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### Cryosurgery and Immediate Bone Grafting: Optimizing Management of Primary Jaw Lesions" - REVIEW

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#### **ABSTRACT**

The purpose of this study is to determine whether concurrent cancellous bone grafting can effectively reduce problems and speed up healing in aggressive mandibular lesions treated with liquid nitrogen cryotherapy and enucleation. Ten of the twenty patients that were evaluated had concurrent bone transplantation, while the other ten did not. In contrast to events in the non-grafted group, where two patients suffered from pathologic fractures and one from a wound dehiscence, complications did not arise in the bone-grafted group. The grafted group had a higher residual bone height, and only osseointegrated implants were inserted in this group. According to the study's findings, simultaneous bone grafting reduces risks, maintains bone height, and makes it easier to insert dental implants in lesions larger than 4.0 cm.

**KEY WORDS** : liquid nitrogen cryotherapy, bone transplantation, bone grafting, concurrent cancellous bone grafting

## **INTRODUCTION**

A wide range of benign, aggressive, and locally recurring lesions affect the maxillofacial region, making management of these lesions extremely difficult. The clinical behaviours of specific lesions, such as ameloblastoma, myxoma, odontogenic keratocyst, central giant cell granuloma, and other fibro-osseous lesions, vary, necessitating customised treatments for the best possible treatment results. Still up for debate, though, are the best ways to proceed with the first operation and when to schedule follow-up reconstructive treatments.<sup>1</sup>

If left untreated, ameloblastoma—a locally aggressive odontogenic tumor—has a high recurrence risk. Myxomas, which are identified by their infiltrative growth pattern, may also locally return after partial resection.<sup>2,3</sup> Because of their tendency towards aggressive behaviour and recurrence, orthodontic keratocysts require cautious management in order to minimise morbidity and prevent recurrence.<sup>4,5</sup> Even though they are benign, fibro-osseous lesions and central giant cell granulomas can behave aggressively.

The best management approaches frequently take a multidisciplinary approach, taking into account patient-specific variables like age and comorbidities as well as lesion size, location, and histological characteristics.<sup>6,7,8</sup> Management must include both long-term follow-up and close surveillance in order to identify and quickly resolve recurrences.<sup>9,10,11</sup>

Modern surgical methods, like clean margin en bloc resection and microvascular free tissue transfer repair, have reduced morbidity and increased results in some instances. Furthermore, adjuvant treatments including radiotherapy, cryotherapy, and pharmaceuticals may be used in conjunction with other therapies to improve treatment outcomes overall and lower the rate of recurrence.<sup>12,13</sup>

In conclusion, treating benign but aggressive lesions that are locally recurrent and aggressive in nature in the maxillofacial area is still difficult and necessitates a customised strategy based on the traits of each patient and the behaviour of the tumour.<sup>14</sup> To maximise results and improve impacted people's quality of life, ongoing research is needed to improve treatment algorithms and investigate new therapeutic modalities such as liquid nitrogen cryosurgery.<sup>15</sup>

## **LIQUID NITROGEN CRYOSURGERY**

Cryosurgery, which was first described by Arnott in 1851, is the process of eliminating tissue by freezing and thawing it continuously. Compared to alternative methods that involve nitrous oxide and carbon dioxide, liquid nitrogen is favoured due to its strong freezing impact

and its lower temperature of  $-196.6^{\circ}\text{C}$ . At  $-20^{\circ}\text{C}$ , cell death is thought to be caused by the development of intracellular and extracellular ice crystals, which directly damages cells and upsets their electrolyte balance. Lethal cell effects are maximised by rapid freezing followed by gradual thawing.

11

In intrabony lesions, liquid nitrogen cryosurgery devitalizes bone while maintaining inorganic integrity, enabling "creeping substitution," which involves necrosis, osteogenesis, and remodelling, to promote regeneration. The inorganic matrix is denatured by chemical agents such as Carnoy's solution, which eliminates its osteogenic characteristics. Its special benefit is that it devitalizes bone in situ, which makes it appropriate for aggressive, benign bone lesions that are common in the maxillofacial region and have high rates of local recurrence after curettage or enucleation. After the lesion is removed, liquid nitrogen is applied to the remaining cells to devitalize them. Many lesions, including as myxomas, ameloblastomas, giant cell lesions, and odontogenic keratocysts, can be successfully managed. 14,15

There are two types of cryosurgical methods used: open spray and closed cryoprobe. Open spray works better. Notwithstanding, a meticulously customised cryoprobe can produce suitable outcomes. Another alternative is to improve cryoprobe adaption by utilising a water-soluble conducting media such as KY jelly. After eight weeks of treatment, osteogenesis gradually restores the strength of the bone after a peak in skeletal necrosis. But weaker bone after cryotherapy increases the risk of fracture, therefore concurrent cancellous bone grafting is necessary to promote early osteogenesis, which requires live osteoblasts and a favourable vascular bed. It is yet unknown how vascularized defects repaired with cryosurgery will be and how wide of a bone cavity is ideal for grafting. Regarding liquid nitrogen cryosurgery, a few questions remain unanswered. Before firmly endorsing liquid nitrogen cryosurgery for troublesome benign aggressive jaw lesions, these doubts must be resolved. Research in this area is still ongoing, with the goal of answering these concerns.

