



## RESEARCH ARTICLE

### GINGIVAL DEPIGMENTATION BY CRYOSURGERY USING TETRAFLUROETHANE

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Cryosurgery is an old concept but with the advent newer technique along with lesser patient discomfort and its greater acceptance, this technique is gaining popularity in the dental fraternity. With more number of studies, cryosurgery with tetraflouroethane may become the treatment of choice in gingival depigmentation.

#### ABSTRACT

**Background:** Cosmetic procedures have become an integral part of periodontology. Patients these days are more concerned about their smile and aesthetics. Gingival hyperpigmentation gives black appearance to the gums which are unaesthetic. Therefore this study was designed to test the efficacy of newly introduced cryogen, 1-1-1-2 tetraflouroethane for the treatment of gingival hyperpigmentation.

**Aims:** To test the efficacy of newly introduced cryogen 1-1-1-2 tetraflouroethane for gingival depigmentation

**Settings and Design:** All the subjects were treated in the surgical section of the department of periodontology and Implantology, Bharati Vidyapeeth Deemed University, Dental College and Hospital, Pune,

**Methods and Material:** Ten subjects (both males and females) in the age group of 18-50 years having the complain of gingival hyper-melanin pigmentation were selected. Site for the study were the patients with pigmentation extending from distal of the right canine to the midline and distal of the left canine to the midline with a score of 2 or 3 on the Dummett and Gupta Gingival Pigmentation Index (DOPI). Subjects were evaluated based upon their DOPI scores, Visual Analogue pain scores and digital photographs Pre and Post-operatively.

**Statistical analysis used:** Chi square test

**Results:** The correlation of gingival pigmentation according to DOPI scores was carried out using chi square test [graph1] and a positive correlation was observed which was highly significant ( $P = 0.03$ ).

**Conclusions:** Cryosurgical depigmentation of gingiva by TFE is a new method and can be used with minimum complications and equipment and is cost effective. However, to allow for its usage more commonly in routine dental practice, more studies with a large number of sample size including histological studies are needed. It can be concluded within the limitations of this study that it is a safe, cost effective, and non-invasive method for the treatment of gingival melanin pigmentation.

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## INTRODUCTION

The harmony of an attractive smile is determined by the shape, position and colour of the teeth and gingiva. Gingiva and appearance are essential components of a healthy smile. Factors which play an important role in the appearance of smile are the zenith of gingiva, its position size and gingival colour. Gingival hyperpigmentation gives an unsightly appearance and hampers a pleasant and confident smile. Although melanin pigmentation of the gingiva does not present a medical problem, the displeasure of 'black gums' is commonly reported. The colour of gingiva is determined by several factors, including the number and size of blood vessels,

epithelial thickness, quality of keratinization, and pigments within the epithelium. Frequently, the gingival hyperpigmentation is caused by excessive melanin deposition mainly located in the basal and supra basal cell layers of the epithelium. The colour varies among different persons and appears to be correlated with the cutaneous pigmentation (Dummett, 1960). Brown and dark pigmentation and discoloration of gingival tissue, has a multifactorial etiology which includes genetic factors, tobacco use, drugs like tricyclic antidepressants, systemic disorders like Addison's disease (Kauzman, 2004). endocrine disturbances, Albright's syndrome, malignant melanoma, Peutz-Jeghers syndrome (Humagain, 2009), trauma and others. Numerous techniques have been developed for removal of undesirable pigmentation like gingivectomy (Dummett, 1963), acellular dermal matrix grafts (Novaes, 2002), free gingival grafts (Tamizi et al., 1996), laser therapy (Atawasuan, 2000; Berl et al., 2005 and

