

CRYOSPRAYS – THE SAVIOUR OF BLACK GUMS

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ABSTRACT

Objective: Comparative evaluation of two different Cryospray Tetrafluoroethane & Hydrocarbon for depigmentation. **Material and Methods:** Twenty healthy patients aged 18 to 36 years divided into 2 groups selected on the basis of inclusion and exclusion criteria. Tetrafluoroethane & Hydrocarbon cryospray was used for the gingival depigmentation, efficacy outcome assessed by Landry index and NIPC Pain Scales. Followup 1 week post-operative, 1 month, 3 month & 1 year has been done. **Results:** During the follow up, no side effects were seen for both the techniques. The statistical analysis carried by Mann-Whitney U test in which P value is not significant in healing index, however P value is found significant (P value <.001) in NIPC pain scale. **Conclusion:** Cryogen spray is easy, practical and inexpensive as compared to other techniques. Having the properties of zero depletion ozone layer of Hydrocarbon & better Pain scales over Tetrafluoroethane, Hydrocarbon is more superior & can be safely used. Further studies are needed to assess the long term effectiveness of the cryosurgical method.

KEYWORDS: Black gums, Tetrafluoroethane & Hydrocarbon.

INTRODUCTION

For achieving beautiful smile gingiva has an integral role. In the era of esthetics depigmentation of gingiva is a cosmetic procedure for improving the overall smile of an individual. Gingival color varies in colour and texture in various races and regions.^[1,4] The pigmentation of the gingiva may be due to various lesions and conditions and varies from physiologic conditions to the systemic illness (e.g. Addison's disease) to malignant neoplasm (e.g. melanoma). Before cosmetic procedure planning etiology of a mucosal pigmentation is essential.^[5] However patient does not present as a medical problem but patient reported with black gums. Esthetic concern is prime importance in cases of gummy smile while they smile or talk.

Cryotherapy can be defined as planned damage of tissue by extreme application of cold. Due to minimal discomfort, no bleeding, no scarring after healing it is well accepted by the patients. It has wide application in the field of dentistry & beneficial to the patient where surgery is contraindicated due to systemic illness or due to advanced age.^[7]

The word Cryotherapy originated from Greek word "Kryos" means frost.^[7] can be defined as deliberate destruction of the tissue by freezing through local application of cold. Egyptians done the first use of cryotherapy for pain relief, followed by for amputated limbs in Franco-American war.^[8] James Arnott (1851) first time reported the uses of a mixture of salt and ice in malignant disease. Any type of Human tissue undergo cryogenic coagulation and necrosis when subjected to temperature below -20 degree centigrade.^[9]

Mechanism of Cryosurgery^[10,11]

Factors of tissue death during cryosurgery depend upon-

- Physical nature of tissue being treated
- distance of cryoprobe
- Rate and degree of cooling^[12]

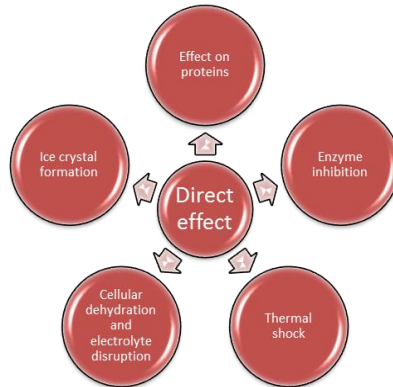
Cryolesion dimension

Variables which affects the cryodimensional lesions are-

- Cryotip's temperature
- Surface area & duration of contact between the tip and tissue.^[13]

- Temperature of the probe tip contributes to the size of the freeze-ball and velocity of freezing within cells.
- There can be direct or indirect effect on the tissue.

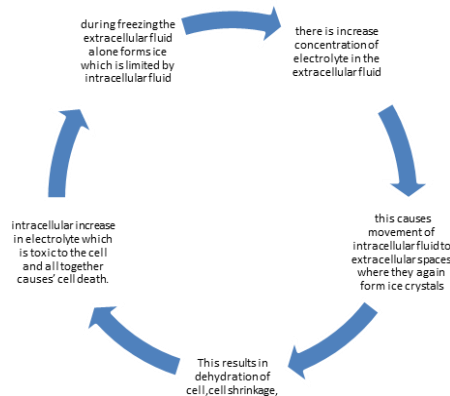
Direct effect on the tissue



1. Formation of Ice Crystal: There is a physical disruption of the cell due to rapid cooling causes

formation of ice crystals from intracellular and extracellular fluid.^[10,11]

