Liquid nitrogen cryotherapy in the management of oral lesions: a retrospective clinical study

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Abstract

Background & objectives The purpose of this study was to evaluate effectiveness and convenience of cryosurgical procedure, to assess the events during postoperative healing and to find out the incidence of recurrence

Materials and methods This study was conducted in the Department of Oral and Maxillofacial Surgery, KLESVK Institute of Dental Sciences, Belgaum. The 40 patients selected for the study were divided into 2 groups of 20 patients each irrespective of age and sex.

Group I 20 patients with Pre-Malignant Lesions

Group II 20 patients with Oral Mucous Cyst

Results It was observed that all the 20 patients of mucocele were cured without any complication and recurrence, but in 20 patients of leukoplakia 5 patients had recurrence which was directly attributed to their persisting habits.

Conclusion We state that this modality of treatment is promising with good results and has certain advantage over other modalities of treatment.

Keywords Cryosurgery · Cryotherapy · Freezing · Thawing · Mucocele · Leukoplakia

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Introduction

Surgical modality of treatment is the gold standard for oral lesions, but as science evolved there was a need of a traumatic bloodless procedure, which could give, same or better results than surgical modality and cryosurgery is one of these modalities, which fulfills these criterias [1]. The prefix 'Cryo' is derived from the Greek word 'KROUS' means cold [1].

Arnott was the first person to develop an instrument for applying cold as a therapeutic agent. He used this modality of treatment to treat cancer and this person pioneered the development of cryosurgery as we know it today [1]. As described in the literature cryosurgery can be defined as a method of lesion destruction by rapid freezing and thawing in-situ. Devitalized soft tissue forms an eschar below which re-epithelization and regeneration of tissue occurs [1,2].

Fig. 1 Armamentarium

Cryosurgery is widely used in the fields of dermatology, ophthalmology, ENT, neurosurgery and general surgery [1]. In the field of oral and maxillofacial surgery it is used to treat, cancer, premalignant lesions, mucous cysts and trigeminal neuralgias [1].

Cryosurgical systems are classified as 'closed' and 'open'. The closed system involves the use of a complex and delicate apparatus [2]. The open system involves

direct application of cryogen to the lesion using a cotton swab [2].

Methodology

Patients Selection: Total 40 patients irrespective of age and sex who reported to Dept. of Oral and Maxillofacial surgery, KLESVK Institute of Dental Sciences, Belgaum between 2003–2006, presenting with intraoral lesions were selected for the study.

The patients were divided into two groups:

- Group 1–20 patients with premalignant lesions (Leukoplakia)
- Group 21–40 patients with mucocele.

Incisional Biopsy was taken before the Cryosurgery to confirm the diagnosis in case of Leukoplakia.

Cryosurgical system: The performance of simple cryosurgical treatment required. Liquid Nitrogen, cotton swabs and a two layer plastic cup.

Table 1 Master chart

Group	Type of lesion	No. of cases	Sex	Age	Pain	Scar	Infection	Recurrence
Group I	Mucocoele	20	11–M	10–20 yrs = 6 cases	Mild	No	No	0 cases
			9–F	20–30 yrs = 10 cases				
				30–40 yrs = 2 cases				
				40–50 yrs = 2 cases				
Group II	Leukoplakia	20	15–M	10–20 yrs = 0 cases	Mild	No	No	5 cases
			5–F	20–30 yrs = 6 cases				
				30–40 yrs = 6 cases				
				40–50 yrs = 3 cases				
				50–60 yrs = 5 cases

Fig. 2 Mucocoele on lower lip **Fig. 3** Border marked **Fig. 4** Application of cryo-probe

Preparation: Topical anesthetic such as Xylocaine jelly was applied on the lesion to minimize discomfort and to prevent the cotton swab from sticking to the mucosa. Patient was fully draped, intraorally the adjacent structures i.e., teeth and tongue was covered with gauze to avoid any complication due to spilling of liquid nitrogen.

Technique: The technique consists of dipping cotton swab into liquid nitrogen for 1–2 seconds and applying it on the lesion with little pressure for 30 seconds. A swab that closely corresponds to the size of the lesion was used.

Freezing time was 10–30 sec per cycle, followed by a thaw period of double the freezing for about 60 seconds. After the ice ball was produced during freezing it was completely thawed and the next freezing

was performed. The freezing and thawing time depends on the size of the lesions.

Secondary treatment was performed after 1–2 weeks if any residual lesion remained. Patients were examined at 2 and 7 days, 2 and 4 weeks, and 3 and 6 months after the cryosurgery. They were subsequently recalled after every 6–12 months.

Results

About 40 patients were included in the study, out of which 20 patients had mucocoele and 20 patients had leukoplakia and all received, open technique cryosurgery using liquid nitrogen and cotton applicator.

- Hyperaemia and oedema of the treated area began to appear immediately after treatment.

- Swelling increased till 1–2 days and remained for 2–3 days.
- The lesion and the overlying mucosa become necrotic and sloughed in 3–5 days during which repair by granulation tissue also took place, epithelization was complete after 1–4 weeks, depending on the size and location of the lesion.
- Healing was uneventful in all patients and acceptance of the treatment procedure was excellent.
- Mean follow up period was 12 months.

Discussion

Most commonly used cryogens are: Liquid nitrogen (-191°C), Nitrous oxide (-81°C) and Carbon-di-oxide (-79°C). Liquid nitrogen is most often used, as it

Fig. 5 Snowball formation

Fig. 6 Immediate postoperative picture

Fig. 7 1 day postoperative picture

is the coldest and most versatile and so is more effective in eradicating soft tissue lesions, liquid nitrogen and cotton swabs are low cost and readily obtained in most hospitals.

Most tissues freeze at -2.2°C , tissue death occurs at a temperature of -20°C , the effectiveness of cryosurgical treatment stems from the formation of extracellular and intracellular ice crystals. A rapid build up of toxic electrolytes, alteration in PH-protein denaturation and disruption of cell membranes subsequently occur [1,2].

The amount of mature collagen found in a cryoscar is appreciably less than in scars produced by knife and electrosurgery. Lesions involving the vermillion border of the lips and mouth angles, often present considerable problems if managed by excision. Extensive lesions treated by conventional surgery frequently require repair by grafting skin or mucosa.

Cryosurgery is therefore, particularly suited for the treatment of lesions which are difficult to manage by conventional methods.

Freezing time varied from second to minutes, according to the volume, and depth of tissue to be frozen and the surgeon's experience. Studies on the depth of freezing achieved by the

application of liquid nitrogen directly to different organs report variations from 2mm to several centimetres. Due to the lack of precision in this procedure, there can be difficulty in judging the final volume of tissues necrosis. Inadequate destruction of the lesion necessitates another cryosurgical procedure. Thermo couples and infrared thermography have been used to monitor the extent of freezing, however, the use infrared thermography within the oral cavity is restricted by difficulty of access for the camera, thermocouples also suffer the disadvantage that they can only record the temperature at one particular point [2].

Conclusion

Ideal treatment modality should have no intraoperative or postoperative complications with good patient compliance, cost effective and operator convenience. In this study we used liquid nitrogen cryotherapy modality and initial results of this modality meet the above mentioned criterias. The initial results are promising with good results and have certain advantages over other modalities of treatment.

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