International Journal of Current Advanced Research
ISSN: O: 2319-6475, ISSN: P: 2319-6505, Impact Factor: 6.614
Available Online at www.journalijcar.org
Volume 7; Issue 3(G); March 2018; Page No. 10870-10873
DOI: http://dx.doi.org/10.24327/ijcar.2018.10873.1865

Research Article

# ROLE OF CRYOSURGERY IN OROFACIAL REGION

**Pankaj Rathod[1]., Dhananjay Rathod[2]., Abhilasha Singh[3]., Shaistha Ansari[4]., Sayed Zafar Iqbal[5] and Meezan .F.Bangi[6]**

[1]Department of Oral Surgery, Horizon Dental College, Bilaspur
[2]Department of and Dentofacial Orthopaedics, NIMS Dental College, Jaipur
[3]Department of Periodontics, Horizon dental college, Bilaspur
[4,5,6]Department of Orthodontics, Aditya Dental College and Hospital, Beed

**A R T I C L E I N F O**

***Article History:***

Received 15th December, 2017
Received in revised form 20th January, 2018 Accepted 7th February, 2018
Published online 28th March, 2018

***Key words:***

Cryosurgery, cryonecrosis, freezing, hemangioma, hyperplastic lesions, malignancy.

**A B S T R A C T**

Freezing has become an important asset to the armamentarium of head and neck surgery. The structures of face and the cavities of the nose, mouth and throat are readily accessible for cryosurgical techniques, without special surgical preparations. Within a span of few years the role of cryosurgery has increased from removal of a small soft tissue lesion to the destruction of large malignant tumors.

***Objective***

The objective of this study is to evaluate the principles, mechanism of action and applications of cryosurgery in various orofacial lesions including premalignant and benign lesions, malignant tumours, intrabony lesions, vascular defects and nerve disorders.



## INTRODUCTION

Cryosurgery (from the greek word Kryos, meaning icy cold, plus surgery) or cryogenic surgery refers to surgery accomplished through application of intense cold to cause tissue necrosis (cryonecrosis) by rapid freezing. Virtually all the biological tissues subjected to a temperature of -20 degree Celsius or below for a minute undergo necrosis. [1]

The oral mucosa is well suited to the application of the cryoprobe because it is moist and does not require a coupling medium. The oral lesions can be repeatedly attacked with cryoprobe, with only minimal preparation of the operative field. [2] Rapid freezing of the tissues close to the probe occurs spontaneously. Tissue necrosis results from a combination of direct cellular effects such as formation of ice crystals, cellular dehydration, disruption of cell membranes and ischaemic infarction. Healing of the oral mucosa after cryotherapy is relatively uncomplicated by infection or pain. [3]

Its simplicity in application and absence of post-operative infection, contraction, scarring and no recurrence makes cryosurgery a highly useful method in treating various lesions of the oral cavity.

**Corresponding author:* **Pankaj Rathod**
Department of Oral Surgery, Horizon Dental College, Bilaspur

***History***

The local application of low temperature was probably first used as a means of analgesia by the ancient Egyptians. It dates back to the 3500 B.C. when the use of cold compresses to reduce inflammation was well described by Edwin Smith Papyrus. [1] In 1851, Dr. James Arnott was the first to report on the therapeutic use of low temperature in malignant diseases by means of salt/ice mixture applied to breast neoplasm.

White, in 1898, described the use of liquid nitrogen for the treatment of lupus erythematosus. Pusey in 1907 used solid $CO_2$ snow and also liquid nitrogen for the treatment of benign tumors of the skin. It seems that following his work, the method then began to be called as cryotherapy.

Cryotherapy began to be seriously considered from oral surgery standpoint in the early 1960s. Amaral et al used liquid nitrogen for the treatment of numerous cases of palatal papillary hyperplasia. [1] In 1981 Mac Donald et al recommended cryosurgery for the management of leukoplakia, lichen planus and hyperplasias of the palate. In 1981 Barnard first showed that cryotherapy produces an extended and reversible nerve block in the management of chronic and postoperative pain. [4, 5]

In the last two decades more sophisticated cryogenic apparatus have evolved, allowing a close degree of control over the freezing process, alongside with increased knowledge of the biological effects of freezing, thus providing the basis for modern cryosurgical practice.