2. Electrolyte Disruption & Cellular dehydration:



4. Inhibition of Enzymes: due to low temperature, function of enzyme get altered.

5. Effect on proteins: after freezing when cell returned to normal temperature due to high concentration of electrolyte cell absorb more water which result in swelling and rupture.^[12]

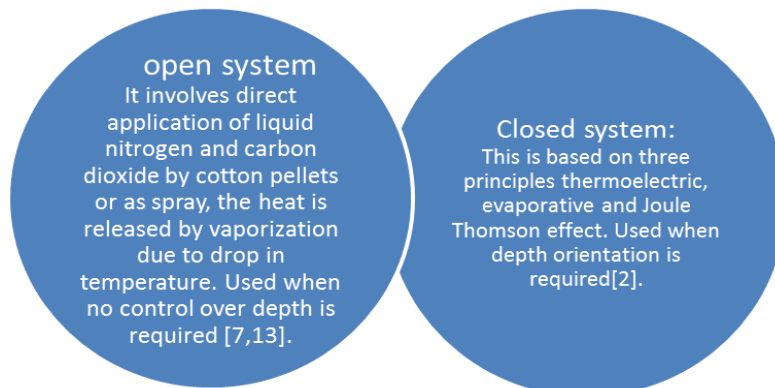
Indirect effect

1. Vascular effect: due to micro thrombus & vascular thrombus formation result in ischemic necrosis.^[13]

2. Immunological effect: host surveillance mechanism get activated due to massive release of pathological cell antigen.

Methods of Cryotherapy

There are two systems



Healing after cryotherapy

After Cryotherapy there is severely damaged of epithelial basal layer whereas intermediate and parabasal layer less affected. Re-epithelialization in the gingiva and other part of the mouth occurs within 7–12 days while in the skin re-epithelialization take place in the 10-20 days.^[11] Bone Cryotherapy devitalized the bone which act as a center for future new bone growth. Cells present deeper in the marrow cavity may survive promotes growth while cortical bone may undergo death.^[11] However Cryotherapy does not affect Cartilages, but the cellular components are replaced within two weeks.^[16]

Advantages^[17]

1. Minimal pain.
2. Less discomfort.
3. Low tissue damage.
4. Minimal scarring.
5. Can be an adjunctive therapy with surgery or radiation therapy in malignancy.
6. Safe, easy to perform, inexpensive.

Disadvantages^[16]

1. Delayed healing.
2. In lesions of the tongue the procedure can limit its function.
3. Volume of lesion can be beyond capacity.

The most commonly used refrigerant gas which is nonflammable, colourless, non chlorofluorocarbon (CFC), 1,1,1,2 Tetrafluoroethane also used in electronic circuits. Safety of Tetrafluoroethane has been proven by various human and animal toxicology studies.^[18,24] In the field of Periodontics Tetrafluoroethane (TFE) has recently been introduced for depigmentation and also used in various field of dentistry like cold pulp testing in the endodontics, the seating of the Nickel titanium expansion loops in the field of orthodontics.

Another Cryogas Hydrocarbons are an ecofriendly alternative to the CFC/ HCFC/ HFC fluorocarbons linked to ozone damage, chemically hydrocarbon is a compound of hydrogen and carbon found in large concentration in crude oil & used as a refrigerant, non-toxic, & ozone protective. The present study was undertaken to compare the Tetrafluoroethane with the newly introduced, cryogen Hydrocarbon for the depigmentation of the gingiva.

MATERIAL AND METHODS

20 patients aesthetically concerned about black gums periodontally healthy patients treated with two different Cryosprays, reported at Department of Periodontics, Kanti Devi Dental College Mathura, India. The criteria for the selection of the patients in the present study were the aesthetic considerations in the periodontally healthy patients.

From each patient informed consent has been taken. exclusion criteria includes-

- Pregnancy & breast feeding females
- Gingival melanin pigmentation associated with systemic disease
- Malignancy
- Uncontrolled Diabetes
- Cold intolerance & Cold Urticaria
- A personal history regarding the smoking habits of the patients was also recorded.

