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Research Article

CRYO SURGERY - AN EFFECTIVE ALTERNATIVE METHOD IN TREATMENT OF GINGIVAL MELANIN HYPERPIGMENTATION

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ABSTRACT

Background and Objectives: Gingival melanin pigmentation may be seen across all races and at any age, and it is without gender predilection. Although melanin pigmentation of the gingiva is completely benign and does not present a medical problem, patient's complain of "black gums" is common due to their unacceptable aesthetics which demands cosmetic therapy. Many attempts have been made in the past to answer this cosmetic demand and eliminate these dark patches of pigmentation using procedures like split thickness epithelial excision, gingival abrasion, free gingival grafts, electrosurgery, scraping technique, cryosurgery, laser therapy etc have been used. In order to find a better technique and also to study the rate of depigmentation this study was conducted to determine the efficiency of cryosurgery and scraping technique for the treatment of gingival pigmentation.

Method: This study was conducted on 10 subjects, aged between 15 to 25 years, with hyperpigmented gingiva on the facial aspect of the maxillary and mandibular anteriors. Right side was chosen for cryosurgical procedure and the left for surgical scraping technique. Photographs & DOPI of each patient, preoperatively and postoperatively after 1month, 3months, 6months and 9 months were taken.

Results: At 6 months, statistically significant rate of recurrence of pigmentation was seen with cryosurgery as compared to scraping technique but at 9 months both the techniques showed same rate of recurrence of pigmentation.

Conclusion: It can thus be concluded that statistically there is no significant difference between scraping technique and cryosurgery in terms of efficiency and rate of repigmentation.

INTRODUCTION

A smile expresses a feeling of joy, success, sensuality, affection and courtesy, and reveals self confidence and kindness. The harmony of the smile is determined not only by the shape, the position and the colour of the teeth but also by the gingival tissues.[1]

Melanin pigmentation often occurs in the gingiva as a result of an abnormal deposition of melanin. The pigmentary complex occupies an almost unique position in the field of research. It has been noted that there are six sources of pigments that contribute to the normal colour of the integument. The color of the gingiva is an integral part of many epidemiological evaluations of gingival health, ranging from pale pink [2]and coral pink[3] to deep red and violet.[4]

The subject of gingival depigmentation has attracted interest, and numerous procedures have been developed for depigmentation of gingiva, Different treatment modalities which have been reportedinclude bur abrasion, scraping, partial thickness flap, cryotherapy, electro-surgery, gingivectomy, gingivectomy with free gingival auto grafting, chemical agents such as90% phenol and 95% alcohol, gas expansion cryosurgery and lasers.[5] Cryotherapy is a method of tissue destruction by rapid freezing.[1] In recent years cryosurgical apparatus has been tailored to suit many disciplines. Since smooth moist mucous membranes are especially suited to freezing, particularly encouraging results in otolaryngology, gynecology, rectal surgery, oral surgery have been obtained.[6] Cryosurgery used for depigmentation of gingiva is relatively painless procedure, simple, effective with good patient acceptance and has shown to produce excellent results lasting for several years.[1] So this study is undertaken to compare the efficacy of scraping technique versus cryosurgery technique in the treatment of gingival melanin pigmentation.

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METHODOLOGY

The patients for this study were selected from Out Patient Department of Periodontics, College of Dental Sciences, Davangere. . A total of 10 subjects of age group 15-25 years were included in the study according to the criteria of the Dummett score 2 – medium brown or mixed pink and brown tissue (moderate clinical pigmentation) and 3 - Deep brown or blue/ black tissue (heavy clinical pigmentation) suited the selection of pigmented gingiva for the present study. The study was single blinded, randomized, split mouth, case control prospective study for a period of 9 months.

Patients anterior segment (13-23,33-43) was selected for the study which was further divided such that on 11-13 & 41 – 43 cryosurgery technique was done and on 21- 23& 31-33 scraping technique was done.