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Esen, 2004), electrosurgery and gas expansion cryosurgery (Tal, 1987). The treatment of gingival depigmentation seems to have taken a paradigm shift from surgical/invasive to non-invasive, painless & more effective procedures. Cryosurgery is an old procedure for gingival depigmentation but due to the complications of handling the gas expansion equipment which makes use of liquid Nitrogen; its use has not been popular. Hence a new colourless, non-inflammable gas, 1-1-1-2 tetrafluoroethane (TFE) having a melting point of  $-101^{\circ}\text{C}$  and a boiling point of  $-26^{\circ}\text{C}$  has been introduced as a cryogen for gingival depigmentation (FatihArikan and Ali Gürkan, 2007) This gas is available in a pressurized can and evaporates immediately following spraying leaving no residue. There are several human and toxicology studies done which no harmful side effects of TFE even following short term inhalation (Ellis, 1993), Skin contact (Anvari, 1998), of TFE shows no adverse effect on inhibition pulse, blood pressure, electrocardiogram, or lung function in healthy volunteers (Emmen *et al.*, 2000). TFE is also used in dentistry in the field of endodontics for cold-pulp testing for full crowned or natural teeth and in orthodontic treatment to facilitate the seating of nickel-titanium expansion loops (Miller, 2004). TFE is also used in dermatology for the purpose of cooling the skin during laser irradiation procedures (Svaasand, 2003). The present study was planned to evaluate the clinical efficacy of tetrafluoroethane as a cryogen in the management of gingival melanin hyperpigmentation and patients perception towards the procedure.

## MATERIALS AND METHODS

Ten patients (both males and females) in the age group of 18-50 years visiting the Department of Periodontology, Bharati Vidyapeeth dental College and Hospital, Pune, India having the complain of gingival hyper-melanin pigmentation were selected. The purpose and the procedure were fully explained to all the patients and written and informed consent was obtained from each one of them prior to inclusion in the study. Inclusion criteria for the study were the patients with sites extending from distal of the right canine to the midline and distal of the left canine to the midline with a score of 2 or 3 on the Dummett and Gupta Gingival Pigmentation Index (DOPI). Patients not included criteria were the ones who smoked, pregnant and lactating women, patients with clinically diagnosed periodontitis and patients with pathological factors which cause gingival pigmentation. Patients would be evaluated based upon their DOPI scores, Visual Analogue pain scores and digital photographs Pre and Post-operatively. The site selected for the gingival depigmentation procedure by cryosurgery was isolated and dried. Topical anaesthetic, lignocaine hydrochloride 2% Jelly<sup>1</sup> was applied and 1-1-1-2 Tetrafluoroethane<sup>2</sup> was dispensed on the cotton rolls kept on a precooled kidney tray (Figure 1 and 2). The cotton rolls were immediately applied on the pigmented area and freezing zone was maintained for about 30-40 seconds (Figure 3). Immediately after the removal of the cotton the freezing zone thawed after 10 seconds leaving an erythematous zone on the

pigmented area. The area does not undergo depigmentation immediately. The patients were reviewed after, 72 hours (Figure 4), 1 week (Figure 5) and 1 month (Figure 6). DOPI scores, Visual analogue pain scale and digital Photographs<sup>3</sup> were taken pre-surgically and postsurgical of each patient.



Figure 1. Armamentarium



Figure 2. Pre-Operative



Figure 3. Freezing zone maintained



Figure 4. 72 Hours Post operatively

<sup>1</sup>(MXCAIN™, NecLife, Punjab)

<sup>2</sup>(DuPont Suva, DUPONT Fluorochemicals, Louisville Packaging Site, 7745, National Turnpike, Suite 190, Louisville, KY, USA 40214)

<sup>3</sup>(Nikon D600)