The study protocol was reviewed and approved by the ethical committee of Kanti Devi Dental college & hospital Mathura. Before Depigmentation procedure all patient undergone for full arch scaling & oral hygiene instruction given to them. To assess the gingival pigmentation Gingival Pigmentation Index (GPI) has been used. By using the coin toss method patients were randomly selected for the treatment. 10 patients treated by using Tetrafluoroethane, another 10 patients treated by hydrocarbon spray. [Table/Fig-2a-c]. For the cryosurgical technique, a local anaesthetic spray (10% Xylocaine) was used to anaesthetize the area. The Tetrafluoroethane cryogen spray was dispensed into a can and a sterile cotton piece was used to carry it to the site. The treatment with the cryosurgical technique: Before the cryosurgical application, the pigmented area was isolated and air dried. A topical anaesthesia with a 10% Xylocaine spray was used to minimize the discomfort. Tetrafluoroethane (TFE) was sprayed on a cotton swab, which was immediately rolled gently over the pigmented area to include the papillae as well [Table/Fig-2d]. A freezing zone was continuously maintained for 30 to 40 seconds in each area by rolling the dampened swab continuously at the site. This technique was continued along the pigmented gingiva. The procedure took about 15-20 minutes. The patients were prescribed analgesics to take if there was any pain. The patients were recalled on the 1 week, 1month, 3 month, and the 1 year post operatively. Each case was photographed. Standard digital photo images were obtained. The head of each patient was positioned and stabilized before the photographs were taken. The digital images were taken by using a standard magnification and a distance of 38cms. The patient satisfaction was assessed by using a simple questionnaire. NIPC pain scale was used to assess the pain. The gingival pigmentation was assessed by a single examiner who was masked to the treatment group to which a patient was assigned. **Healing is assessed by Landry Healing index** During the follow up, no side effects were seen for both the spray. The statistical analysis carried by Mann – Whitney U test.



Fig. 1: Cryosprays PIC.



Fig. 2: Preoperative picture of group A patient.



Fig 3: CFC Cryospray Application with the Help of Custom made Nozzle.



Fig. 4: Postoperative Picture.



Fig. 5: Preoperative Picture.



Fig. 6: Hydrocarbon Spray Application.



Fig. 7: Postoperative Picture.

RESULTS

No significant clinical changes were noticed immediately after the removal of the cryosprays, for the evaluation of the healing postoperatively. But the areas became red within half an hour after the procedure. On the first day, the tissue necrosis became evident. In 4-5 days time, the whitish necrosed gingival tissues sloughed off from the underlying tissue. At the end of 1 week, the gingiva revealed a red colour without any clinically visible gingival pigmentation, irrespective of the cryosprays which was followed. After 1 week when NIPC pain scale was evaluated in hydrocarbon patient group was more comfortable than CFC group patient, however P value was not found significant in VAS component but in Wong – Baker Faces Pain rating scale and Numeric Pain rating scale P value found to be significant and positive result found in Hydrocarbon group. While recording

Landry Healing index no significant P- value found, healing time were not affected irrespective of the cryosprays used. When the overall results were analyzed, clinically and on the basis of the patient response, the cryosurgical mode seemed to be favourable, as it was associated with less or no pain, the healing was faster, and the gingiva remained depigmented at the end of 1 years.

Table 1: NIPC pain scale Mann-Whitney U test.

	GROUP A (tetrafluoroethane)			GROUP B(hydrocarbon)			Z	P-Value	Inferences
	Median	Mean	S.D.	Median	Mean	S.D.			
INTENSE SCALE	2.50	2.70	0.82	2.50	2.60	0.70	-0.207	0.836	NS
SHARP SCALE	4.00	3.70	0.95	3.00	3.10	0.88	-1.524	0.128	NS
HOT SCALE	4.00	3.70	0.95	3.50	3.50	1.08	-0.433	0.665	NS
COLD SCALE	4.50	4.40	0.97	4.00	4.20	0.63	-0.569	0.569	NS
SENSITIVE SCALE	5.00	4.70	0.95	4.00	4.30	0.67	-1.052	0.293	NS
TENDER SCALE	4.00	3.90	0.88	4.00	4.10	0.74	-0.563	0.574	NS
ITCHY SCALE	4.00	3.80	0.79	4.00	4.00	0.67	-0.659	0.510	NS
SHOOTING PAIN	4.00	3.70	0.67	3.00	3.30	0.67	-1.169	0.242	NS
NUMB SCALE	4.00	3.50	0.71	3.50	3.40	0.70	-0.382	0.702	NS
ELECTRICAL SCALE	4.00	3.70	0.67	4.00	3.60	0.52	-0.258	0.796	NS
TINGLING SCALE	3.50	3.60	0.97	3.50	3.50	0.53	-0.205	0.837	NS
CRAMPING SCALE	4.00	4.00	0.67	4.00	3.80	0.42	-0.750	0.453	NS
RADIATING SCALE	3.00	2.90	0.88	3.50	3.40	0.97	-1.152	0.249	NS
THROBBING SCALE	3.00	3.10	0.57	2.50	2.80	0.92	-0.933	0.351	NS
ACHING SCALE	3.00	3.20	0.79	3.00	3.20	1.03	-0.080	0.937	NS
WONG- BAKER FACES PAIN RAITING SCALE	2.50	2.60	0.70	2.00	1.70	0.48	-2.792	0.005	S
NUMERIC PAIN RATING SCALE	3.00	3.30	0.67	2.00	2.00	0.47	-3.433	0.001	S

Table 2 : Landry Index Independent Samples Test.