Control Group: After infiltration with 2% lignocaine anesthesia, blade no 11 with BP handle was used to scrape the epithelium with underlying pigmented layer. The raw surface was irrigated with saline solution. The surface was cleaned & bleeding stopped. The exposed depigmented area was covered with a periodontal dressing for 1 week.

Experimental Group: Liquid nitrogen (-190ºc) using MINI CRYO GUN liquid nitrogen cryo system model-LNC-196 was directly sprayed on to the gingiva.

Fig 1 cryogun

Fig 2 Pre operative

Basco makes MINI-CRYO GUN for everyday simplified Cryosurgery at affordable Price. It is indispensable, simplified tool. (BASCO 781, Munusamy Salai, West K.K.Nagar,Opp. West Bus Terminus,Chennai-600 078.) (Fig:1) Liquid nitrogen can be applied in a direct precise spray form with CRYO SPRAY GUN to treat a wide variety of dermatological procedures, gynaecological conditions quickly and effectively. It reduces application time and eliminates adhesion to probes (fig 1, 2 and 3).

Fig 3 Scalpel and Cryogun

Technical detail to use the cryogen

The cap of the cryogen was removed and liquid nitrogen was poured into the cryogen flask slowly from the container (cryocan) using funnel only upto 3/4thof the flask (350 ml approx.) the cap was closed and after 5 minutes the pressure was built up before use.

The cryogen was held supported by the index finger on the rod was to freeze readily and maintain the gap of the spray tip atleast 10 mm away from gingiva. Then the spray was done diversity on gingiva so that the rapid cooling occurred till the iceballs were formed and allowed for slow thrawing.

The patients were given periodontal dressing and examined. After the procedure, patients were evaluated for 1month, 3months, 6months & 9months. Dummet Oral Pigmentation Index[7] was recorded in proforma & also photos were taken.

RESULTS

The collected data was subjected to statistical analysis. For quantitative data, unpaired t test was used for group wise comparison and categorical data was analyzed by chi square test. Study results were presented for the amount of depigmentation, and repigmentation for a period of 9 months postoperative (fig 4, 5and 6) None of the patients complained

Fig 4 3 months post operative

of any discomfort during the cryosurgical procedure except for a slight tingling sensation as it was performed without any local anesthesia. Patients did not develop any postoperative complications like bleeding, infection, swelling and sensitivity.

Fig 5 6 months post operative

Fig 6 9 months post operative

In the present study at the base line all the areas of gingival (marginal, attached & interdental gingiva) was pigmented (100%), at 3 months there was no recurrence seen in any of the areas of attached gingiva of any tooth.

In the overall recurrence of pigmentation, the recurrence was observed only in 6th and 9thmonth. The recurrence of pigmentation was highly significant in cryosurgery group [marginal gingiva (95%), interdental gingiva (50%) and in attached gingiva (17%)] as shown in table 1

In interdental gingiva, the DOPI score 1 was significantly higher in cryosurgery (83.3%) then in scalpel group (23.3%). However at 9 months, at 9 months, similar severity of DOPI scare was found in both groups as shown in table 3

In marginal gingiva, the intensity of repigmentation was similar was similar at 6 months. At 9 months, the dopi score of 2 was not found in cryosurgery group as shown in table 4.

DISCUSSION

Pigmentation is a discoloration of the oral mucosa or gingiva due to the wide variety of lesions and conditions. Oral pigmentation has been associated with a variety of endogenous and exogenous etiologic factors. Most pigmentation is caused by five primary pigments. These include: melanin, melanoid, oxyhemoglobin, reduced haemoglobin, and carotene. Others are caused by bilirubin and iron. Melanin, a non hemoglobin derived brown pigment, is the most common of the endogenous pigments.[8]

Melanins are usually classified into two main groups: the black and the brown eumelanins. The physiologic pigmentation is genetically acquired, the quantity and distribution of the pigment granules are thought to be determined by several genes.[9] Physical, chemical, and hormonal factors can increase the amount of melanin activated by the melanocytes. [10]

