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Cryotherapy in Dentistry – A Review

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ABSTRACT:

The deliberate freezing of tissue is known as cryotherapy. Patients favour it because there is little to no pain, no bleeding, and little to no scarring following healing. It is extremely helpful in patients for whom surgery is contraindicated due to age or medical history and has many applications in oral medicine and clinical oral pathology. In this paper we outline the history, principles, mechanisms of action, and applications of cryotherapy in dentistry.

KEYWORDS: Cryotherapy, cryogens, ice pack, oral lesions, intraoral surgery.

INTRODUCTION:

The term "cryosurgery" refers to the local freezing of tissue. The term "cryotherapy" is derived from the Greek word "kryos," which means "frost." [1]. Though, it refers to lowering or decreasing the tissue temperature for therapeutic reasons, cryotherapy actually does not imply implementing cold but rather extracting heat [2]. The amount of the temperature change and biophysical changes in the tissues depend on the temperature differential between the object and the heat or cold applied, the exposure time, the thermal conductivity of the tissues, and the kind of heat or cold agents used. The local temperature of the host changes as a result of the therapeutic implications of this type of therapy in human tissues [3]. The purpose of cryosurgery is to kill and destroy cells [4]. Cryotherapy has long been recognised as a useful method that, when applied properly, can lessen discomfort and swelling while eradicating lesions with minimal scarring [1]. Its original application was restricted to the management of oral and lip cancer. There are several applications for it currently in the head and neck area. Additionally, after different surgical procedures and physical injuries, cryotherapy may be recommended [5].

HISTORY:

Egyptians were the first to apply localised cold therapy for pain relief; during the Franco-Prussian Wars, this freezing property was also used to remove appendages [6]. According to John Hunter in 1777, "the local tissue reaction to freezing involves local tissue necrosis, vascular stasis, and excellent healing," Hippocrates advised using cold to reduce edoema, haemorrhage, and pain. James Arnott (1851) was the first to describe and demonstrate this freezing therapy for malignant breast tumours using a solution of salt and ice. The first person to employ extremely cold refrigerants for medical conditions was White in 1899. He treated warts and other dermatological conditions with liquefied air [1]. A.W. Pusey used the term "cryotherapy" in 1908 to describe the use of extremely low temperatures to cure skin lesions. Currently, cryotherapy involves cooling the body's surface without destroying tissue, whereas in cryosurgery, diseased tissues are frozen to death. Yamauchi and his team established the first cryogenic temperature chamber in the world in Japan in 1978 [5].

CRYOGENS:

Low boiling point substances are referred to as cryogens. Liquid nitrogen (-1960 C), nitrous oxide (-890 C), solidified CO2 (-780 C) (dry ice CO2 snow), chlorodifluromethane (-410 C), dimethyl ether, and propane are among the regularly employed cryogens (-240 C, -420 C) [7].

PRINCIPLES OF CRYOTHERAPY:

The basic method of cryotherapy emphasises quick cooling, slow thawing, and repeated freezing to optimise tissue damage. The two methods recognized are;

1) A closed system with use of probes and nitrous oxide

2) An open system with use of a liquid nitrogen spray or a cotton tip [8].

To prevent recurrence following curettage, spray techniques are helpful for large dermatological lesions, minor skin malignancies, and intra-bony cavities. The nitrous oxide technique is effective for treating a variety of benign and malignant lesions of the oral cavity where deeper necrosis is also a component and more predictable necrosis is required [9].

The closed system adheres to the Joule-Thompson expansion principles, which allow materials to experience a decrease in temperature when transferred from a high pressure area to a low pressure area. For instance, the change in temperature permits the tissues to freeze when nitrous oxide is released from the high pressure inside the cryoprobe to the lower pressure cryotip [10],[11]. Modern cryoprobes may also be equipped with tip temperature monitors, allowing for increased control and time selection. This enables medical professionals to monitor the outcomes at a specific probe temperature and use this information to guide further treatment [12]. According to current guidelines, a freeze/thaw cycle using a cryoprobe lasting 1-2 minutes is sufficient for the majority of benign mucosal lesions. Three freeze/thaw cycles lasting two minutes are advised for premalignant or malignant lesions. Shorter freezes (20-30 seconds) are sufficient for smaller lesions [9].

