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**Odontogenic Keratocyst: An Overview of Management Protocols** 

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#### Abstract

The Odontogenic Keratocyst is essentially categorized as a cyst having a developmental origin as per the latest WHO classification of 2017. It has certain characteristic clinical and histopathological features. The aggressive nature and the high recurrence rate impart unique features to the cyst. Inspite of the many attempts to classify and re classify the cyst, the specialists often face challenges in the management modalities. This article is an attempt to lay down various treatment modalities with a focus on the aggressive nature and recurrence and the need for a perfect treatment protocol for Odontogenic Keratocyst.

**Keywords:** WHO, clinical, Odontogenic, Keratocyst, OKC.

#### Introduction

The term "Odontogenic Keratocyst" was originally coined by Philipsen (1956)<sup>[1]</sup>. It is defined by WHO as 'A noncancerous uni or multi-cystic , intra osseous tumor of odontogenic origin , having a typical inner lining of parakeratinized stratified squamous epithelium as well as a likelihood of a potent , destructive behavior .<sup>[2]</sup> It can attain a massive size because of its ability to undergo enlargement , extension and invasion into the surrounding tissues.<sup>[3]</sup> It comprises of about 3-11 % of the odontogenic cysts.<sup>[4]</sup> OKC has been associated with many syndromes such as the Nevoid Basal cell carcinoma syndrome.<sup>[4]</sup>

The origin of OKC is thought be from the cell rests of the dental lamina .<sup>[5]</sup> They have a high tendency to recur because they present with a slender and friable wall

structure which can be difficult to enucleate from the bony component in toto. The presence of daughter cysts known as satellite cysts further complicate its removal as a whole .<sup>[6]</sup> Radiographically , OKC presents as a well defined unilocular or multi locular radiolucency with a distinct or corticated margins .In 25-40 % of the cases , it is associated with an impacted tooth within the lesion .They have a tendency to expand in an anteroposterior direction within the medullary cavity of the bone without much cortical expansion . This is related to its late appearance in the affected individuals <sup>[6,7]</sup>.

The management of OKC's is still a topic of debate comprising of treatments ranging from conservative to much aggressive modalities. The conventional treatment usually comprises of enucleation, with or without curettage, or marsupialization <sup>[8]</sup>. The aggressive management consists of peripheral ostectomy, curettage followed by Carnoy's solution, Cryotherapy, Electrocautery and Resection <sup>[9]</sup>.

#### **Decompression and Marsupialization**

Decompression of a cyst involves any technique that relieves the pressure inside the cyst that causes its growth . Growth of cysts is believed to primarily occur by a combination of osmotic pressure and pressure resorption <sup>[9]</sup>which is accompanied with release of prostaglandins and growth factors.<sup>[10]</sup> Decompression, by any means, appears to change according to the encompassing tissues and decreases the amount of interleukin that is released.<sup>[11]</sup> Decompression can be performed by creating a small opening in the cyst and keeping it open with the insertion of a drain of some kind.<sup>[12-15]</sup> (Figure 1).

Marsupialization, on the other hand, involves converting the cyst into a pouch. (The word marsupial is derived from the Greek for "pouch") (Figure 2 ).By converting the cyst to a pouch, the lesion gets decompressed and this is a more definitive treatment for the cavity as it exposes the cystic lining to the oral environment.<sup>[16]</sup> Mandibular cysts are normally marsupialized into the oral cavity, although maxillary cysts can also be marsupialized into the maxillary antrum or nasal cavity, as well as the oral cavity.<sup>[17]</sup>



FIGURE 1. Diagrammatic representation of decompression of a large maxillary cyst into the oral cavity with a drainage tube in place.



FIGURE 2. Diagrammatic representation of marsupialization with the cyst mucosa sutured to the oral cavity mucosa.

M. Anthony Pogrel. Decompression and Marsupialization of Keratocysts.

J Oral Maxillofac Surg 2005.<sup>18]</sup>

Decompression and marsupialization of cysts is probably one of the earliest described treatment modalities and was first suggested by Partsch in the German literature in the late 19th century.<sup>[18,19]</sup> In many parts of the world, marsupialization is still described as a Partsch I procedure (the Partsch II procedure is enucleation and primary closure). At the time, this method was put forward as being the sole treatment of choice, because without the advent of antibiotics, any attempt at enucleation and primary closure of a cyst was accompanied by a very high postoperative infection rate.<sup>[20]</sup>

The actual marsupialization method was explained by Pogrel in which a window of a minimum of one centimeter across is created into a cyst followed by an effort to suture the cystic lining to the oral mucosa. Within the maxilla, the cyst is then simply just often packed with the material protruding through the opening. The packing contains iodoform gauze impregnated with bacitracin cream. After it is removed from the maxilla, the cavity becomes self-maintaining and the affected individual needs to irrigate it two times a day to avoid deposition of food and fistula closure . In the mandible, there is a higher tendency for natural closure of the fistula and reformation of the cyst particularly in the region of posterior mandible.