## **METHODOLOGY**

Group 1 of the trial consisted of 10 consecutive patients with locally aggressive mandibular lesions who received simultaneous autogenous bone graft repair, cryotherapy, and enucleation. Ten patients with identical diagnoses were included in Group 2, a control group, and they had cryotherapy and enucleation without bone grafting. Age and defect size

comparison was used for the patients in both groups. A Frigitronics CS-76 cryotherapy equipment was used to give liquid nitrogen cryotherapy. Lesions with a maximum size of less than 2 cm were treated with two freeze-thaw cycles after being post-enucleated with a water-soluble conducting medium (KY jelly). Liquid nitrogen spray was directly applied to other bone cavities until solid frost developed, then there was a thawing time and a second application.

To fill the void, Group 1 underwent particulate cancellous bone and marrow (PCBM) transplants from the iliac crest. Vertical mattress sutures were used for primary wound edge closure in both groups. Pre- and postoperative alveolar height was measured with a personalised panoramic mandibular index. Similar analysis was done on postoperative radiographs after accounting for variations in magnification. There is documentation of postoperative complications including wound dehiscence, sequestrum development, and pathologic fractures. Furthermore, records were kept of Group 1 patients who subsequently underwent surgery at the site of implants.

## **RESULT**

Patients in the control and study groups ranged in age from 7 to 79 years old; there were 7 female patients and 13 male patients. Ossifying fibromas (2 cases), myxomas (1 case), ameloblastomas (6 cases), and odontogenic keratocysts (11 cases) were among the reported diagnoses. The mean follow-up period for radiography after surgery was 12.6 months, with a range of 5 to 21 months, while the mean follow-up period for clinical imaging was 3.5 years, with a range of 1.1 to 8 years.

### **GROUP 1**

Following enucleation, patients who received cryotherapy in addition to PCBM grafting had no complications following surgery. Lesions ranged in size from 2 to 8 cm, with an average of 2.8 cm × 5.5 cm. Over a follow-up period of 12.6 months on average, alveolar height remained at 81% of preoperative values. Six patients received fifteen implants.

### **GROUP 2**

Complications from cryosurgery alone after enucleation included two pathologic fractures in three individuals. A blended diet and subsequent surgery were used to treat a patient who had an ascending ramus fracture. Another patient had dehiscence of the wound, which was treated with packing and irrigation before the sequestrum was removed. Lesions in the control group had an average size of 2 cm by 3.5 cm and a follow-up time of 34.9 months. There were no

dental implants inserted, and the average alveolar ridge height was 78% of its preoperative value.

## **DISCUSSION**

With benefits including ease of use, less discomfort, and less scarring, liquid nitrogen cryosurgery has proven effective in devitalizing both hard and soft tissues in the maxillofacial area. On the other hand, disadvantages include uneven tissue damage and edoema following surgery. Patients who were beyond their fifth decade developed fractures, especially those with lesions larger than 4.0 cm close to the mandibular border. Fractures usually developed eight weeks after cryotherapy, at the time when the bone was at its weakest. While immediate bone grafting did not increase alveolar height, it did appear to decrease fractures in larger lesions. In order to enable efficient reconstruction, dental implants were primarily positioned in bigger lesions, particularly in the anterior mandible. In order to reduce postoperative problems, cryotherapy in conjunction with rapid bone grafting seems to be beneficial; nevertheless, larger studies are required for statistical analysis. In order to prevent fractures, patients with lesions greater than 4 cm that involve the alveolar crest and limited cortical bone may benefit from rapid autogenous bone grafting. After enucleation, dental rehabilitation with implants is possible when paired with cryotherapy and bone grafting; its suitability in the absence of grafting is still unknown.

## **CONCLUSION**

This study shows that in individuals with aggressive mandibular lesions, contemporaneous cancellous bone grafting together with enucleation and liquid nitrogen cryotherapy effectively decreases postoperative problems and accelerates up healing. According to our research, patients who had bone grafting experienced noticeably fewer issues than those who did not. In particular, there were no postoperative problems in the bone-grafted group that were seen in the non-grafted group, such as pathologic fractures or wound dehiscence.

Furthermore, the only group in which osseointegrated implants were successfully positioned was the bone-grafted group, which also maintained a higher residual bone height. This emphasises how crucial it is to preserve bone volume and integrity for upcoming dental rehabilitation, especially in cases when lesions are larger than 4.0 cm. The results of this investigation imply that prompt bone grafting not only promotes early osteogenesis but also maintains the bone structure, lowering the risk of fractures related to cryotherapy. With larger lesions, where preserving structural integrity is essential to preventing problems and guaranteeing successful implant placement, this method is

especially

helpful.

Larger patient cohorts and longer follow-up times should be the main topics of future study in order to confirm these results and improve treatment procedures. Enhancing patient outcomes will need addressing the unresolved issues of the optimal size of bone cavities for grafting and the vascularization of defects treated with cryosurgery. To sum up, concurrent liquid nitrogen cryotherapy and enucleation bone grafting provide a viable approach to aggressive mandibular lesions, lowering risks, preserving bone height, and improving chances of dental implant recovery. A major progress in the management of benign but aggressive maxillofacial lesions has been made possible by this comprehensive strategy.

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