***Instrumentation and technique***

***Apparatus***

The basic technique of cryotherapy involves rapid cooling, slow thawing and repetition of the freezing process to maximize tissue destruction. [6] Cryosurgical apparatuses are used in two basic techniques, either in a closed system with probes for application to the tissues or by spraying liquid nitrogen directly on the tissues. [1, 3] Probe techniques, in general, give a more controllable freezing and more predictable necrosis, and a greater depth of freezing may be achieved.

The different cryosurgical apparatus available are as follows –

***Liquid nitrogen cryoprobes***

These are the most powerful cryoprobes which are in use today and utilize liquefied gases to produce cooling. In liquefied nitrogen cryoprobes, the liquefied gas is allowed to boil within the tip of the instrument, and in doing so absorbs its latent heat of boiling from this region. It is an efficient method of cooling. [7] As long as the liquid is passed through the tip fast enough for it not all to be boiled away, then the gas-liquid mixture inside the tip will remain at the boiling point of -195.8 º C while still absorbing large quantities of heat from the tissues. [1, 2, 6, 7] Hence larger tips, which produce larger ice balls, without tip temperature being adversely affected, can be used with liquid nitrogen devices. The liquid nitrogen cryoprobes are powerful and effective freezers, but are expensive.

***High pressure cryoprobes***

The other major process used to cool a cryoprobe is the controlled expansion of a high pressure gas or liquid. The cooling produced by a drop in pressure is used to cool these cryoprobes. The high pressure fluid is allowed to escape through the narrow orifice and expand in to tip cavity. The tip cavity is at a much lower pressure as the expanding fluid cools. This process is known as a Joule-Thomson expansion. The cryogen is stored in a high pressure cylinder and the fluid is passed through a pressure regulator to the cryoprobe via a flexible hose. The only major problem is narrow orifice through which the fluid expands. The size of orifice has to be carefully monitored to produce necessary pressure drop. Various liquids and gases have been tried as the refrigerant in cryoprobes and temperature of the expanding fluid varies accordingly. The most commonly used fluid is nitrous oxide. The temperature achieved with high pressure cryoprobes is -80 ºC. The high pressure cryoprobes are less potent coolers than liquid nitrogen cryoprobes, but are cheaper.

***Liquid nitrogen sprays***

A potent method of cryosurgery is to use liquid nitrogen in the form of a spray. (Figure1) The liquid again cools by absorbing its latent heat of boiling from the tissues, but in this case, boiling takes place on the tissue surface rather than inside a cryoprobe tip. Liquid nitrogen sprayed from the nozzle of an appropriate apparatus is an efficient method of producing rapid shallow freezing of tissue. When used as a spray, the cryogen is used as its coldest temperature and its produces superficial freezing rather quickly and easily over wide areas if required. The more superficial the lesion more suitable is the use of a spray, especially if the surface is irregular or extensive.

***Cryo-applicators***

The early techniques of using cotton swabs dipped in liquid cryogens continue today in some dermatological practices. (Figure 3) The technique suffers from problems of handling and control, and the need to reimmerse the swab once it has warmed. There also tends to be a gas layer formed between the swab and the tissue as the liquid boils, and this reduces the swabs cooling power.

***Endoscopic cryoprobes***

The main means of monitoring ice- ball growth is to simply watch the progress of the white ice front. Visual monitoring is possible for surface sites, or sites within easily accessible body cavities such as the oral cavity. One difficulty with combining cryoprobe with endoscopes is that the delicate optics can become permanently damaged by exposure to temperatures below -20 ºC.