Research has proven that if the OKC is opened up to the oral cavity through marsupialization, several changes take place in the cystic lining. Histologically, the lining of OKC is just Five to six cell layers deep and also breaks quickly upon attempted enucleation; and that is one of the many factors that contributes to its high recurrence rate. With decompression or marsupialization, the lining seems to become denser and simpler for enucleation, and histologically it can seem to transform like typical oral mucosa, both with routine histology together with immunohistochemistry.<sup>[21]</sup> Pogrel finally stated that, decompression and/or marsupialization is as good a treatment modality as any other aggressive one as it is associated with a low morbidity rate and no vital structures are harmed.

Those writers who happen to oppose the usage of marsupialization or decompression to treat OKC depend on the fact that this approach fails to completely eliminate the cystic lining , which results in a continuation of epithelial proliferation and promote recurrence.<sup>[22]</sup> A

recurrence rate of 25% has been documented in 32 cases when decompression was used as the sole treatment.<sup>[6]</sup> However, additional research indicates that the marsupialization of OKC may be associated with complete settlement of the lesion which virtually requires no further surgery.<sup>[23]</sup>

#### **Enucleation With and Without Adjuncts**

To enucleate is simply "to clear away as a whole, the tumor from its envelope." Curettage means "the eradication of abnormal growths or any other content out of the wall of the cavity.<sup>[24]</sup> Enucleation together with and without different adjuncts has long been employed. Despite the fact that enucleation/curettage provides an edge over marsupialization of providing an entire sample for histopathologic evaluation, it exhibits recurrence rates as high as 62.5%. This significant reason of recurrence is actually attributed to the slender, friable wall structure of the OKC, which is difficult to enucleate from the bone fragments successfully, as well as to the presence of miniature satellite cysts inside the fibrous wall.<sup>[24]</sup> A lot of specialists take into account enucleation and curettage as the bare minimum prerequisite in the management of OKC.<sup>[25]</sup> Concerning curettage, clinicians currently have recommended mechanized methods (hand, rotary) alone or perhaps in conjunction with a compound solution [26] cryosurgical (Carnoy's) or products (liquid nitrogen).<sup>[27]</sup>

# Enucleation and Treatment of the Bony Defect with Carnoy Solution

As a consequence of the problem regarding enucleating the slender, friable wall structure of the OKC as a whole, in addition to the little satellite cysts, thus, treatment method was devised to attempt removal of all the possible critical cells left out in the defect. For this particular purpose, a gentle, not profoundly infiltrating, cauterizing agent is employed for example- Carnoy's

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solution (is made up of 3 ml of chloroform, 6 ml of absolute ethanol, 1 ml of glacial acetic acid as well as 1 gm of ferric chloride).<sup>[28]</sup> This is generally sufficient to complete cauterization of the leftover cells. Should the cyst have permeated via the lingual or buccal cortex, surgeons referred to the employment of electrocauterization in order to avoid a recurrence within the soft tissues.<sup>[29]</sup>

Additional research stated that, even though the problem appeared to be cured with Carnoy's solution, microcysts as well as epithelial islands ended up generally in the overlying attached mucosa. Therefore, recurrence occurred. Thus, the particular writers of all of these scientific studies suggested the total removal of the overlying mucosa to diminish the recurrence.<sup>[26]</sup> Additionally it was cited in a research the fact that treatment with Carnoy's solution failed to display a substantial association with recurrence.<sup>[30]</sup> Yet, Voorsmit et al. documented a reduced recurrence rate subsequent to therapy using enucleation along with Carnoy's solution (2.5%) in contrast with enucleation on its own (13.5%).<sup>[28]</sup> As per (Blanas et al., 2000) enucleation of KCOT and use of Carnoy's solution seems to be the most minimally invasive procedure together with the smallest recurrence rate. Plus they documented that employing Carnoy's solution to the cyst cavity for 3 min following enucleation provides a recurrence rate similar to those of resection without the need of unjustifiable aggressive surgery.<sup>[31]</sup> The side effects associated with Carnoy's solution over the inferior alveolar nerve had been initially reported by Frerich et al. (1994).<sup>[32]</sup> The writers failed to detect axonal injury through the initial 3 min of the primary application. On the other hand, another significant research, Wright et al. (1981)<sup>[33]</sup> mentioned how the modifications in neural conductivity established soon after 2 min of immediate application, with hardly any indications of healing following 2 weeks of follow-up. Dammer et al. (1997),<sup>[34]</sup> claimed that whenever a suitable standard protocol is adopted, the chemical therapy for the nerve can be achieved inspite of the long lasting functional deterioration.

