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Keratocystic Odontogenic Tumours: Three case reports outlining treatment of large lesions using decompression followed by surgical enucleation

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Abstract

Purpose: Keratocystic odontogenic tumour (KOT) is a benign, locally invasive, highly recurring odontogenic tumour. Surgical resection may be debilitating and disfiguring, therefore long-term decompression followed by enucleation can be used as a technique for the treatment of large KOTs, especially those close to vital structures.

Methods: Three patients who presented to the Maxillofacial Department at Middlemore Hospital, New Zealand, with extensive histologically proven KOTs were treated with long-term decompression, using modified Penrose decompression drains. Patients irrigated the cyst cavity with chlorhexidine (0.2%) for 6-18 months, followed by surgical enucleation. Patients were monitored for at least three years following definitive surgical treatment.

Results: All three patients remained symptom free of KOT reccurence at 3-5 years post surgery.

Conclusion: Decompression of KOTs requires increased patient compliance, although it appears to reduce the size of the lesion prior to surgical enucleation which may mean less surgical burden to the patient. Conclusions regarding recurrence rates cannot be made due to the small sample size and relatively short follow-up.

Introduction

Keratocystic odontogenic tumours (KOT) are highly recurrent slow growing, unilocular or multilocular intraosseous odontogenic tumors, which occur within the jaws (Phillipsen 2005). Originally termed odontogenic keratocysts (OKC) (Phillipsen 1956) because of their histological appearance, they were reclassified as tumours and termed KOTs in 2005 due to their extremely high recurrence rate, potential for aggressive local infiltration, increased mitotic activity, potential for epithelial budding from the basal layer, presence of chromosomal abnormalities and the role of mutations in the PTCH gene (Barnes *et al.,* 2005).

KOTs commonly occur in the second and third decades of life (Cawson 2008) with an average age of presentation at 30.8 years (Myoung 2001). Two-thirds of all KOT occur in the angle of the mandible, commonly associated with an unerupted tooth. The remaining one-third occur in the maxilla or anterior mandible (Stolinga *et al.,* 2001). They can also spread to the soft tissue (Stolinga *et al.,* 2001). Whilst rare, there are reports of malignant transformation (Foley *et al.,* 1991, Keszler & Piloni 2002). Multiple KOTs may also represent the presence of nevoid basal cell carcinoma syndrome (NBCCS), also known as Gorlin-Goltz syndrome (Shear 2003). This syndrome also includes the presence of basal cell carcinomas on the skin, bifid ribs, calcified falx cerebri, frontal bossing, palmar pits and medulloblastomas (Shear 2003).

Histological KOT classification has been controversial, with the former orthokeratonised variant of the odontogenic keratocyst no longer being recognised as part of the KOT spectrum due to a reduced recurrence rate when compared with the parakeratinised varient (Barnes *et al.,* 2005). The main histopathological features are presented in Table 1.

Clinical presentation may vary between patients however the specific clinical presentation often relates to the anatomical structures affected, and for example may include nasal obstruction, paraesthesia or root resorption. The patient most commonly seeks treatment due to pain, swelling and/or discharge which occurs following infection of the lesion or expansion out of bone into the soft tissue. Radiographic presentation is generally of a unilocular radiolucent lesion with a scalloped and well-defined margin. Due to the lack of specific signs and symptoms associated with KOT it is impossible to definitively diagnose the lesion without histological confirmation. Prior to definitive diagnosis other cystic and neoplastic bone lesions need to be excluded, these are included in Table 2.

The ideal treatment aims to eliminate the tumour and reduce the risk of recurrence whilst minimizing surgical complications for the patient. Options range from radical en-bloc resection, where the whole section of the jaw containing the tumour is removed, through to surgical curettage, where only the tumour contents are debrided. The treatment described in this series involves long-term decompression of the KOT followed by surgical enucleation. This is the process of marsupialising the internal cyst contents by penetrating the superficial wall of the cyst, maintaining patency with a tube. This allows communication with the oral cavity and leads to decompression of the cyst over time, as well as presence of chronic inflammation which may aid in regeneration of peripheral bone around the cystic cavity (Marker *et al.,* 1996). Decompression tends to create a chronic inflammatory state within the lining epithelium. Histological and immunological findings have shown the chronic inflammatory state induces changes in the epithelial cells