***Multitipped cryoprobe***

Several authors have suggested that the target tissue would be more effectively frozen when more than one cold tip was used. A large mass of tissue would be frozen more effectively by using a number of small cryoprobes spaced around the lesion, rather than one large one placed in the middle. A multitipped cryoprobe has separate flexible hoses supplying cryogen to each tip. The necessary flexibility is achieved in this way and vision is not obscured by bulky insulation. (Figure 2)

***Combined cryosurgery and cauterization apparatus***

Cryosurgical equipment which combines the capability of cooling the probe and then heating the probe in sequence has recently become available. Control permits pre-selection and maintenance of probe temperature as cold as -190 ºC using a liquid nitrogen system, or as warm as about +200 ºC using the heating element which is inbuilt. It is possible to combine the maximum tissue destruction provided by freezing followed by the haemostatic effect of heating [11, 13].

***Technique***

***Cryosurgery of premalignant and benign oral and maxillofacial lesions***

Cryotherapy has been reported to be an effective therapy for oral white lesions such as leukoplakia. Painful erosive lesions such as lichen planus and lichenoid-like lesions or psoriasis have responded rapidly to cryotherapy, in such cases, it is regarded as palliative and not curative management, as it has had a place in the relief of pain, even though the course of dermatological disorder has not been significantly altered. [14] The response of common warts on the skin to freezing has been well documented. It has been found to be a quick, painless and effective method of management, in contrast to the tedious infiltration with anesthetic and electrodesiccating multiple warts on the skin.

Likewise, in the oral cavity, viral warts, occasionally transferred from finger to mouth, can be readily and successfully treated with nitrous oxide cryoprobe application. The lesion shrivels and disappears leaving no trace of the previous presence on the oral mucosa. Lesions at the angle of the mouth are treated equally effectively, without scarring or distortion of the lips or vermillion. [14, 15] Figures 4 and 5 illustrate the frozen appearance of a mucocele in the lower lip, 15 seconds after being treated with closed system cryoprobe using double – freeze thaw cycles.

The advantages of cryosurgery in comparison to excision or electrocautery are simplicity in the procedure, absence of bleeding and postoperative pain, infection free period of repair and absence of scarring in the healed tissues.[11]

***Cryosurgery of malignant soft tissue lesions of oral cavity and face***

Cryosurgery for the management of malignant soft tissue lesions of the face, scalp and oral cavity require careful selection of patients, the choice of technique of freezing to suit the disease and critical determination of the goal of treatment. [17] Certain indications for the use of cryosurgery in malignant orofacial region include single small cancers of the face, especially about the nose and forehead region where skin closure after excision is sometimes difficult, multiple small superficial cancers preferably without cervical lymphadenopathy, cancers which arise in irradiated skin and cancers which persist after excision or radiotherapy.

When the conventional methods of treatment of oral cancer cannot be used for one reason or the other, such as high surgical risk because of associated disease, then cryosurgery as a primary method of treatment may be considered. Careful evaluation of the extent of disease is required because cryosurgery is only local therapy and cannot deal effectively with large tumors and it does not treat metastatic carcinoma to the cervical lymph nodes. [19]

The freezing for the cure of cancer must be aggressive and controlled with careful attention to treat all areas of tumor and a surrounding margin of normal tissue. In any technique a 5mm margin of normal skin beyond the cancer is chosen as a therapeutic target.

With freezing of the tissues, edema begins to form and the area becomes discolored and hemorrhagic. For a number of days following cryosurgery, a serous exudate comes from the skin wound and a simple dressing is needed ordinarily. [17, 18] The wounds heals within 4 to 6 weeks, however wounds produced by extensive freezing for large cancers take longer time to heal. Some scar formation must be expected.

***Cryosurgery of bone in maxillofacial region***

The various experimental studies on animals have shown that freezing of bone could possibly help to eradicate neoplastic or other pathological tissue from the bone without the need for radical excision. The bone subsequently repopulates itself with cellular elements and even remodel. This is particularly advantageous in maxillofacial region where excision creates many cosmetic, functional and reconstructive problems. The response of bone to freezing includes necrosis at the early stage, provisional osteogenic phase over few weeks and remodeling over a period of few months.