#### **Enucleation and Liquid Nitrogen Cryotherapy**

In principle, the optimal strategy for OKC will be enucleation as well as curettage accompanied by treating the cavity using an agent aimed at destroying the epithelial remains or satellite cysts.

Moreover, the osseous structure should be kept undamaged to enable osteoconduction. Liquefied nitrogen has the capacity to devitalize bone in situ without changing the inorganic framework, as a result of which, cryotherapy has been used for several locally potent jaw lesions, such as OKC, ameloblastoma and ossifying fibroma (Pogrel, 1993, Lo Muzio 1999).<sup>[35,36]</sup> Cell death by using cryosurgery takes place simply by immediate injury from intra cellular as well as extracellular ice crystal in addition to osmotic and electrolyte formation disturbances (Rosen and Vered, 1979).<sup>[37]</sup> As per Pogrel (2001)<sup>[27]</sup> the regular method is as follows, the 1st step in treating of the lesion comprises of enucleation of the cyst. The encompassing tissues are after that, guarded with clean and sterile wooden tongue blades as well as gauze, and also the cavity is applied with liquid nitrogen 2 times for 1 min, using a 5 min thaw in between freezes. Bone graft may be loaded within the defect all at once, after which mucosa is closed up with water tight sutures. The attributes of liquid nitrogen above other methods of devitalizing the tissue over and above the noticeable lesion of the border are that (1) the actual bone fragments matrix remains in position to act like a clear scaffold for new bone development, (2) a bone graft may be put instantly in order to speed up healing and reduce the chance of a pathologic bone fracture, and (3) reduction in hemorrhage

and scarring. Nevertheless, due to the issues in managing the quantity of liquid nitrogen used on the cavity, the resulting necrosis in addition to swelling might be erratic (Pogrel, 1993; Salmassy and Pogrel, 1995).<sup>[36,38]</sup> The recurrence rate subsequent to enucleation and liquid nitrogen cryotherapy happens to be documented at 3-9% (Pogrel, 2005; Schmidt, 1999).<sup>[21,27]</sup>

Any time the liquid nitrogen cryotherapy is administered about the inferior alveolar nerve, it can be damaged, and affected individuals are affected by paresthesia or maybe anesthesia. Even so, the axon sheaths remain undamaged and neuronal regrowth is typical in a way that most patients attain partial or total return of sensation in 3 months (Schmidt, 1999).<sup>[27]</sup>

# Block Resection, With or Without Preservation of the Continuity of the Jaw

Resection represents possibly segmental resection (surgery associated with a portion of the mandible or maxilla without preserving the continuity of the bone) or marginal resection (surgery of a lesion undamaged, preserving a rim of uninvolved bone, retaining the continuity of the bone) (Kondell and Wiberg, 1988) <sup>[39]</sup> which in turn is a risky approach ending up in significant morbidity, specially due to the fact that reconstructive procedures are required to regain jaw function as well as aesthetics (Barreto et al. 2000)<sup>[40]</sup> Jensen (1988),<sup>[41]</sup> questions whether or not these kinds of ambitious treatments are justified for a benign lesion that can be managed reasonably well with relatively simple means.

In a thorough overview by Blanas et al. (2000),<sup>[31]</sup> the particular experts documented that resection was identified to provide the least recurrence rate (0%) however, it has the maximum morbidity rate, whereas enucleation with use of Carnoy's solution can lead to a recurrence rate similar to resection without unjustifiable aggressive surgery.

Numerous research determined that keratocysts may be addressed with a conservative approach, the shortcomings , being the prolonged curative time frame.<sup>[34,42,43,44]</sup> Substantial resection of the mandible having a high morbidity might be way too radical for massive OKC and perhaps an overtreatment (Giuliani et al., 2006; Marker et al., 1996).<sup>[45,46]</sup>

#### Summary

OKC is amongst the various overly aggressive odontogenic cysts having a significant recurrence rate. Numerous surgical strategies have been published such as decompression, marsupialization, enucleation with or without adjunct (Carnoy's solution, cryotherapy), as well as resection. Based on additional scientific studies OKC may be cautiously addressed with enucleation and use of Carnoy's solution or cryotherapy. This kind of treatment can be utilized mainly in the sizeable lesions that in case cured with resection, the continuity of the jaw would be disrupted. This method displays very similar outcomes to other more aggressive methods.

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