Although melanin pigmentation of the gingiva is completely benign and does not present a medical problem, patients complain of "black gums" is common due to their unacceptable aesthetics.[11] Many techniques have been tried in the past to treat gingival pigmentation which include chemical cauterization [12], gingivectomy[13] abrasion of gingiva[14], electrosurgery[15], scraping[16], cryotherapy[17], free gingiva autograft[18], and laser therapy.[19]

Various clinical and experimental reports describe different depigmentation methods. Elimination of these melanotic areas through surgery and laser surgery, as well as by cryosurgical depigmentation through the use of a gas expansion system, has been reported.

Table 1 Comparison of Tooth wise recurrence of pigmentation between cryosurgery & scraping Groups

		No of sites	Baseline (DOPI)		3months (DOPI)		6months (DOPI)		9months (DOPI)	
			Pigment present N%	Pigment absent N%	Pigment present N%	Pigment absent N%	Pigment present N%	Pigment absent N%	Pigment present N%	Pigment absent N%
Marginal	Cryosurgery	60	60(100)	-	-	60(100)	57(95)	3(5)	57(95)	3(5)
	Scraping	60	60(100)	-	-	60(100)	14(23)	46(77)	60(100)	-
	Cryo vs scraping		-		- NS		p<0.001HS		NS	
Interental	Cryosurgery	60	60(100)	-	-	60(100)	50(85)	10(17)	60(100)	-
	Scraping	60	60(100)	-	-	60(100)	14(33)	46(77)	60(100)	-
	Cryo vs scraping		-		-NS		p<0.001HS		NS	
Attached	Cryosurgery	60	60(100)	-	-	60(100)	10(17)	50(83)	60(100)	-
	Scraping	60	60(100)	-	-	60(100)	3(5)	57(95)	56(93)	4(7)
	Cryosurgery vs scraping		-		-NS		-NS		-NS	

* Chi-square test, significant-S, non-significant- NS, DOPI - (Grade 0- No pigmentation of gingiva; Grade 1 – Mild gingival pigmentation; Grade 2 – Medium gingival pigmentation; Grade 3 - Heavy gingival pigmentation).

Comparison of severity of recurrence of pigmentation in attached gingiva was found to be highly significant in cryosurgery group for DOPI score 1 at 6 months. However at 9 months, the DOPI score 2 was significantly higher in Scalpel group (50%) than in cryosurgery group (20%) as shown in table 2

One of the first and still popular techniques to be employed was the surgical removal of portions of pigmented gingiva using scalpels. The use of the scalpel technique for depigmentation is the most economical one as compared to other techniques which require more advanced armamentarium.

Table 2 Comparison of Severity of Recurrence of Pigmentation between Cryosurgery & Scraping Groups Attached Gingiva

Group	No	Baseline (DOPI)		3 Months (DOPI)	6 Months (DOPI)			9months (DOPI)			
		2	3	-	0	1	2	3	0	1	2	3
Cryosurgery	60	39 (65.0)	21 (35.0)	-	3 (5.0)	57 (95.0)	-	-	2 (3.3)	46 (76.7)	12 (20.0)	-
Scraping	60	41 (68.3)	19 (31.7)	-	57 (95.0)	3 (5.0)	-	-	-	30 (50.0)	30 (50.0)	-
x^2		0.15		-	97.2				13.08			
P		0.70,NS			<0.001,HS				<0.01,S			

* Chi-square test, significant-S, non-significant- NS, highly significant- HS. DOPI - (Grade 0- No pigmentation of gingiva; Grade 1 – Mild gingival pigmentation; Grade 2 – Medium gingival pigmentation; Grade 3 - Heavy gingival pigmentation).