Application of the cryogen directly using cotton pellets or a spray is done in an open system. A drop in temperature causes the tissue's heat to be released by vaporisation. The majority of the time, it is employed to treat medium-to-large oral lesions with either smooth or rough surfaces [13]. Although they are more readily available to clinicians, cotton swabs and liquid nitrogen sprays should not be used in the oral cavity. They are risky to use intra-orally because they lack control over the temperature reached within cells and the area of freezing. Besides this, numerous applications of liquid nitrogen on the lesion are necessary for quick evaporation from cotton swabs. With a nitrous oxide cryoprobe, a more precise and profound depth of freezing can be accomplished due to direct contact between the cryogen and tissues [5].

MECHANISM:

Following the application of the cold instrument or liquid, the target tissue exhibits three fundamental physiological reactions:

1. A decrease in local blood flow
2. A decrease in metabolic activity
3. Inhibition of neural receptors in skin and subcutaneous tissues [40].

Cryotherapy does not require the use of local anaesthesia and is a relatively painless procedure because nerve conduction capacity is directly diminished. The thermal receptors are stimulated when the epithelium is exposed to cold, and this can prevent nociception in the surrounding tissue. Freezing causes the neuron to lose vitality, but the axon sheath is resistant to cold and unaffected. This enables the development of a new neuron, regeneration is frequently visible after a week, and normal function is anticipated to revert back in one to two months [41].

APPLICATION OF CRYOTHERAPY IN DENTISTRY:

In 1965**, Andrew A. Gage** studied the use of modern equipment and liquid nitrogen in five patients to treat oral cancers of the lip and oral cavity. Resistance to radiotherapy, lesions in locations inaccessible to excision without disabling bone sacrifice, and severe heart disease making the risk of surgery prohibitive were among the factors influencing the choice of therapy. Depending on the patients' overall health, either local or general anaesthesia was used. One patient passed away from arterial MI No residual tumour was found in the treated area at autopsy, 4 months after treatment. Other patients' lesions fully recovered, and there was no evidence of a local recurrence. The use of cryotherapy was found to be an efficient way to locally destroy a lesion while still applying pressure to the structural continuity of the area. Cryotherapy needs longer trials and should only be used on carefully chosen patients [14].

In order to compare the effectiveness of electro surgery and cryosurgery in the treatment of benign oral lesions, **Poswillo DE** (1971) conducted a comparative study. Six mature macca irus monkeys were chosen for this study. Two monkeys underwent routine tissue resections, and the wound was stitched up. In the remaining animals, cryosurgery was used on one side of the hyperplastic mouth tissue and electrosurgery on the other. The treated areas were monitored for three days, following surgery, and then every week for five weeks. To show the proportions of mature and immature collagen in the healing wounds, a biopsy and histological examination were performed at this time. The outcomes showed that mature collagen bundles were positioned in the dermis parallel to the epithelial surface in the clean excised and sutured wounds. Histologically, the amount of mature and immature collagen in the electrosurgery wound was roughly equal. Although the collagen in the cryosurgery wounds was slightly more mature, their arrangement was sloppy and irregular. The overall impression was once more about the delayed repair in both electrocoagulated and cryosurgery treated cases in comparison to excised wounds, with cryosurgery leading to somewhat less scar formation. The author came to the conclusion that for small lesions and superficial lesions, cryosurgery might be preferable to electrosurgery and excision [15].

Sako et al. conducted a study in 1972 using cryotherapy, 60 patients with oral leukoplakia received treatment. The floor of the mouth, hard palate, soft palate, and buccal mucosa were all affected. The lesions ranged from isolated single lesions to multiple areas being affected. A cryosurgical device with a 9.5mm probe tip diameter was employed. The cooling agent was liquid nitrogen. 35 patients needed just one treatment, 14 needed two, two needed four, and two needed five to completely remove the lesions. 12 patients experienced recurrence during the follow-up period, which lasted between 2 1/2 and 4 years. There are a number of benefits to cryotherapy over excisional surgery, according to the authors. However, the lack of a complete specimen for microscopic analysis seems to be the main drawback. To ensure adequate depth throughout the entire area, it has been suggested that one should rely

on the side of overtreatment. Cryotherapy as a standard treatment for leukoplakia has been questioned by the authors due to the incidence of malignant transformation of leukoplakia in 6.6% of cases [16].