lining the KOT (Marker *et al.,* 1996, Piatelli 1998). The lesion being in a chronic state of inflammation shows a shift from fragile KOT lining epithelium back to less fragile, hyperplastic, stratified, non-keratinised squamous epithelium. This may help when the surgeon attempts complete removal of the lesion (Marker *et al.,* 1996). Further, a retrospective study of twenty eight patients with KOTs treated using marsupialization showed no progression of the tumour after at least 3-years post treatment, while malignant transformation and recurrence rates were the same as other treatment methods (Nakamura 2002).

A further surgical benefit of the decompression technique is that it leads to shrinkage of the tumour away from anatomical structures, such as tooth roots, a perforated lingual plate or ascending ramus of the mandible and the posterior recess of the maxillary sinus. In these areas it may be difficult to remove the lesion in one piece. To date there have been no randomised clincial trials comparing one treatment modality with another, therefore the best treatment is a matter of debate. Furthermore, any comparison between recurrence and treatment outcomes in the literature is difficult to interpret. This is due to heterogenicity between surgical methods, post operative care, and follow-up timeframes. Pogrel and Jordan (2004) reported no relapse during a 1.8-4.8 year follow-up period of ten patients treated with marsupialization and decompression. Regular follow up is recommended for the first five years due to the prevalence of recurrence (Myoung 2001), as well as rare cases of malignant transformation and metastatic spread (Brondum 1991). Stoelinga and colleagues (2001) described outcomes up to 25 years following decompression and enucleation or enucleation alone, and reported a recurrence rate of 9/82 treated KOTs. Most recurrences were associated with the enucleation group and were seen up to 25 years following treatment. Special attention and longer surveillance periods were reccommended for large maxillary KOTs because of the comparatively thin alveolar bone and potential communication and spread into the pterygopalatine fossa and access to the cranial base.

We present three patients who were referred to the Oral and Maxillofacial Department (OMFS) at Middlemore Hospital, New Zealand with large KOTs.

Table 1. Main histological features of keratocystic odontogenic tumour (Barnes *et al.,* 2005)

• Parakeratotic layers with an often corrugated surface
• Well defined, often palisaded, basal layer of columnar or cuboidal cells
• Intense basophilic nuclei of the columnar basal cells orientated away from the basement membrance
• Mitotic figures frequently present in the suprabasal layers

Table 2. Cystic and neoplastic bone lesions associated with unilocular radiolucencies

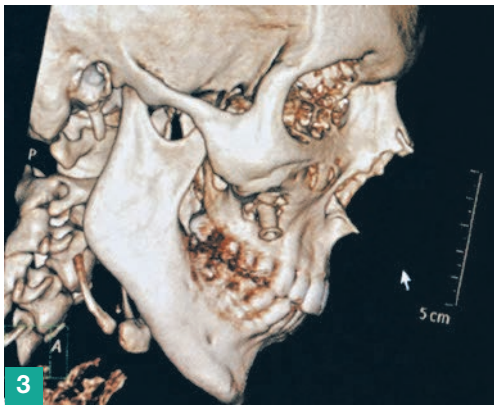
Unilocular radiolucency differential diagnosis
• Traumatic bone cyst
• Lateral periodontal cyst
• Dentigerous cyst
• Central giant cell granuloma
• Minimally calcifying odontogenic cyst
• Radicular cyst
• Arteriovenous malformation
• Benign bone tumour
• Ameloblastoma
• Adenomatoid odontogenic tumour
• Ameloblastic fibroma
• Plasmacytoma
• Odontogenic myxoma