Liquid nitrogen probe can be directly applied over the rough bony surface produced in a cavity after curettage of an intrabony lesion. This method is best confined to the treatment of intraoral soft tissue lesions overlying the bone. The treated bone is usually left open and frequently a small flake sequestrum will separate with time. [18, 20]

The use of liquid nitrogen sprays at temperatures of -198 ºC pored through a funnel into the bony cavities after curettage of giant cell or other tumors have been described. This has found to be a highly potent method allowing deep penetration of bone up to several centimeters. [18, 19, 20] The complications in cryosurgical treatment of bone include sequestration and pathological fracture.

***Cryosurgery of nerves***

Cryosurgery can be used to treat accessible nerves with tumor infiltration. Direct freezing of the nerve can eliminate tumor cells and produces only transient paresis of the nerve with clear advantages over radical resection.[5] Freezing of the nerve causes disruption of local nerve endings, although complete disruption of functions have been reported. However there is complete functional recovery as the regeneration of nerve occurs. Cryosurgery can also be used for peripheral conduction nerve blockade in the management of acute postoperative pain. [4] The relevant nerve is exposed under local anesthesia and after careful dissection from the tissues; the nerve is freezed with cryoprobes.

***Cryosurgery of blood vessels***

Cryothrombosis of the microcirculation is now recognized to be of major importance in establishing cryonecrosis. The key factors in the induced thrombosis appear to be the formation of platelet plug and modification of the endothelial cells. Small arteries and veins are more likely to be involved in the process of cryothrombosis, while the larger blood vessels appear to be very resistant to cryothrombosis.

Cryosurgery can be used for the treatment of hemangiomas, fibroangiomas, hemorrhaggic pyogenic granuloma and lymphangiomas. Thrombus formation in the vessels is followed by ischemic infarct which produces sloughing of superficial tissues within 72 hours, and epithelialization occurs in 14 to 21 days. The incidence of tissue infection is rare and so as the secondary hemorrhages. [22]

The advantages of cryosurgical treatment of vascular lesions include relatively few recurrences, low morbidity, relatively no scar after healing with relatively no resistance on the part of patient.

***Limitations associated with cryosurgery of oral tissues***

- Inadequate involvement of the tissues around the lesion during cryotherapy can result in persistent of the pathologically changed epithelium and re-establishment of the lesion. So normal tissues beyond the margins of the lesion should be adequately frozen. [1]
- Sometimes the volume of the lesion might be beyond the freezing capacity of the available instrument, in such cases repeated cryosurgery procedures or alternate method of management should be considered.
- Slow healing or associated postoperative lymphadenopathy can be an indication of recurrence of the lesion particularly in cases of malignancy.
- Cryosurgery of tongue can result in large swellings that might interfere with swallowing and rarely with respiration. [23]
- Extensive cryosurgery procedures may produce scarring, extensive postoperative pain, loss of normal

anatomy which may lead to trismus, speech disturbances or prosthetic problems.
- Vesicle formation
- Exposure of the bone especially in areas of thin mucoperiosteum like lingual aspect of the mandible.
- Late complications include postsurgical infections, fever, pyogenic granulomas and pseudoepitheliomatous hyperplasia.

## SUMMARY AND CONCLUSION

Cryosurgery without doubt is a very convenient, simple and quick method of management of various orofacial lesions. Even though it gives rise to depigmentation and minimal scarring on the skin, it is esthetically acceptable.

Absence of infection, bleeding and severe pain make it superior to other forms of treatment. It is not definite up to what depth freezing is effective but it can be stated that it is more effective in superficial lesions than in deeper lesions, though the depth of the lesion cannot be clinically evaluated. Improved instrumentation and the acceleration of freezing have further enhanced the value of cryosurgery in the outpatient clinic.