Table 3 Comparison of Severity of Recurrence of Pigmentation Between Cryosurgery & Scraping Groups In Interdental gingiva

Groups	NO	BASE LINE (DOPI)		3 MONTHS (DOPI)	6 MONTHS (DOPI)				9 MONTHS (DOPI)			
		2	3	-	0	1	2	3	0	1	2	3
Cryosurgery	60	40 (66.7)	20 (33.3)	-	10 (16.7)	50 (83.3)	-	-	-	45 (75.0)	15 (25.0)	-
Scraping	60	54 (90.0)	6 (10.0)	-	46 (76.7)	14 (23.3)	-	-	-	39 (65.0)	21 (35.0)	-
x^2		9.62		-	43.39				1.43			
P		<0.05			<0.01,S				0.23 NS			

* Chi-square test, significant-S, non-significant- NS. DOPI - (Grade 0- No pigmentation of gingiva; Grade 1 – Mild gingival pigmentation; Grade 2 – Medium gingival pigmentation; Grade 3 - Heavy gingival pigmentation).

Table 4 Comparison of Severity of recurrence of pigmentation between Cryosurgery & Scraping Groups in Marginal Gingiva

Groups	No	Base Line (DOPI)		3months (DOPI)	6months (DOPI)				9months (DOPI)			
		2	**3**	**0**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
Cryosurgery	60	39 (65.0)	21 (35.0)	60 (100)	50 (83.3)	10 (16.7)	-	-	-	60 (100)	-	-
Scraping	60	45 (75.0)	15 (25.0)	60 (100)	46 (76.7)	14 (23.3)	-	-	-	48 (80.0)	12 (20.0)	
x^2		1.43		-	0.83				13.3			
P		0.23			0.36 NS				<0.01,Significant			

* Chi-square test, significant-S, non-significant- NS. DOPI - (Grade 0- No pigmentation of gingiva; Grade 1 – Mild gingival pigmentation; Grade 2 – Medium gingival pigmentation; Grade 3 - Heavy gingival pigmentation).

However, scalpel surgery causes unpleasant bleeding during and after the operation and it is necessary to cover the surgical site with periodontal dressing for 7 to 10 days. [20]

Cryosurgery is that branch of therapeutics which makes use of local freezing for the controlled destruction or removal of living tissues.[21]The first clinical application of liquid air (-190°C) was in 1889 by a New York City physician, Campbell White, who used either a swab, a spray, or a brass roller device used for the treatment of diverse skin conditions, including lupus erythematosus, herpes zoster, chancroid, warts, and epitheliomas. Solidified carbon dioxide (-78.5°C) was introduced into clinical use by Dr.William Pusey of Chicago which was mainly used for the freezing techniques indermatology. Liquid oxygen (-182.9°C) came into clinical use in the 1920s but was unpopular because it was combustible.[22]

Cryosurgery, an effective method of tissue destruction by freezing, has become a firmly established surgical technique in medical and dental practice. On spraying the cryogen, there is a rapid transfer of heat from the tissue to the cryogen, with ice formation in the extracellular compartment .the extracellular solutes are concentrated, setting up an osmotic gradient, with movement of fluid extracellularly and concentration of solutes damage the cell membrane mechanically. Moreover, intracellular is ice formation occurs, damaging organelles like mitochondria and endoplasmic reticulum. There is severe vasoconstriction and endothelial damage due to cold temperature leading to platelet aggregation and microthombi formation, producing ischemic necrosis of the tissue. There is inflammation in response to cell death causing further destruction. There is differential sensitivity of each cell or tissue to cryodamage, with melanocytes and deeper epidermal cell layers being very sensitive and dermal collagen being cryoresistant.[23]

The main advantages of cryosurgery were that no anesthesia was required, absolutely no hemorrhage hence chances of postoperative infection were minimal or nil, uneventful healing and easy technique.

This technique also has its demerits as it could leave behind residual pigments due to the inability to observe immediate changes after application of the liquid nitrogen by spray. This could lead to areas unexposed to the cold temperature. This finding coincides with the study by Chin – Jyh Yeh who suggested a second course of cryosurgical treatment after 1 week to remove any residual pigments. The depth and extent of destruction of the underlying tissue is difficult to control as this is affected by several factors such as temperature attained at the

tip of the cryoprobe, cryodose, pressure applied, number of cycles and the type of tissue treated.[17]

This study was undertaken to determine the efficiency of cryosurgery and scraping for the treatment of gingival pigmentation and to compare the efficiency of these two techniques and the rate of repigmentation.