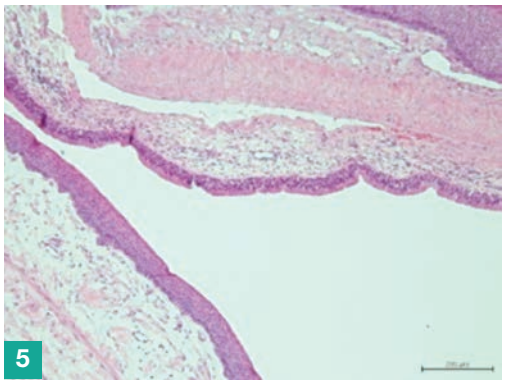
Case One

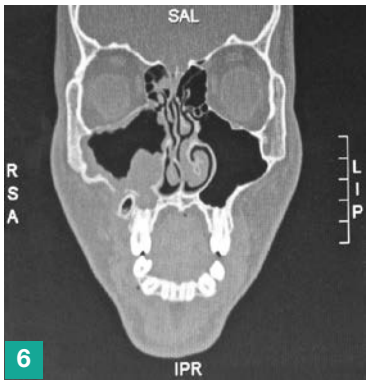
A 19-year-old male of New Zealand European decent presented with a three-month history of a diffuse swelling over his right cheek. There was no pain or tenderness, although a three week history of increased secretions from the lacrimal glands (epiphoria) was reported. The patient also complained of recurrent hay fever and sinus issues.

Clinically there was diffuse swelling over the right cheek with slight proptosis of the right eye, no diplopia, no restriction of eye movement and no trismus. The area was not tender and the patient was afebrile. Computed tomography (CT) of the face revealed a large, well-circumscribed lesion in the right maxillary sinus, extending to the floor of the orbit (Figure 1). The lesion displaced the maxillary upper right third molar tooth into the floor of the orbit and involved the entire right maxillary sinus, most of the ethmoids and perforated the buccal maxillary sinus wall (Figure 2). An incisional biopsy was performed under general anaesthesia (GA) through the lateral wall of the maxillary sinus (Figure 3). The cyst contents was drained and a silicone plastic decompression tube was secured with non-resorbable sutures (3/0 silk) during the surgery to facilitate decompression (Figures 3 and 4). Histology was consistent with a parakeratinised KOT (Figure 5).

The patient was discharged the following day with oral antibiotics (Augmentin 875mg bd 10 days), analgesics and individualised instruction on the use of daily irrigation with saline and chlorhexidine mouthwash (0.2% chlorhexidine gluconate). Following six months with the decompression tube *in situ* CT revealed considerable bony infill and reduction in size of the cyst (Figure 6). The cyst was then formerly enucleated with blunt disection until healthy sinus lining was visualised. The maxillary third molar was also extracted and the decompression tube removed. Histology reconfirmed parakeratinsed KOT. Follow-up CT 6 months following tumour enucleation showed some persistent mucosal thickening at the sugical site and no evidence of recurrence. The patient has been regularly reviewed at six monthly intervals for the past three years with no signs of further lesions on plain radiographic films or CT (Figures 6, 7 and 8).







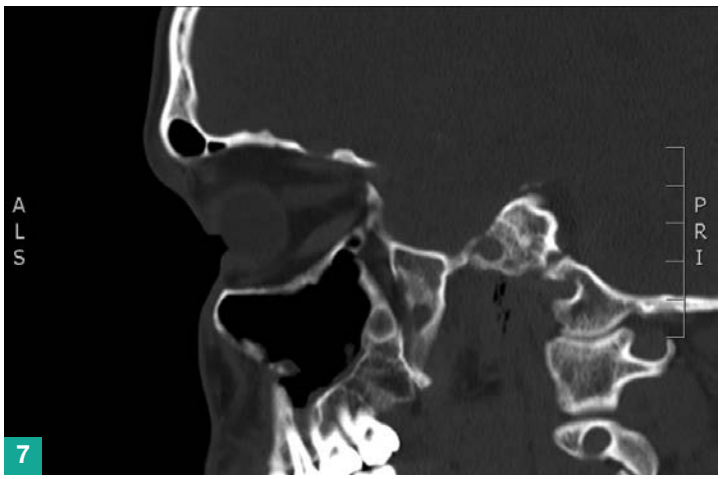


Figure 1. Sagittal view showing tooth displaced into orbital floor

Figure 2. Coronal view showing displaced tooth into orbital floor and right sinus opacity

Figure 3. CT recontruction showing placement of Penrose drain exiting the right maxillary sinus