90 selected cases of intraoral benign and malignant lesions were treated with cryosurgery by **Bekke JPH** in 1979. Over the course of six years, this clinical study examined the efficacy of cryosurgery as an additional or alternative form of treatment. In addition to treating 33 cases of malignant oral cavity tumours, cryosurgery was also used to treat 22 cases of hemangiomas, lymphangiomas, inflammatory papillary hyperplasia, and leukoplakia. When treating small to moderate, superficially located angiomas, they had great results. Good outcomes were also attained in cases of oral leukoplakia without the formation of severe scars or functional impairment. Inflammatory papillary hyperplasia of the palate, for example, can be treated symptomatically with cryosurgery [17].

The management of patients with chronic facial pain was examined by **David Barnard, John Lloyd, and James Evans** in 1981. They used cryoanalgesia to block peripheral branches of the trigeminal nerve. Cryogenic blockade was used to treat 54 people with chronic facial pain. Using a fine cryoprobe and isolation techniques, the nerve was frozen over a period of 1-2 minutes before the wound was closed. According to the findings, 67% of patients with non-herpetic neuralgia (Tic doloureux) who underwent surgery showed that the duration of pain relief outlasted the time during which they experienced sensory loss [18].

In a study conducted by **Tal H. et al**. in 1982, histological and clinical observations were made regarding the effects of cryotherapy on widespread leukoplakia of the buccal and vestibular mucosa. The discomfort and inconvenience of the treatment were barely noticeable, and the treated areas were clinically normal two months after the initial treatment. The stratum spinosum epithelium returned to its parakeratinized or non-keratinized state, with a normal distribution of glycogen, from an orthokeratinized state with mild dysplasia and almost completely lacking in glycogen [19].

To study the impact of cryosurgical treatment on oral lesions, **Richard K. Gonglof** (1983) treated a total of 14 patients. The lesions ranged from superficially invasive squamous cell carcinoma to papillary hyperplasia. The procedure was performed using a CS-76 Cryosurgery System. Depending on the histopathologic diagnosis of the lesion, lesions were frozen to a minimum temperature of - 2 C to - 40 C at the basal margin. The findings showed that while lesions of papillary hyperplasia completely regressed and did not recur, lesions of carcinoma initially regressed but later recurred. They came to the conclusion that cryosurgery is a safe, effective, reasonably self-limiting, and conservative treatment option for all types of oral disease when used properly. Delay in healing is a problem with this surgical technique because necrosis and sloughing of the treatment area must occur with proper therapy. Otherwise, it is free from side effects seen with other forms of therapy, such as discomfort, bleeding, infection, unintentional harm to nearby structures, or scarring [20].

Cryosurgery was used to successfully treat erosive lichen planus of the tongue in a case presented by **Greg A. Loitz** in 1986. Erosive lichen planus of the tongue had been biopsy-proven in a 57-year-old white man. He reported ongoing moderate tongue pain with occasional combustion of severe pain. The 3 x 5 cm ulcer was erythematous with a marginally raised edge. The tongue's remaining dorsal surface appeared atrophic. The entire lesion was frozen using a portable nitrous oxide cryosurgery unit and conventional methods while the patient was under general anaesthesia. Following surgery, the patient recovered well and only needed a few mild oral analgesics. On day 6, the symptoms completely vanished, and by day 16, the lesion had healed with only minor scarring. 18 months after the operation, a biopsy revealed mild chronic inflammation and moderate fibrosis. Twenty months after starting treatment, the patient had no symptoms. The author came to the conclusion that cryosurgery can successfully treat extensive lingual erosive lichen planus [21].

