

# Cryosurgery as an Effective Alternative for Treatment of Oral Lesions in Children

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Children can exhibit a wide variety of oral pathologies, such as oral lesions, bone lesions, tumors, cysts and cutaneous lesions. Different techniques have been described for the treatment of these lesions, but all of them are invasive. This paper presents a series of cases that demonstrate the clinical efficacy of cryosurgery as an alternative to invasive surgical treatments of the most common oral lesions in children. This technique has been well tolerated by patients due to the absence of anesthesia, rapid healing and minimal bleeding. Cryotherapy has many applications in oral medicine and is an extremely useful alternative in patients to whom surgery is contraindicated due to age or medical history. It is a simple procedure to perform, minimally invasive, low-cost and very effective in pediatric dentistry clinic.

## Introduction

Cryosurgery, a method based on the cytotoxic effects of cold, consists of the therapeutic application of extremely low temperatures to living tissues to obtain their destruction (1). Many cell types have different sensitivities to freezing temperature. Experiments have shown that the temperatures at which the differences in cell sensitivity can be identified are in the range of 0 to 30 °C (2).

The cryosurgical site is characterized by two zones: a central zone of total coagulative necrosis and a peripheral zone characterized by varying degrees of cellular death and injury (3). The mechanisms by which acute, direct cellular death occurs in the central zone are quite well established. Both the involved mechanisms include intracellular ice crystal formation resulting in mechanical trauma, and cellular dehydration with associated osmotic damage. Subsequent cell death is mediated by ischemia and apoptosis (4).

The mechanisms for cell destruction after cryosurgery are complex, involving a combination of direct and indirect effects (5). Direct effects consist of extracellular and intracellular formation of ice crystals that, in turn, disrupt cell membranes. Cellular dehydration, toxic intracellular electrolyte concentration, inhibition of enzymes, protein damage are thawing effects that cause the cell to vacuolate, swell and rupture, producing thermal shock injury to cells.

Indirect effects include vascular changes that lead to ischemic necrosis of the treated tissue and immunologic responses that cause cell damage by a cytotoxic immune mechanism (5)

This method has several advantages including bloodless treatment, a very low incidence of secondary infections and a relative lack of scars and pain (6). Other advantages

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Key Words: cryosurgery, oral pathology, pediatric patients, oral lesions.

include the ease of application, preservation of bone inorganic structure, and very low incidence of infection. Perhaps its greatest advantage is its indication for patients for whom conventional surgery is contraindicated due either to age or medical history.

The very cold temperature of the cryosurgery technique reduces the number of open capillaries and blood flow, which decreases the extravascular fluid extraction, so the patient does not feel any discomfort or pain (6).

In this paper are described applications of cryosurgery for the treatment of the most common oral lesions in young children. Five cases are presented in this paper. In all of them, cryosurgery was performed without local anesthesia or any sedation considering the lesion size, easy localization and short clinical chair time. The aim of this case series is to report and discuss the efficacy of cryosurgery as a non-invasive alternative for treating the most common oral lesions in children.

## Case Report

### Case 1 - Mucocele

Mucoceles, which originate from minor salivary glands, are also referred to as mucus retention phenomenon and mucus escape reaction. The mucus retention cyst appears to be caused by epithelial proliferation of a partially obstructed salivary duct, which becomes unable to adequately drain the saliva produced, leading to duct dilatation and swelling (7)

Discomfort, interference with speech, mastication and swallowing, and external swelling may occur depending on the size and location of mucoceles. They are very common oral lesions in children, perhaps because they are more likely to experience trauma that induces mucin spillage (8).

Mucoceles often arise within a few days after a

minor trauma, but then stabilize in size. They may persist unchanged for months unless treated (9). The most common treatment, however, is complete removal of the lesion and the involved salivary gland by surgical excision. Other techniques have been proposed for the treatment of mucoceles, such as micro-marsupialization, marsupialization and cryosurgery.

Cryosurgery was the technique indicated to remove a Blandin-Nuhn mucocele located on the ventral surface of tongue (Fig. 1A). The mucocele was exposed directly to 4 consecutive freeze-thaw cycles once a week, and it was possible to notice ice crystal formation on the mucocele surface (Fig. 1B). When the patient returned 2 weeks later, the lesion had remised completely without scar formation (Fig. 1C).

#### Case 2 - Ranula

This oral lesion is a type of mucocele found on the floor of the mouth and appears as a tense fluctuant dome-shaped vesicle, sometimes with a blue hue. The most common site is the lateral floor of the oral cavity. Ranulas appear as a swelling of connective tissue consisting of collected mucin from a ruptured salivary gland duct, which is usually caused by local trauma (10).

