to avoid spicy, hard, sour and hot food, avoid smoking and brushing on the treated area and was instructed to maintain oral hygiene by regular rinsing after meals and advised warm saline rinses from the next day.

Carbon – dioxide laser for gingival depigmentation: Before using the carbon dioxide laser, it was necessary to decide the parameters like Wavelength, Waveform, Energy output, Pulse duration and focal distance to confirm the settings. The wavelength specific glasses which are Plain glasses were worn by the operator, assistant and the patient. Reflecting surfaces like mouth mirror were avoided in the area during treatment. A plastic cheek retractor was used to keep the cheek and the lips retracted. After allotment of the site, the pigmented area was wiped with sterile gauze moistened with normal saline. Initially topical anaesthesia in the form of spray was applied to the operating area, and if required, second time during the procedure. If the patient complained during the procedure, only then infiltration anaesthesia was given. The carbon dioxide laser (10,600nm) was set at 2-4 watts. The ablation was performed in a non-contact, continuous wave, defocused mode with focal distance almost 1inch away from the pigmented area. The delivery system was a flexible hollow-wave guide. The "Epithelial peel" technique was used where a blister formation was induced and the entire epithelium along with melanocytes was removed in the form of a peel using wet gauze. During the procedure the smoke evacuator was turned on to absorb the laser plumes, formed as a result of ablation. Following this procedure the residual pigment was inspected. The same procedure was carried out and finally in the areas close to the tooth surface, residual pigment was removed using focused and superpulse mode to avoid build up of energy and accidental damage to the tooth surface (Fig 2). Care was taken to avoid directing the beam continuously at one point for a longer duration, and to avoid damaging the underlying periosteum and the bone. Few areas of carbonization were formed, which were sites of deeper pigmentation. Efficacy of removal of pigment differed based on the degree of pigmentation and the pigmented surface treated, and the epithelial thickness .The operated area was finally cleaned with gauze soaked with normal saline and no dressing was given.

Diode laser: Topical or local anaesthesia will be given to the patient, if required. Melanin pigmented gingiva will be ablated by Gallium Aluminum Arsenide (GaAlAs) diode laser device with a continuous wavelength of 810 nm at 1.5 to 1.75 W power. The semiconductor diode laser is emitted in continuous wave mode, and is usually operatedin a contact method using a flexible fiber optic delivery system. Remnants of the ablated tissue will be removed using sterile gauze dampened with saline. The procedure will be performed from a cervico-apical direction in all pigmented areas (Fig 3).

Electrocautry: After allotment of the site for surgical treatment, local anesthetic lignocaine hydrochloride 1:1, 00,000 was administered by infiltration of the desired area. The area to be operated was demarcated by an incision placed peripheral to the area of pigmentation. The electrocautry unit (SENSIMATIC ELECTROSURGE 600SE) was set at a power of 3 with cut and coagulation mode, fitted with a loop attachment. The tip was used in a brush stroke manner and the charred tissue was cleaned with the help of wet sterile gauze

piece. Care was taken to avoid exposing the periosteum (Fig 4).

RESULTS

The study included 30 patients 21 male and 9 female patients with gingival melanin pigmentation within a range of 18 to 50 years. Significant improvement seen in gingival index, visual analogue scale & wound healing from baseline, 1 day postoperative, 1 week postoperative & 3 months. However no significant difference was seen in Dummet oral pigmentation & Hedin index from baseline to 3 months.