Goss AN performed cryoneurotomies on the great auricular nerve and/or the temporomandibular joint capsule for six consecutive patients who had intractable neurogenic pain in the preauricular region (1988). All of the patients had severe pain that was made worse by unsuccessful prior treatment, analgesic abuse, or psychiatric issues. Following cryoneurotomy, all patients experienced excellent pain relief for a full year, but four patients experienced recurrence. The effectiveness of repeated cryoneurotomies decreased over time. In conclusion, the procedure is a useful addition to the armamentarium of the oral and maxillofacial surgeon who treats patients with intractable facial pain in collaboration with a multidisciplinary pain clinic [22].

An alternative form of treatment may be offered by the portable carbon dioxide laser used by **Kardos TB and Ferguson MM** in 1991. By creating lesions on the lateral border of sheep tongues, the effectiveness and healing response following use of the two techniques were compared. The authors came to the conclusion that while Cryosurgery resulted in more extensive lesions and a noticeable inflammatory response, there were no differences in the time course of healing. In the removal of superficial tissues, laser surgery was just as successful as cryosurgery, but it resulted in less swelling, making it potentially more useful in some clinical circumstances [23].

M. Anthony Pogrel (1993) used a combination of enucleation and cryosurgery to treat locally aggressive bone lesions in order to devitalize the surrounding bone and reduce the need for segmental mandibular resection. Over a 7-year period, liquid nitrogen cryotherapy was used to treat 37 patients with locally aggressive bone lesions like ameloblastoma, OKC, giant cell lesions, etc. Cryosurgery offers some distinct advantages over other treatment modalities for osseous lesions because it will kill bone cells while leaving the inorganic osseous framework untouched, allowing it to continue serving as a matrix for new bone formation. According to the findings of this study and those of other researchers, the phenomenon known as "creeping substitution" causes liquid nitrogen to aid in the formation of new bone [24].

The clinical management of oral lichen planus was reviewed by **McCreary CE and McCartan BE** in 1999. A variety of palliative rather than curative treatments are available. The mainstay of therapy continues to be corticosteroids in various forms, but newer immunomodulatory drugs are playing a bigger part. The benefits and uses of surgical procedures like cryosurgery, CO2 lasers, and traditional surgical excision have also been discussed by the authors. Due to its advantages of less scarring and better patient acceptance, cryosurgery appears to be superior to lasers and excision [25].

Chin-Jyh Yeh (2000) performed an outpatient study on the efficacy of straightforward cryosurgery on 102 benign oral lesions. These lesions included 36 mucoceles, 25 leukoplakias, 20 hemangiomas, 16 verrucous hyperplasia, 3 labial fibromas, and 12 erosive lichen planus, according to the histopathology reports. A 4% xylocaine jelly topical anaesthetic was applied to the lesion. A cotton swab was placed in liquid nitrogen for 1 to 2 seconds before being pressed against the lesion to form an ice ball. We used two successive freeze-thaw cycles. Results revealed that hyperemia and edema of the treated area started to develop right away. In 10 cases, bullous formation developed 30 minutes after treatment. For 1-2 days, swelling got worse and persisted for 2-3 days. In 3-5 days, the lesion and surrounding mucosa turned necrotic and shed. There was no or very little scarring, and there was no bleeding or infection. If pain was present, it was typically mild and could be easily managed with non-narcotic painkillers in most patients. All patients recovered without incident, and there was excellent patient compliance with the prescribed course of action. 8 cases of leukoplakia (32%), 2 cases of mucocele (5.6%), and 4 cases of verrucous hyperplasia (25%) all experienced primary recurrence. Additional cryosurgery was used to treat all of them successfully [26].

In a 2004 study, **A. Darbandi and N. Amel Shahbaz** examined how cryotherapy affected the physiological pigmentation of ten patients' oral mucosa. Every lesion's location and size were identified, and a supraperiosteal injection was used to achieve local anaesthesia. A suitable probe was chosen based on the size of the lesion, and nitrous oxide gas was used to freeze the pigmented area for 20–30 seconds. A white line from mucosal necrosis around the probe was caused by the treatment method. 60% of patients had recovered by the seventh day after treatment, and by the second post-treatment day, all lesions had satisfactory appearances. The procedure was effective and produced satisfying results in each patient. This study came to the conclusion that the oral cavity makes an excellent environment for cryotherapy because of its smooth surface and the presence of saliva. It can also be used as a useful treatment for oral pigmentations and other oral lesions [27].