The recurrence of pigmentation was compared between cryosurgery and scraping groups in the gingiva of individual tooth and the results showed recurrence to be more with cryosurgery at 6 months as compared to scraping which was statistically significant, but at 9 months the results showed non significant results.

At base line the DOPI score of pigmentation was 2 and 3 which was similar in both the groups. The severity of reccurence of pigmentation measured using DOPI varies from 0 -2 between 6 - 9 months. At 6 months, the DOPI score 1 recurrence of pigmentation was significantly higher in cryosurgery than scraping. However, at 9 months the DOPI score 1 was higher in cryosurgery group but score 2 was significantly higher in scraping group (table 2).

Although the recurrence of pigmentation was faster in cryosurgery (6months) the degree of reccurence of pigmentation (DOPI score 2) was significantly higher in scraping group.

The recurrence of pigmentation could be due to technical difficulties in manipulation of cryosurgery gun to narrow zones of gingival parts. The quality of recurrence of pigmentation in terms of lighter version of gingival pigmentation is encouraging. The recurrence of pigmentation began to appear from 6 months in both types of surgeries. The overall recurrence was significantly higher in cryosurgery group at 6 months. At 9 months, both groups showed similar recurrence of pigmentation. However the score 2 DOPI was higher in scraping group i.e severity of repigmentation was more in scraping group.

In our study after cryosurgery there was repigmentation at 6 & 9 months & after scraping repigmentation occurred at 9 months in most of the sites. The reason why there is a repigmentation following cryosurgery as compared to conventional scraping may be technical variation, remnant of residual pigmentation. The mechanism of repigmentation is not understood, but according to the migration theory, active melanocytes from the adjacent pigmented tissues migrate to treated areas, causing failure. Reports of repigmentation are quite limited and varied.

Postoperatively repigmentation with cryosurgery technique was not seen in 10 patients till the end of the study period of 90 days, the result obtained in the study was similar to the studies done by Tal *et al*[25] who did not observe repigmentation 20 months after gingival depigmentation using cryosurgery. Perlmutter and Tal[25] have also reported gingival repigmentation that occurred 7 years postoperative. Yeh CJ[17] showed no repigmentation after a follow up period of 2 years.

Studies Ginwalla *et al*[26] showed repigmentation of 50% of the cases by using abrasion technique after 24 to 56 days.

Cryosurgical procedure was more acceptable to the patient as the procedure took less time and was more comfortable as the area did not require anesthetizing and there was absence of postoperative pain and haemorrhage. Also from the operators point of view cryosurgical technique was easier and faster to perform than scraping technique.

On comparison of recurrence of pigmentation using DOPI scoring criteria, the cryosurgery groups demonstrated higher DOPI score 1, whereas DOPI score 2 was always higher in scraping group throughout the study. This is suggestive of clinical effectiveness of cryosurgery in bringing about lesser degree of recurrence of pigmentation i.e lighter version of unesthetic pigmentation. The possibility of cryosurgery action on melanin producing cells to bring down the intensity of repigmentation requires to be ascertained. In future, the cryoprobe to treat the gingival units need to be designed.

CONCLUSION

Growing cosmetic demand necessitates removal of gingival melanin hyperpigmentation for esthetics. Both, surgical scraping technique as well as cryosurgery was efficient for depigmentation of the gingiva. However, compared to conventional scraping technique, cryosurgery was found to have advantages in terms of simplicity, non-invasiveness, ease of procedure, no requirement of anesthesia, total lack of hemorrhage, minimal postoperative complications, and good acceptability by the patients. Nevertheless it is proposed that further studies to be taken up for a longer period of monitoring along with histopathological assessment to understand the process of repigmentaton.

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