DISCUSSION

Demand for cosmetic therapy of gingival melanin pigmentation is common and over the years, various techniques including Gingivectomy, Gingivectomy with Free gingival Autografts, Electrosurgery, Cryosurgery, Chemical agents such as 90% phenol, and 95% Alcohol, Abrasion with diamond bur, Surgical stripping have been used. The various techniques used have shown various advantages and disadvantages, and the need to overcome those inadequacies, there has always been a quest for some new technique. It is a known fact that Surgical stripping using scalpel surgery, causes unpleasant bleeding during and after the procedure and may be necessary to cover the exposed lamina propria with Periodontal dressing for 7 to 10 days. (Ozbayrak 2000). However, it is a time tested procedure and remains the "Gold Standard" for Gingival depigmentation. Gingivectomy has also been used; however, this is associated with loss of alveolar bone, prolonged healing by secondary intention, and excessive pain. Also results in non-permanent depigmentation. (Dummett CO 1963, Bergamaschi N1993). Electrosurgery requires more expertise than scalpel surgery. Prolonged or repeated application of current to tissue induces heat accumulation and undesired tissue destruction. Contact with periosteum or alveolar bone and vital teeth needs to be avoided. (Gnanashekhar 1998). Cryosurgery requires a skillful clinician to manage the complicated instruments and technique. It is followed by considerable swelling and all parts of the freeze-thaw cycle can

Table 1.

Hedin Index:		
	p Value- baseline	p Value-3 months
Surgical Vs Electrocaurtry	0.389	0.768
Surgical Vs Diode laser	1	0.543
Surgical Vs CO2	0.614	0.373
Electrocaurtry Vs Diode laser	0.389	0.244
Electrocaurtry Vs CO2 laser	0.688	0.175
Diode Vs CO2	0.64	0.365
Gingival index:		
	p Value- baseline	p Value-3 months
Surgical Vs Electrocaurtry	0.85	0.34
Surgical Vs Diode laser	0.69	0.0021
Surgical Vs CO2	0.58	0.0048
Electrocaurtry Vs Diode laser	0.84	0.0004
Electrocaurtry Vs CO2 laser	0.72	0.0021
Diode Vs CO2	0.87	0.66
Dummetoralpigment:		
	p Value- baseline	p Value-3 months
Surgical Vs Electrocaurtry	0.64	0.838
Surgical Vs Diode laser	1	0.367
Surgical Vs CO2	0.64	0.651
Electrocaurtry Vs Diode laser	0.64	0.601
Electrocaurtry Vs CO2 laser	1	0.896
Diode Vs CO2	0.64	0.549
VisualAnalogue Scale: 1 Day post-operative		
	p Value	
Surgical Vs Electrocaurtry	0.862	
Surgical Vs Diode laser	0.006	
Surgical Vs CO2	0.003	
Electrocaurtry Vs Diode laser	0.001	
Electrocaurtry Vs CO2 laser	0.001	
Diode Vs CO2	0.839	
Wound Healing:		
	p Value- baseline	p Value-3 months
Surgical Vs Electrocaurtry	0.739	0.063
Surgical Vs Diode laser	0.718	0.003
Surgical Vs CO2	0.448	0.793
Electrocaurtry Vs Diode laser	0.488	0.001
Electrocaurtry Vs CO2 laser	0.278	0.065
Diode Vs CO2	0.688	0.002
Patient preference:		
	p Value- baseline	
Surgical Vs Electrocaurtry	0.1	
Surgical Vs Diode laser	0.275	
Surgical Vs CO2	0.561	
Electrocaurtry Vs Diode laser	0.111	
Electrocaurtry Vs CO2 laser	0.102	
Diode Vs CO2	0.85	