The most common treatment for ranula consists in the removal of the feeding sublingual gland or marsupialization (11,12). However, these procedures are often unsuccessful; complications of these types of surgery include injury to

Wharton's duct, obstruction of the sublingual gland, lingual nerve injury, sensory impairment of the tongue, recurrence and the development of a cervical ranula (12,13).

The use of cryosurgery for the removal of ranula in a baby was the choice in this case because it would be the easiest and most effective technique with very good prognosis (Fig. 2A). The lesion was exposed directly to a freeze-thaw cycle that was repeated 3 times with weekly intervals. It is possible to observe ice crystal formation on the ranula surface. When the patient returned for control one week after the procedure, the ranula had disappeared.

#### Case 3 - *Verruca vulgaris*

Cutaneous warts are common skin lesions caused by human papillomavirus infection. Treatment is aimed at relieving the patient's physical and psychological discomfort and for preventing the spread of infection by autoinoculation (14).

Many cases of *Verruca vulgaris* will spontaneously disappear without treatment. However, treatment may be sought for a variety of reasons, such as discomfort or being prevented from undertaking sports or daily life activities (15). Cryosurgery induces a subepithelial blister that lifts the infected epithelium from the underlying connective tissue, allowing it to slough away.

*Verruca vulgaris* was found in the lower lip of a young patient and its clinical aspects were visible in the border of the vermilion (Fig. 3A). Application of extremely low



Figure 1. A: Mucocele in ventral surface of the tongue. B: Frozen lesion after 4 freeze thaw cycles. C: Lesion reduction after 1 week of treatment. D: Two-week postoperative evaluation.



Figure 2. A: Ranula on the floor of mouth. B: Frozen lesion after 4 freeze thaw cycles. C: Lesion reduction after one week of treatment.

temperatures was made four times, once a week, turning into four freeze-thaw cycles and it was possible to note the ice crystal formation (Fig. 3 B). Two months after the treatment the patient returned without scar formation (Fig. 3 C).

**Case 4 - Molluscum contagiosum**

*Molluscum contagiosum* is a benign viral infection of the skin. It is caused by a poxvirus and usually affects children from 2 to 5 years old. Treatment consists of different methods to destroy infected tissue together with the virus. They may be crude/bloody (curettage, electrocoagulation, clamping), excessive (oral cimetidine, oral isotretinoin), or topical therapies (salicylic acid, tretinoin or potassium hydroxide) (16). However, among all these techniques, cryosurgery has the advantage of being rapidly effective and less expensive, and may be the preferred treatment for large isolated or few lesions (17).

In order to treat a child with multiple white papulas around the lips and chin (Fig. 4A), four freeze thaw cycles were required (Fig. 4B) repeated four times at weekly intervals. It is possible to note the ice crystal formation on the papula's surface. Two months after cryosurgery all the papulas had disappeared.

**Case 5 - Pyogenic Granuloma**

Pyogenic granuloma is a common intraoral lesion characterized by a proliferation of connective tissue containing numerous blood vessels and inflammatory cells. This lesion is commonly found in areas such as the lips, tongue and buccal mucosa. Pyogenic granuloma may vary considerably in size and may occur at any age (18). There are several treatment options, including surgical excision, electrodesiccation, curettage/shave excision, lasers, sclerotherapy, imiquimod cream and cryosurgery. This last technique is recommended for this type of oral

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Figure 3. A: Clinical aspects before cryotherapy treatment. B: Frozen lesion after 4 freeze thaw cycles. C: Clinical aspect after 2 months.



Figure 4. A: Multiple papulas. B: Frozen lesion after short freeze thaw cycles. C: Clinical aspect after 2 months.



Figure 5. A: Clinical aspects before cryotherapy treatment. B: Frozen lesion after short freeze thaw cycles. C: Clinical aspects after 1 month of cryotherapy treatment, note a discrete erythematous area.

lesion (Figs. 5A to 5C).

A pyogenic granuloma was localized on the left side of the mandible between the primary second molar and permanent first molar (Fig. 5A). Clinically, the lesion appeared as red node with 3 mm diameter and sessile in the gingival papilla. After four freeze thaw cycles it was possible to notice the ice crystal formation (Fig. 5B). When the patient returned one week later, the lesion had disappeared and no scar was visible (Fig. 5C).

## Discussion

Most studies on the frequency of oral disease in children have involved surveys with an emphasis on caries, periodontal disease, or specific diagnoses such as tumors or cysts (19). The knowledge of basic clinical characteristics of these lesions can be valuable in clinical diagnosis and patient management. In all these cases, clinical interview and clinical examination were the only methods used to make the diagnosis of all lesions reported, since these lesions are very common in children.