In their review, **Farah CS and Savage NW** (2006) defined cryotherapy as the intentional freezing to death of tissue. Due to the low level of pain, lack of bleeding, and minimal to nonexistent scarring following healing, it is well received by patients. It has many uses in oral medicine and oral pathology and is very helpful for patients for whom surgery is not advised due to their age or medical history. The principles, mechanisms of action, and current applications of cryotherapy for the treatment of oral lesions have also been covered by the authors [5].

Cryotherapy's use, biology, and clinical applications in the maxillofacial region were highlighted in a 2007 study by **Phillip J**. Ameerally and Graham B. Clover. The blood supply, thermal conductivity of the tissue, rate of freezing, and temperature of the refrigerant are some of the variables that affect the rate of heat exchange. The two main application techniques are spraying liquid nitrogen directly onto the tissues or using closed probes. Up to a depth of 6 mm, the shape of the cryolesion is roughly dome-shaped, and the lateral spread of the ice is roughly equal to the depth of freeze. The formation of extracellular and intracellular ice crystals causes cell death. In addition to disrupting the cell membrane and damaging the mitochondria and endoplasmic reticulum inside the cell, the formation of ice crystals reduces extracellular water, which results in fluid shift. The benefits of cryotherapy include the fact that it can be used by people of all ages, even those with poor oral health. Sites that are prone to scarring, such as the shoulder and anterior chest wall, can benefit from cryotherapy. Anticoagulant-using patients can be safely treated. Several cutaneous lesions, including benign lesions, pre-malignant lesions, Bowen's disease, solar keratosis, Actinicheilitis, and skin cancers, have been treated with cryotherapy, according to authors. Edema or blister formation within 24-72 hours are complications or side effects of cryotherapy. Additionally, there may be an ulcer and haemorrhage. The most frequent long-term side effect of cryotherapy is pigmentary changes, which may interfere with nerve conduction [28].

According to **Manu Prasad et al.** (2009), liquid nitrogen cryotherapy is more effective than other types of cryogens. The majority of tissue freezes at 2.2 °C, and tissue death occurs at 20 °C. Compared to scars left behind by knife or electrosurgery, a cryosurgery leaves behind less mature collagen. The final volume of tissue necrosis can be difficult to estimate due to the lack of precision in this procedure. The initial results are encouraging, and liquid nitrogen cryotherapy has some advantages over other treatment modalities, according to the authors' analysis [29].

Chuan-Hang Yu et al. (2009) investigated the effects of the cotton-swab cryotherapy (CSC) technique on oral leukoplakia lesions. This technique involves using a cotton swab to apply liquid nitrogen directly to the lesion. Depending on the size of the lesion, two different types of cotton swabs with diameters of 4 and 7 mm were used for the therapy. Before starting treatment, the area of the lesion was air-dried to stop the cotton swab from adhering to the oral mucosa. After being submerged in liquid nitrogen for at least five seconds, the cotton swab was used to create an ice ball on the lesion by applying pressure for 20 seconds. The ice ball was then allowed to thaw for an additional 20 seconds. On the same region of the lesion, four successive freeze-thaw cycles were carried out. After an average of 6.3 (range, 1–17) cryotherapy sessions, all 60 OL lesions showed complete regression without scarring [30].

A study on keratocystic odontogenic tumours (KOTs) of the jaws was conducted by **Leonardo Tonietto et al.** (2011) using a technique of lesion enucleation without capsule disruption combined with liquid nitrogen cryotherapy. In the study, eight patients were induced. Liquid nitrogen was applied twice for 1 minute after enucleation, with 5 minutes elapsed between applications to allow for defrosting. During the follow-up period, there were no pathological fractures in any patients. One patient experienced numbness in the left lower lip area, which gradually improved over the course of a year. In conclusion, liquid nitrogen preserves inorganic structures and has cell necrotizing properties, whereas carnoy solution destroys osteogenic and osteoconductive properties. Therefore, the KOT's cryotherapy technique preserves the bone framework and leads to better repair [31].