cause tissue injury, and healing is eventful. Also the depth control is difficult and optimal duration of freezing is not known, thus prolonged freezing leading to increased destruction (Ozbayrak, 2000; Yeh, 1998; Gage 1998). Topical chemical therapy using harmful chemical substances such as phenol cause tissue necrosis, in addition to pain, which is the result of burning both during and after the treatment. This treatment is not acceptable to the clinician or the patient. (Tamizi Tahiri 1996). Treatment with Free gingival autografts is uncomfortable to the patient as there is involvement of a second surgical site that is the donor site, which is denuded and the final colour matching may not be predictable. (Tamizi 1996, Bouchard, Malet, Borghetti 2001). The introduction of Lasers into Dentistry, especially Periodontal surgery, have easened out many a complications of other conventional procedures, however with their own disadvantages. Lasers have been used for Gingival depigmentation from the last decade, however Comparitive Clinical trials and Reports on their efficacy are limited. The effectiveness of melanin hyperpigmentation removal with different type of lasers has been evaluated in several studies (Sharon E.et al 2000, Ozbayrak et al 2000, Atsawasuwan P et al 2000, Stuart Coleton et al 2004, Rosa Daniel SA, 2007,Emin Essen 2004, Azzeh MM 2007).The rationale for use of Lasers in the treatment of Gingival Hyperpigmentation is manifold. This is in conjunction with the studies done by Wigdor et al 1995, who described advantages of Lasers over cold steel surgical procedures as: Dry and bloodless, Instant sterilization of the surgical site, Reduced bacteraemia, Reduced mechanical trauma, Minimal post-operative swelling and scarring, Minimal post-operative pain and Minimal or no anesthesia. In the present study, carbon dioxide laser, Diode lasers and Electrocautry were compared with Surgical stripping. A Clinical evaluation was carried out. It was decided to carry out all the procedures in each patient at the same time to enable uniformity, reduce the number of patient visits and to avoid any difference in the biological variation, genetic makeup and host response of the patient. Since the patients were comparatively evaluated for Gingival wound healing, patient perspective and time interval of repigmentation, carrying out the treatments at the same visit facilitated the study.

In the present study, in 6 out of 30 sites (22.7%), it was noticed that one more treatment session would have been required or a higher power setting at superpulse mode would have been required for complete removal of pigment. As the depth of thermal damage of carbon dioxide laser extends from 50 to 100 micron m compared to 200 micron m for the Argon and 600 micron m for the Nd:Yag laser, application of carbon dioxide laser would be of lower risk to the periosteum and underlying bone. Results of the present study support the idea as none of the treated sites encountered fenestration. However only 2 of the 30 sites encountered periosteal damage, in attempting to remove deeper pigments. To prevent recurrence, the gingival tissue should be cleared of melanin entirely, including free gingiva and interdental papilla since repigmentation starts as a result of migrating melanocytes from free gingiva. (Sharon E, Azaz B et al 2000).However, while using carbon dioxide laser, adequate tissue removal may not be possible at the gingival margin and interdental papilla region, due to close proximity of the adjacent teeth which can be a limitation.

The observations and results showed a highly significant reduction in Dummett Oral Pigmentation Index. This was in agreement with the observations made by T.M.S Ginwala, Rosa D, 2007, who found low levels of pigmentation scores throughout the study. But the intra group comparisons does not show any significant diffrence (p-0.8) from baseline to 3 months in all the treated sites with carbon dioxide laser , Diode laser, electrocautry and Surgical stripping. There was a significant fall in the Hedin index from baseline to 3 months post-operatively, but intra group comparision does not show significant difference in any of the groups (p- 0.5) in all the treated sites with carbon dioxide laser, Diode laser, electrocautry and Surgical stripping. The scores for gingival index at baseline were similar for all the allocated sites, across all three treatment groups. The results for patient perception of treatment procedure for gingival depigmentation by CO_2 laser, Diode laser, electrocautry and Surgical stripping, based on the experience during and after the treatment and the cost of the treatment showed that significantly higher number of patients gave the first preference for surgical stripping. Higher number of patients preferred CO_2 laser, followed by Diode laser and electrocautry, and least number of patient preferred electrocautry. The Visual Analog Scale scores were lowest for CO_2 laser treated sites. The scores were comparable for Electrocautry sites and CO_2 laser sites. The difference between VAS scores between, Surgical and Diode laser, Surgical and CO_2, Electrocautry and Diode laser, Electrocautry and CO_2 laser was significant. The CO_2 laser treated sites showed the least amountof pain intra-operatively and post-operatively. It is a sensitive and reproducible means of expressing pain numerically (Huskisson 1982). Results of the VAS showed that most of the CO_2 laser treated sites had Slight pain(0.1-3.0). In the Diode laser treated sites, most patients showed slight to moderate pain (0.1-3.0, 3.0-6.0). Only 2 patient complained of Severe pain (6.1-10).For the surgical treated sites, pain was comparable with CO_2 laser sites.3 patients complained of severe pain (6.1-10). In electrocautry treated site, most patient showed moderate pain (3.0-6.0), and 4 patient showed severe pain (6.1-10). In the present study, CO_2 laser showed faster wound healing at 1 day and 1 week post-operatively. It was observed that in 89.2 % of the sites, repithelization was completed by 1 week (Azzeh MM 2007). Tal et al in 2003 reported complete tissue healing within 1 to 2 weeks .The rapid wound healing may be related to photobiomodulation (PBM). The wound healing thus shown by the lasers can be said as an intermediate type, due to the protein coagulum, which covers the wound. The surgical treated sites showed wound healing comparable to CO_2 laser and diode laser, however significantly different from that of the electrocautry. In the present study, the Repigmentation was assessed in terms of change in Hedin Index (extent), DOPI (change in density) and change in Area of pigmentation from baseline to 3 months post-operatively. There was a steady fall in the area of pigmentation from baseline to 3 months in all the treatment groups ($p<0.001$). This is in agreement with studies done by Tal H, Littner S, Kozlovsky A, 1988, T.M.S. Ginwala, B.C Gomes & B. R. R Verma 1966, Azzeh MM 2007. Clinical repigmentation occurred only in some patients. It may be that either “migration” of melanocytes did not occur during this period or that melanocytes, which had migrated were not active. Further the genetic influence on repigmentation cannot be ruled out. The exact reason was difficult to explain.