Figure 4. Customised “Penrose” decompression drain, fabricated using clear acrylic tube with diameter 5 mm. Tube made from a section of a plastic Yunkauer tube (Amtech, RES414). A 1 mm diameter hole was made through the middle of the tube to allow securing with a suture (Ethicon, 3/0). The ends of the tube were heated and moulded to allow easier access for irrigation and provide some resistance to displacement

Figure 5. Photomicrograph showing parakeratinised KOT. Biopsy was taken from the lower aspect of the antral epithelium

Figure 6. CT taken 6 months after placement of decompression tube showing reduction in size of cyst

Figure 7. CT 12 months following enucleation of the KOT, showing a clear sinus and no signs of reccurence

Figure 8. CT 12 months following enucleation of the KOT

Case Two

A 34-year-old male of Indian descent presented with mild pain over his left mandible, swelling of two weeks duration and pus draining from his buccal sulcus, adjacent to the anterior mandibular teeth.

Clinical examination revealed a mild swelling in the right buccal vestibule of the mandible. No trismus or extraoral swelling was found and the patient was afebrile. Intraoral examination revealed draining straw-colored fluid from the buccal vestibule adjacent to his mandibular right canine/ premolar teeth. A panoramic dental radiograph (DPR) revealed a large unilocular radiolucency in the anterior mandible, extending from tooth 34 to tooth 46 (Figure 9). CT scans revealed expansion of the buccal/ labial plate. Within the radiolucent area was an impacted canine tooth (tooth 33) and resorption of the anterior tooth roots. Under GA an incisional biopsy was performed in the right and left hand side parasymphysis areas, the cyst contents drained, the impacted 33 removed and a decompression tube secured to the mucosa in the right parasymphysis area. Histology was consistent with a parakeratinised KOT.

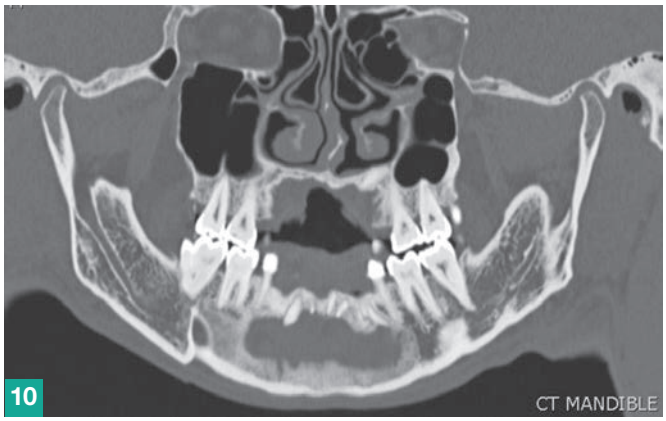


Figure 9. Panoramic dental radiograph revealing the extent of the lesion and the impacted canine tooth

Figure 10. CT image showing reduced size of KOT following 12 months of decompression

Figure 11. Panoramic dental radiograph 3 years after enucleation showing good bone infill

The patient was discharged the following day with oral antibiotics (Augmentin 825 mg, bd, 10 days) analgesics and instruction on daily irrigation with saline and chlorhexidine (0.2% chlorhexidine gluconate) mouthwash. A repeat CT taken seven months after decompression tube placement showed good bony infill with margins 'shrinking' away from the tooth apices, and no expansion of the buccal/labial plate (Figure 10). The tumour was subsequently removed with blunt dissection until clean hard margins were visualised, as well as the bony walls and tooth roots. Some areas required 'planing' from the bone. The surgical site was irrigated with saline and closed. Postoperatively the patient reported mild tingliness and paraesthesia of the chin although this resolved over the proceeding few months. The patient has been regularly reviewed at six monthly intervals for the past three years with no signs of reoccurence on plain radiographic films (Figure 11).