Cryotherapy was used to treat 17 patients in a 5-year retrospective study conducted by **Sidebottom AJ, Carey EC, and Madahar AK.** These patients had severe temporomandibular joint pain that had not improved after trying every conventional conservative treatment option. Intra-articular bupivacaine injections were administered to patients as preliminary diagnostic treatments to reduce pain. General anaesthesia was used to treat the patients. After making a preauricular incision, the area was dissected until the capsule was discovered. Three 90-second freeze-thaw cycles were applied to the posterior and lateral portion of each capsule using a cryoprobe in an inverted L shape. Patients were routinely followed up with at 6 weeks and for a year. According

to the findings, cryoanalgesia may provide some long-term relief for intractable neurogenic pain in the TMJ. Intractable pain that is localised to the TMJ can benefit from the addition of cryoanalgesia, according to the authors [32].

In a 2011 study, **Hung-Pin Lin et al.** evaluated the effectiveness of the cryogun to treat 60 oral leukoplakia lesions in 54 patients. Their goal was to determine whether the cryogun cryotherapy required significantly fewer treatments to achieve complete regression than the cotton-swab cryotherapy. A total of 60 oral leukoplakia lesions were found in 54 patients (48 men and 6 women; mean age, 54 11 years; range, 33 - 80 years). Cryogen cryotherapy was used to treat all lesions after conformational biopsies were taken. After the lesion was air-dried, a ball or field of ice that extended 2 to 3 mm beyond the lesion's visible pathologic border was created on the lesional surface by spraying liquid nitrogen onto it for 7 to 10 seconds. A minimum of 20 seconds were given for the frozen field to thaw. The same lesion was subjected to four or five successive freeze-thaw cycles. After an average of Cryogun Cryotherapy treatments, every single one of the 60 oral leukoplakia lesions completely regressed with little to no scar formation [33].

In a 2012 study by **Ravi Narula and Bhavna Malik**, 34 patients with lichen planus, mucocele, leukoplakia, and pyogenic granuloma were included. For all of the cases of leukoplakia, he used freeze-thaw cycles of one and a half minute freeze and three minute thaw at overlapping sites. Epulis fissuratum needed two cycles of double freeze-thaw, lasting two minutes for each freeze and four minutes for thaw. Each mucocele lesion required a double freeze-thaw cycle of one minute freeze and two minutes thaw, and they were all treated in a single session. All ranula cases only required one session. Recurrence was seen in two cases of lichen planus and one case of mucocele. With the exception of one case of epulis fissuratum, which showed size reduction but incomplete healing between the second and fourth week postoperatively after the last cryo-application, all cases showed normal healing. The outcomes of cryosurgery's management of various lesions support the clinical argument that cryosurgery has earned a spot in the armamentarium of maxillofacial surgery [34].

Using a time spot freeze technique, **Daveinthiran Thanabalan** (2012) has described lesions up to 2 cm in diameter. Using a tiny spray gun filled with liquid nitrogen, this technique is used. In order to target the lesion's centre, the spray gun is aimed at a distance of 1 to 1.5 cm from the skin. The spray is kept on for at least 30 seconds after the initial ice ball formation to ensure that the lesion is adequately frozen. Many oral lesions, including hyperkeratotic and oral leukoplakia, lymphangiomas, hemangiomas, accelerations, hyperplastic conditions, oral cancers, and oral lichen planus, have been treated with cryosurgery [35].

Cryotherapy was described as a novel treatment option for oral lesions by **Syed Nayeema and Subha M** in their review from 2013. A substance's temperature can drop when it is moved from a high pressure to a low pressure area thanks to the physical principle of Joule Thompson expansion, which is the basis for cryotherapy. Vasoconstriction is the biophysical change brought on by cooling; however, when the temperature is lowered and kept low for longer than 15 minutes, cold-induced vasodilation occurs. The cycle is known as the hunting response because it keeps happening continuously. Either a direct response to cold, such as the formation of ice crystals, thermal shock, or cellular dehydration, or an indirect response, such as ischemic neurosis and immunological effects, causes tissue death. The type of apparatus used, the coolant used, the temperature reached, the duration, the number of cycles, the volume of tissue, and the type of tissue are all factors that affect cryotherapy. Numerous lesions of the oral mucosa can be treated with cryotherapy, including vascular malformations, leukoplakia, hyperplastic lesions, mucous cysts, facial pain, TMJ pain, and oral cancer. The authors' conclusion is that cryotherapy is preferable to surgery and is widely accepted in patients of all ages, including infants and the elderly [36].