Figure 5. One week post Operatively



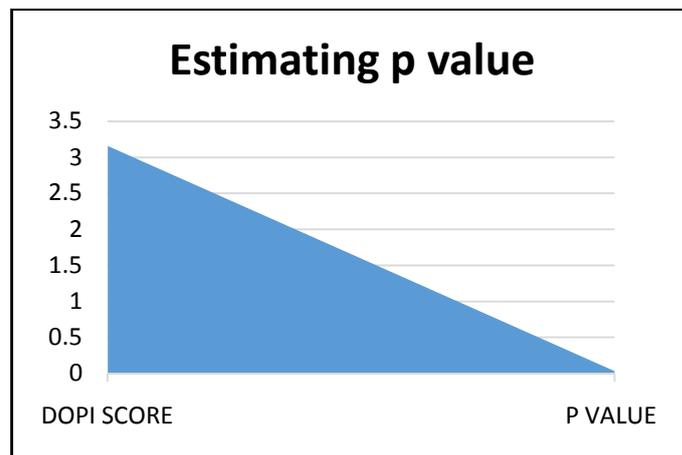
Figure 6. One Month Post Operatively

## RESULTS

Table 1 shows the Pre-operative and Post-Operative DOPI scores. The correlation of gingival pigmentation according to DOPI scores was carried out using chi square test (Graph 1) and a positive correlation was observed which was highly significant ( $P = 0.03$ ). Slight erythema developed after the procedure which was discernible from the adjacent area. After 24 hours the tissue surface became slightly elevated and reddish. Superficial necrosis of the epithelium became evident after 72 hours and whitish slough was formed which could be easily separated from the surface leaving a reddish erythematic area (Figure 4). The new pink epithelium replaced the pigmented epithelium entirely after the 1<sup>st</sup> week of the surgery (Figure 5). The epithelium keratinization was completed after 4 weeks of the surgery. There was no scarring, haemorrhage or infection in any of the patient. The patient compliance was good. Only 2 out of 10 patients reported mild pain the next 2 days for which they were prescribed a pain killer (Tab. Combiflam 650mg).

Table 1.

PATIENT NO.	DOPI			VAS
	BASE-LINE	7 DAYS	30 DAYS	7 DAYS
1.	3	1	0	2
2.	3	0	0	2
3.	2	1	0	1
4.	3	1	0	3
5.	2	0	0	1
6.	3	1	0	1
7.	3	1	0	2
8.	2	0	0	1
9.	3	1	0	2
10.	3	0	0	1



Graph 1.

## DISCUSSION

Melanin pigmentation of gingiva is one of the most common aesthetic problems of the patient which come to the clinic with a chief complain of black gums. Melanin Pigmentation is caused by Melanocytes residing in the suprabasale layer of the epithelium. Minimum temperature needed for cell damage is cell-specific, and melanocytes are very sensitive to low temperatures at  $-4^{\circ}\text{C}$  to  $-7^{\circ}\text{C}$  where cell death can occur (Thai *et al.*, 1999). A single session of cryosurgery is usually sufficient for depigmentation the entire aesthetic region, although any evidence of remaining flecks of pigmentation can be detected as early as 1 week and can be given a second sitting. Cryosurgery has been traditionally done with nitrogen oxide gas expansion cryoprobes. This required sophisticated equipment and delicate handling. The problem with leakage of the probe was also persistent so this technique did not gain much popularity. To overcome this problem 1-1-1-2 Tetrafluoroethane was introduced by FatihArikan and Ali Gürkan (FatihArikan and Ali Gürkan, 2007) TFE has a distinct advantage of being painless, non-scarring, does not produce haemorrhage and is cost-effective for use as it requires very less chair time therefore it has a higher acceptance among the patients and is beneficial to the dentist as well. A histological study done by Santosh Kumar *et al* (Santosh Kumar, 2013), provided evidence that the depth of penetration of the cryogen can be controlled by controlling the time of application. They also stated that the cryogen does not penetrate the connective tissue and removes only the epithelial layer further stating that use of TFE is safe. Santosh Kumar *et al* (Kumar *et al.*, 2013), compared cryosurgery by TFE and gingival abrasion technique by rotary diamond burs and concluded that depigmentation by TFE yields much better results than gingival abrasion technique. Although laser is nowadays the treatment of choice for gingival depigmentation, it does come with its own disadvantages like laser application may not be efficiently used at the gingival margins and interdental papillary region due to close proximity to the adjacent teeth. Avoiding damage to the adjacent teeth by the laser beam may result in inadequate tissue removal. This limitation may result in incomplete vaporization of the pigment in such delicate areas, which tends to promote repigmentation. Since doing depigmentation procedure with tetrafluoroethane is

safe and easy it can therefore in future be the method of choice. However, to allow for its usage more commonly in routine dental practice, more studies with a large number of sample size including histological studies are needed.

## Conclusion

Cryosurgical depigmentation of gingiva by TFE is a new method and can be used with minimum complications and equipment and is cost effective. It can be concluded within the limitations of this study that it is a safe, cost effective, and non-invasive method for the treatment of gingival melanin pigmentation.

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## Conflicts of interest:

There are no conflicts of interest

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