Case Three

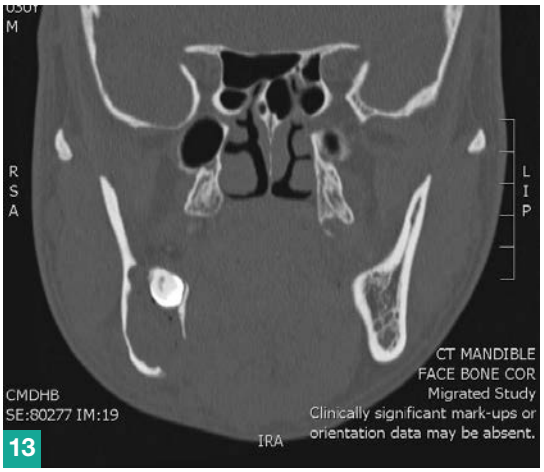
A 37-year-old male of Chinese descent presented with a five day history of facial swelling. The patient was afebrile despite frank suppuration from his mandibular third molar tooth. He had marked trismus with maximal jaw opening of 10-15 mm and reported normal mental nerve sensation. A PDR and CT revealed a large unilocular radiolucent lesion associated with impacted mandibular third molar (Figures 12 and 13).

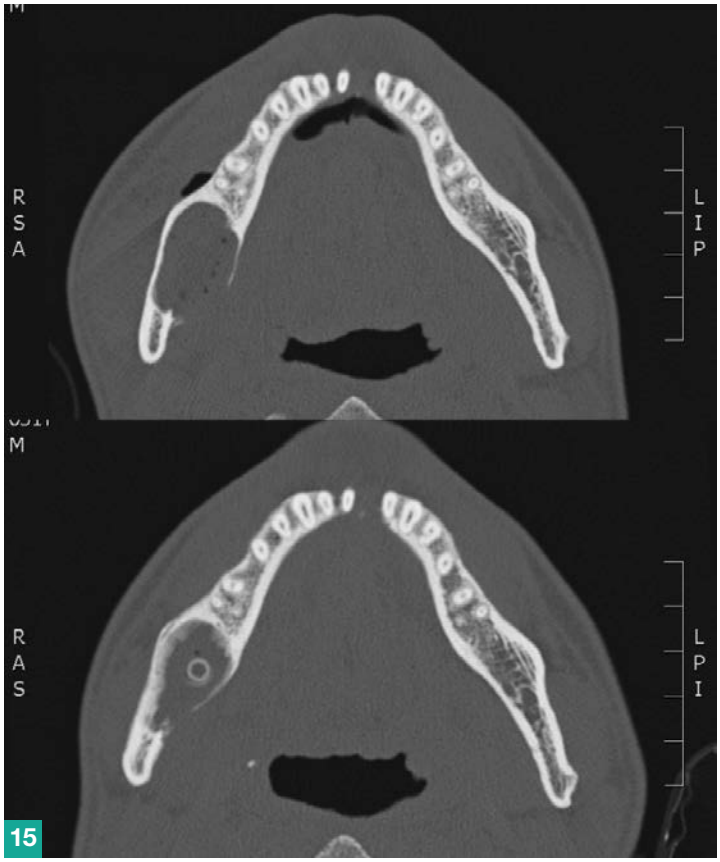
An incisional biopsy was performed under GA through the retromolar area, the cyst contents drained, and the third molar tooth removed. A silicone decompression tube was secured at operation with the access in a foward position to facilitate irrigation. The patient was discharged the following day with oral antibiotics, analgesics and instruction on daily irrigation with saline and chlorhexidine mouthwash (0.2% chlorhexidine gluconate). The histology was consistent with orthokeratonised KOT (Figure 14).

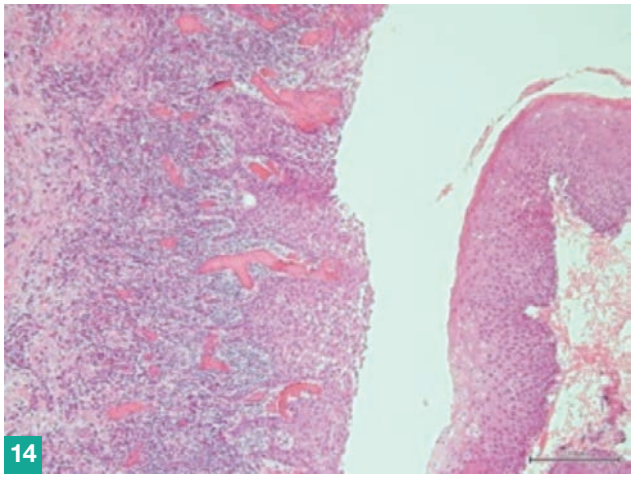
Following six months with the decompression tube *in situ* a CT revealed good bony infill with appearance of regrowth of the lingual cortical plate (Figure 15). The tumour was enucleated three months later and at the time it was reported that visually clean healthy margins were seen. Betadine-soaked ribbon gauze was secured in the surgical site and remained *in situ* for two weeks, at which time it was removed and replaced with Bismuth Iodoform Paraffin Paste gauze to allow the cavity to granulate and reduce food impaction. One week later this was removed and the surgical site was left to fully granulate and mucosalise. The patient was reviewed six months following surgery and good bony infill was evident on plain film radiography (Figure 16).