	GROUP A (tetrafluoroethane)			GROUP B(hylocarbon)			t-test	P-Value	Inferences
	Median	Mean	S.D.	Median	Mean	S.D.			
WEEK I	3.50	3.40	0.70	3.00	3.30	0.48	0.372	0.714	NS
1 MONTH	4.00	3.80	0.42	4.00	4.10	0.32	-1.800	0.089	NS
3 MONTH	4.00	4.20	0.63	4.00	4.20	0.42	0.000	1.000	NS
1 YEAR	5.00	4.90	0.32	5.00	4.90	0.32	0.000	1.000	NS

DISCUSSION

Physiologic blackened gingiva causes unpleasant smile to esthetic concern people. Various mode of treatment are available for black pigmented gingival included chemical treatment by Hirshfield I and Hirshfield L,^[3] Dummett CO.^[20] tried gingivectomy, Manchandia in 1979 used scrapping procedure, advance technique in the form of laser therapy by Trelles et al,^[24] and Cryotherapy by Tal Haim et al.,^[4] Chin - Jyh Yeh,^[1] satisfactory and long lasting result found to be with laser and cryotherapy . Cryosurgery can be done by liquid nitrogen with swab is not easily stored and closed gas expansion system is quite expansive. Cryosurgery is usually applied with a gas expansion system that is expensive, depigmentation by laser technique is associated with technique sensitive can cause alveolar bone destruction followed by gingival fenestration. In comparison to these techniques Cryosprays are inexpensive, less technique sensitive easy to storage with easy handling carrier bottles. In addition of this less bleeding, no scar formation, without regional anesthesia, no suture, no dressing ,no complicated instruments are the extra advantage of cryosprays.

The present study did not show any significant differences in the healing of the depigmented areas of the gingiva, even though with the both the cryosprays In both the cryosprays, the evaluation on the 30th day

revealed restoration of the normal features of the gingiva without any scar formation. Thus, the healing of the depigmented gingiva was uneventful, irrespective of the techniques which were used.

The data on the gingival pigmentations which were treated by cryotherapy revealed 3 cases of mild areas of repigmentation without any cosmetic significance on the 30th day of the observation, whereas in the rest of the patients, the gingiva remained depigmented till the end of the study period. The previous studies which were done by Tal Haim et al.,^[4] and Chin – Jyh Yeh.^[1] on the cryosurgical mode of the gingival depigmentation reported no evidence of a repigmentation during the initial follow up period of 20 and 48 months respectively. But the continuation of the study which was done by Tal Haim et al.,^[4] reported two cases with limited areas of repigmentation without any cosmetic significance after 3 years of the treatment.

In these areas where the melanin pigmentation did not occur, either “migration” of the melanocytes did not occur or the melanocytes that migrated were in an inactive state due to the inhibition of their tyrosinase system. They were thus unable to produce melanin pigmentation during the observation period according to Bandish LK.^[19] The minimum temperature which is

needed for the cell damage is cell-specific, and the melanocytes are very sensitive to a low temperature [-4°C to -7°C] where the cell death can occur.^[2] At the ultralow temperature (- 47°C × 30 seconds) which was created by the cryosurgical technique, a complete epithelial destruction and elimination of the gingival epithelium along with the melanocytes, was achieved.^[9,25]

The less number of patients which was seen with a delayed reappearance of the melanin pigmentation and the number of areas and the degree of pigmentation remained same throughout the study. The cryosurgical technique was more acceptable to the operator as well as to the patient. The healing after surgery was uneventful and no scar was formed. Hydrocarbon is a compound of hydrogen and carbon atom ecofriendly, easily available, found naturally in crude oil, nontoxic to human in the present study isobutane is used as hydrocarbon. No much documentation is available in hydrocarbon cryospray, first time study has been done on comparison of CFC and Hydrocarbon.

CONCLUSION

Having the properties of zero depletion ozone layer of Hydrocarbon & better Pain scales over Tetrafluoroethane, Hydrocarbon is more superior & can be safely used. Further studies are needed to assess the long term effectiveness of the cryosurgical method.

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