Whenever cryosurgery is possible, it should be the first option to treat a wide variety of skin and oral mucosa disorders in children instead of other surgical techniques. Since cryosurgery is a non-invasive therapy, it does not need local anesthesia, never has complications during the surgery procedures, and it may be used to treat multiple lesions at the same time. In addition, it is better tolerated by fearful children (20). This is a great advantage in Pediatric Dentistry. Other advantages of cryosurgery over surgical excision include easy operation, absence of pain, low risk of infection and no need of suture removal, which make this technique well tolerated by young patients (6,21).

In all 5 cases reported in this paper, the postoperative period was uneventful and healing occurred without pain, bleeding, discomfort, infection and with minimal or no scar formation.

The cryogenic substance used in all 5 cases was liquid nitrogen, which has been considered the best substance due to its physical properties such as being inert, odorless, non flammable, without release of toxic gases, poor heat and electricity conductive and good thermal capacity. In all cases was used the spray method. A portable cryoprobe with a 3 mm diameter tip applicator was applied over the lesion until ice crystals were formed.

Four freeze-thaw cycles were made in all cases, with quick freeze-thaw and slow thaw-out. The time of application varied, but all surfaces of the lesions have shown ice crystal formation during the freeze-thaw cycle. The cycles were repeated four times once in a week.

Cryosurgery is a therapeutic method adopted for the treatment of benign and malignant lesions of the skin and mucosa by a physical process that produces cell death by

sudden and intense freezing. The mechanisms of cell death following freezing have received considerable attention. Studies of isolated cells or tissues have defined ice-crystal dimensions and locations and have led to the commonly held view that intracellular ice is usually lethal, whereas extracellular ice is not (20).

It is not exactly understood how cooling reduces pain. It is probably by reducing inflammation, causing vasoconstriction and subsequent reduction in edema and pain-producing mediators such as bradykinin, 5-hydroxytryptamine, P substance, and eicosanoids (22,23)

In this paper was described the successful cryotherapy for oral pathologies commonly found in children. Several alternative techniques have been proposed for the management of mucoceles, such as micro-marsupialization, carbon dioxide laser, gamma-linolenic acid and erbium laser (22,23), which ultimately complicate the proper choice for each modality. Treatment options over excisional surgery include lesion removal with Nd:YAG laser because of the lower bleeding risk compared with other surgical techniques (24). However, the high cost and need of specific training for handling limit its use in dental offices. A randomized study (25) compared the use of laser and cryotherapy in the treatment of cervical intraepithelial oral tumor and the success rates for laser and cryosurgery were not significantly different and were mainly related to lesion size. The authors concluded that the widespread introduction of laser facilities in small centers is not justified because the success rates are not so much better than those of cryosurgery, and because the advantages of less discharge are outweighed by the high cost.

The main disadvantage of the cryosurgery is the lack of specimens to be examined postoperatively in order to confirm the diagnosis (25). Therefore, this technique can only be used in cases where the professional has a sure clinical diagnosis or the diagnosis is confirmed by anatomical and pathological examination. In the present case series, all lesions were diagnosed by clinical aspects only. Other disadvantages include unpredictable degree of swelling, lack of precision for depth and freezing area, and high dependence on the operator's skill and experience.

There are few contra-indications to cryosurgery. In general, they are related to concomitant illness in which excess reactions to cold may occur or delayed healing may be anticipated. Cryosurgery has also many applications in oral medicine and clinical oral pathology, and it is extremely useful in patients for whom surgery is contra-indicated due to either age or medical history.

It may be concluded that cryosurgery is an effective and painless treatment method of oral lesions in children. It is a simple technique to perform, minimally invasive and there is no need for local anesthesia. Sutures are not

necessary either, which provides greater comfort to the patient and therefore should be the most commonly used in pediatric dentistry clinics.

## Resumo

As crianças podem apresentar uma grande variedade de patologias bucais, como lesões da mucosa oral, lesões ósseas, tumores, cistos e lesões cutâneas. Diferentes técnicas têm sido descritas para o tratamento destas lesões, mas todas elas são invasivas. O objetivo deste trabalho é relatar, por meio de uma revisão de literatura e apresentar clinicamente a eficácia da criocirurgia como alternativa para tratamentos cirúrgicos não invasivos das lesões bucais mais comuns em crianças. Esta técnica tem sido bem tolerada por pacientes pela ausência de anestesia, hemorragia mínima e rápida cicatrização. A crioterapia tem muitas aplicações na medicina oral e é uma alternativa extremamente útil em pacientes nos quais a cirurgia é contra-indicada devido a idade ou história médica. É uma técnica simples de se executar, minimamente invasiva, barata e muito efetiva na clínica de odontopediatria.

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Received September 17, 2013

Accepted July 14, 2014