Discussion

The three cases highlight the ability for the decompression technique to be used to reduce the size of the lesion,







although further follow-up and a larger sample is required to determine the effect upon reccurence.

The adaptation of the standard open ended Penrose decompression drain to better suit the clinical suitation was important (Figure 4). The viscosity of the cyst contents increased as the degree of chronic infection increased, therefore a tube diameter of five millimetres was chosen to allow improved flow of fluid. Successful outcomes depended on the maintenance of the tube *in situ*, therefore a hole for securing the tube was made to allow a non-resorbable suture to be passed through and the ends moulded to increase resistance to displacement. None of the tubes dislodged during the treatment period.

All three patients reported considerable difficulty with irrigating through the tube. Patient one described disliking the salt water entering the sinus and patients two and three reported difficulty with dexterity. All three

Figure 12. Panoramic dental radiograph showing unilocular radiolucent lesion in the right mandible and impacted tooth 48

Figure 13. CT image showing the radiolucent area in the mandible with perforation of the lingual plate

Figure 14. Photomicrograph of specimen removed from the cystic cavity. There is considerable inflammation of the cyst wall and epithelium at the left of the slide. There is a more typical appearance of KOT on the right.

Figure 15. Transverse CT views before and after decompression showing reduction in size of the lesion as well as regrowth of the cortical bone in the mandibular left angle of the mandible. There is also increased cortical bone lingually.

Figure 16. Bone infill 12 months following enucleation of the KOT

reported that with practice they were able to irrigate through the tube, although not as effectively as they would have liked. This emphasises the importance of informing the patient about cyst irrigation despite its discomfort and difficulty. It also demonstrates the importance of placing the tube in an easily accessed position, ensuring its width is adequate to allow insertion of the tip of a Monoject™ 12 mL curved tip syringe with space in the lumen for contents to escape. The patients were seen at regular 2 week intervals during the first 2 months to encourage and demonstrate individualised irrigation techniques to obtain sufficient homecare.

Upon histological examination case one and two were lined with parakeratotic cells (Figures 5 and 14) while case three was a lined with orthokeratotic cells (Figure 14). The differentiation between keratin type is important for determining follow up and likelihood of reccurence. The literature reports that KOTs lined with parakeratinised cells are much more agressive and have a much higher recurrence rate than those lined by orthokeratin (Barnes *et al.,* 2005). The case series presented was small and follow-up in these cases were short (<5 years), therefore no conclusion can be made regarding whether there is a difference in reponse to decompression between parakeratinized or orthokeratinized KOT's.

Whilst the relationship between decompression and recurrence rates cannot be established, there does appear to be regrowth of bone around the lesion where initially there was cortical bone perforation (Figure 15). The regrowth of the lingual cortical bone may help reduce recurrence rates following formal enucleation, however the effect of this is unclear in the literature as it is unknown whether this alters the presence of daughter cells in the surrounding tissues (Pogrel *et al.,* 2003). The follow-up in these case series is insufficient to draw conclusions. It would be interesting to know whether the presence of chronic inflammation and the return of a bony margin to the extent of the KOT alter the presence of daughter cells in the adjacent soft tissue.

In conclusion the surgical technique of long-term decompression followed by enucleation of KOTs appears to decrease the size of the lesion that requires removal. We have presented three cases where despite mild patient inconvenience due to daily irrigation of a decompression tube there has been a successful outcome. All of the cases presented have required minimal post operative rehabilitation and have responded well to treatment.

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