Similiarly, Ozbayrak et al 2000 reported no recurrence after CO_2 ablation of gingival melanin pigmentation in 18 months follow-up. In a study by Essen et al 2004, 2 out of 10 patients treated by superpulse mode of the CO_2 laser had partial recurrence in the 12-24 month follow-up period. Dummett and

Bolden 1963 reported Repigmentation in 66.66% of the cases they treated with gingivectomy. Repigmentation in these cases was described as spontaneous and was attributed to the migration of cells from the surrounding areas, but unable to explain why migration occurred only in some areas. Ginwala , Gomes and Varma 1966, observed repigmentation in 3 out of 6 patients treated with slicing and abrasion technique, while none of the cases treated with bone denudation showed signs of repigmentation. The cases were observed for 6 months and repigmentation that appeared was in the form of small dots. They thought it to be the activity of local melanocytes that were left behind during the procedure. Thus to summarize the results of this study, it was found that all the patients were satisfied with the overall treatment and outcome of therapy. Esthetically pleasing results were obtained, as perceived by the patient as well as the operator. There was no change or deformity in the gingival contour as result of any of the treatment procedures.

After analysing the data from other studies and the present study, it may be hypothesized that CO_2 laser and Diode laser are successful newer techniques for gingival depigmentation, however with distinct differences, while Surgical stripping remains to be the gold standard , the only major disadvantage being that of poor hemostasis. The CO_2 laser and the Diode laser, on account of their hemostatic property, less time, minimal or no anesthesia, can be used for repeated treatments of physiologic melanin hyperpigmentation, however the cost factor and availability of the equipment can prove to be practical disadvantages.

Conclusion

The results of the study concluded that Surgical stripping, CO_2 laser, Diode laser and Electrocautry proved to highly effective for Gingival depigmentation, however with distinct differences. It can also be emphasized that CO_2 laser and Diode laser can be used as highly effective and safe alternatives to surgical stripping, for esthetic gingival depigmentation,. However, a longer follow up period should be considered to actually determine the time required for complete repigmentation. In the present study, we conclude that Surgical stripping remains to be a conventional, thorough and time tested procedure and also is highly beneficial in terms of cost for money. Thus it remains the "Gold Standard" for gingival depigmentation. It is a very superficial procedure, without any damage to underlying structures, hence can be used for retreatments, however at timely intervals. The only drawback being that of a medically compromised patient, where surgical approach is stipulated upon. The CO_2 laser and Diode laser are relatively new techniques and reports on their efficacy are few. In the present study it was concluded that all the four modalities were highly effective for the gingival depigmentation procedure. They have shown numerous advantages, such as painless, bloodless, sterile field, minimal anesthesia, hence can be repeatedly used more easily than surgical stripping for retreatments. Also their use in medically compromised patients is highly beneficial and a big advantage over surgical procedure.

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