## References


1. Bansal A, Jain S, Gupta S. Cryosurgery in the treatment of oro-facial lesions. *Indian J of Dent Research* 2012; 23 (2): 297-304.
2. Poswilla DE. A comparative study of the effects of electrosurgery and cryosurgery in the management of benign oral lesions. *Br J Oral Surg* 1971; 1:1-7.
3. Leopard PJ. Cryosurgery and its application to oral surgery. *Br J Oral Surg* 1975; 13: 128-52.
4. Barnard JDW, Llyod JW, Gylnm CJ. Cryosurgery in the treatment of intractable pain. *Br J Oral Surg* 1978; 16:135-42.
5. Barnard D. The effects of extreme cold on sensory nerves. Ann Roy College of surgeons of England 1980; 62:180-7.
6. Farah CS, Savage NW. Cryotherapy for treatment of oral lesions. *Australian Dental Journal* 2006; 51(1):2-5.
7. Richard GK. Treatment of intraoral hemangiomas with nitrous oxide cryosurgery. *Oral surg oral med oral pathol* 1983; 56 (1):20-1.
8. Robert MD, John TM. Postoperative sequelae of cryosurgery. *J Oral Surg* 1975; 33:458-61.
9. Chapin M. E. and Burkes Jr. E .J. Cryosurgery of oral white lesions. *J Oral Surg* 1973; 31:584-91.
10. Pogrel MA, Yen CK, T Robert. A study of infrared thermographic assessment of liquid nitrogen cryotherapy. *Oral surg Oral med Oral path* 1996; 81:396-401.
11. Pogrel MA, Yen CK, Hansen LS. A comparison of carbon dioxide laser, liquid nitrogen cryosurgery and scalpel wounds in healing. *Oral surg Oral med Oral path* 1990; 53 (3): 269-73.
12. Curi MM, Lauria L, Pinto DS. Management of solid ameloblastoma of the jaws with liquid nitrogen spray cryosurgery. *Oral Surg Oral med Oral path* 1997; 84, 339-44.
13. Aiiroldi M, Fazio M, Gandolfo S, Pedani F, Brando V, Vercelloni V. Combined chemotherapy, cryosurgery and radiotherapy for oral cancer. *Int J Clin Pharm Res*. 1985; 5 (5): 357-62.
14. Emmings F. G, Koepf S. W, Gage A. A. Cryotherapy for benign lesions of the oral cavity. *J Oral Surg* 1967; 25:320-6.
15. N Ravi, Malik B. Role of cryosurgery in the management of benign and premalignant lesions of the maxillofacial region. *Indian Jour of Dent Research* 2012; 4(2):63-6.
16. Gongloff RK, Samit AM, Greene GW, Gage A. Cryosurgical management of benign and dysplastic intraoral lesions. *J Oral Surg*. 1980; 38:671-6.
17. Praveen KN, Veeraraghavan G, Reddy RS, Kotha P, Yelisetty K. cryosurgery in the management of potentially malignant lesions: A Report of two cases . *Int Jour Scientific Study* 2015; 1(8):5-9.
18. Pereira CM, Carneiro DS, Arcanjo RC, Filho MS, Silva FAC, Silva AF Surgical approach and the use of cryotherapy in a keratocystic odontogenic tumor after 12 months of decompression, RSBO 2012; 9(2):207-12.
19. Pogrel MA. The keratocystic odontogenic tumor. Oral and maxillofac. *Surg clin N. Am* 2013; 25: 21-30.
20. Salmassy D, Pogrel MA. Liquid nitrogen cryosurgery and immediate bone grafting in the management of aggressive primary jaw lesions. *J Oral maxillofac Surg* 1995; 53:784-90.
21. Bradley PF, Fischer AD. The cryosurgery in bone: an experimental and clinical assessment. *Br J Oral Surg* 1975; 13:111-27.
22. Nair K, Khera S.S, Chitre AP, Rao B. Cryosurgery in the management of hemangiomas. *J. Oral Surg* 1983; 55:463-6.
23. Karasu HA, Aysegul M, Oncul T, Uyanik O. Cryosurgery of a huge hemangioma of tongue: A case report. *J oral health comm. Dent* 2010; 4(3):83-7.


**How to cite this article:**

Pankaj Rathod *et al* (2018) 'Role of Cryosurgery in Orofacial Region', *International Journal of Current Advanced Research,* 07(3), pp. 10870-10873. DOI: http://dx.doi.org/10.24327/ijcar.2018.10873.1865

*******