Cryoprobe was used by **Aarti Garg et al.** (2014) to treat a mucocele case in a 6-year-old male patient who had a painless swelling in his mouth floor. A cryoprobe attached to the liquid nitrogen equipment was used to directly expose the lesion to 4 cycles of freezing and thawing after local anaesthesia had been given. Each cycle lasted between five and ten seconds, moving from the lesion's centre to its edges until the lesion turned white and froze, resembling an ice ball. At the first, third, and sixth months of follow-up, no recurrence was reported. The lack of specimen that can be examined under a microscope to confirm the diagnosis is the main drawback of this technique, according to the authors' further discussion. Cryotherapy for a clinically diagnosable lesion like a mucocele may be compromised by a biopsy before the treatment. Unpredictable swelling levels, a lack of accuracy in the depth of the electron beam, and an undefined area of freezing are additional drawbacks. According to the authors, mucocele in children can be effectively and safely treated with liquid nitrogen cryosurgery as a therapeutic alternative [20].

Karla Myra Rezende et al. (2014) treated a series of 5 cases to show the clinical efficacy of cryosurgery as a less invasive alternative to invasive surgical treatments of the most prevalent oral lesions in children. The cases, which included mucocele, Ranula, Verruca Valgaris, Molescum Coatagiosum, and pyogenic granuloma, were chosen at random. Four quick freeze and thow cycles were used in each case, with liquid nitrogen as the cryo-agent. In each case, the postoperative period went without incident. Without any pain, bleeding, discomfort, infection, or significant scarring, healing occurred. The author recommends using cryosurgery whenever it is practical to treat a variety of skin and oral mucous disorders rather than using other surgical methods. It was determined that cryosurgery is a successful and painless method of treating oral lesions in children [37].

A study was conducted in 2015 by **Hsin-Ming Chen, Shih-Jung Cheng, Hung-Pin Lin, Chuan-Hang Yu, Yang-Che Wu, and Chun-pin Chiang** to assess the efficacy of cryogun cryotherapy for oral leukoplakia and nearby melanotic lesions. In this study, 72 oral leukoplakia and nearby smoking-induced melanosis (OLM) lesions on the buccal mucosa were treated with cryogun cryotherapy. All 72 OLM lesions completely regressed following a mean of 3.3±1.3 cryogun cryotherapy sessions. We discovered that OLM lesions had the largest diameter, 50 m, in patients who did not smoke. The study came to the conclusion that oral leukoplakia can be successfully treated with cryogun cryotherapy [38].

ADVANTAGES:

The benefits of cold therapy include a relative lack of pain and discomfort, the absence of bleeding, minor to no scarring, ease of application, preservation of inorganic bone structures, a very low incidence of infection, no long-term side effects, and a more localised action. Perhaps its biggest benefit is that it can be used on patients for whom surgery is not recommended [6],[39].

DISADVANTAGES:

However, cryotherapy has its own drawbacks. These include the unpredictability of the swelling's intensity, the lack of accuracy in the freezing's depth and area, and the system's disproportionate reliance on operator expertise and experience. One significant drawback is that cryotherapy is not recommended, especially when a lesion's diagnosis is uncertain [5],[6],[39].

CONCLUSION:

Cryotherapy is a potential alternative management technique for a wide range of lesions and conditions, and patients may prefer it to surgery when it is deemed appropriate. However, due to its limited applicability, patient selection is crucial. It is obviously not the first option for many tests and treatments. The captivating potential of cryotherapy should, however, be further explored through clinical studies into various dental applications, in order to establish exact treatment protocols and an evidence-base. The use of cryotherapy in dentistry could expand in the future, leading to specific procedure recommendations that are in-depth and customised training programmes for dental specialists and professionals.

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