

GUIDED BONE REGENERATION IN THE MANAGEMENT OF LATERAL PERIODONTAL CYST USING INDIGENOUSLY PREPARED DFDBA AND AMNION-CHORION MEMBRANE: A CASE REPORT AND LITERATURE REVIEW

Periodontics

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ABSTRACT

The Lateral Periodontal Cyst (LPC) is a rare developmental odontogenic cyst occurring alongside tooth roots. Predominantly located between canine and premolar teeth in the lower jaw, it's uncommon in the upper jaw and very rarely occurs in the maxillary incisor area. In the present case, a 60-year-old woman revealed a painless swelling in her upper front teeth region, and the teeth are vital. X-rays revealed a well-defined radiolucent area alongside the root of tooth #11 root. Surgical enucleation and curettage of the cyst were done, followed by guided bone regeneration (GBR) of the defect using an indigenously prepared DFDBA (Demineralized Freeze-Dried Bone Allograft) bone graft and ACM (Amnion Chorion Membrane) processed and stored according to standard protocols in the central tissue bank, MAIDS New Delhi. Six months later, regeneration of the osseous defect showed in the radiograph the bone defect had completely healed. This case highlights the importance of diagnosis of LPC in the maxillary anterior tooth region, its surgical removal and guided bone regeneration for effective treatment and optimal bone healing. Anticipation of bone reconstruction of lost tissues destroyed by disease is a challenge, but due to the great regenerative potential of Indigenous graft materials, it is possible.

KEYWORDS

Bone, Cyst, Odontogenic, Periodontal, Regeneration

INTRODUCTION

The lateral periodontal cyst (LPC) is a rare non-inflammatory developmental odontogenic cyst located along the lateral root surface of a vital tooth. Classified in the World Health Organization 2017 classification, LPC represents only 0.4% of all odontogenic cysts and 0.7% of jawbone cysts.¹⁻² LPC is typically asymptomatic, often discovered during routine radiographic examination, and appears as a well-circumscribed unilocular radiolucency with a sclerosing margin, commonly found in the mandibular canine and premolar regions (66%) rarely in the maxilla, with the least occurrence in maxillary incisors. There is no gender predilection, but few authors reported slight male predominance. The majority of individuals affected are in their fifth to seventh decade of life. It can also manifest as a multicystic lesion known as a Botryoid odontogenic cyst (BOC), which has a higher recurrence rate of 30.1%.^{3-4, 5, 6}

The common management of LPC is enucleation and curettage, but after the cyst removal, a bony cavity usually remains, which results in less bony support to neighbouring teeth and leads to tooth mobility, bone dehiscence, or fenestration. One method for bone regeneration is guided bone regeneration, which uses various membranes and graft materials. Osteoconductive and osteoinductive properties are possessed by allogenic bone graft materials, such as demineralised freeze-dried bone allograft (DFDBA) by releasing several growth factors and bone morphogenetic proteins (BMPs) progressively encourage bone repair.⁷ To facilitate osteogenic cell migration and tissue regeneration, barrier membranes such as ACM are utilised to arrange bone graft material within defects.⁸ DFDBA particulate graft and ACM were Indigenously prepared, processed and stored according to standard protocols in the central tissue bank, MAIDS New Delhi, in response to the rising demand for regenerative procedures in clinical settings and the rising expense of commercial graft materials.

Case Presentation

A 60-year-old female patient presented in the OPD of the Department of Periodontics with a chief complaint of painless gingival swelling and discomfort in the upper front teeth region, which she started noticing six to eight months back. Her medical history was non-contributory, and she was generally healthy. There were no instances of trauma or foreign objects causing the issue. Upon thorough

examination, a gingival swelling was observed near the upper right central incisor, specifically at the attached gingiva and mucogingival junction (Figure-1a and 1b). The tooth was vital and showed no mobility, and percussion tests were also negative. The surrounding gingiva was resilient and non-inflammatory. Radiographic analysis revealed a well-defined oval, unilocular radiolucent area with well-defined borders, measuring less than 1 centimetre on the mesial side of the right central incisor (Figure 2). Based on these findings, a provisional diagnosis of a lateral periodontal cyst was made.



Figures -1a and 1b Preoperative clinical pictures showing gingival swelling



Figure- 2 Preoperative radiographic view showing oval-shaped well-circumscribed radiolucency on the lateral surface of the right maxillary central incisor.

Informed written consent was obtained from the patient before surgical intervention. Local anaesthesia using 2% lignocaine and adrenaline (1:80,000) was administered. A crevicular incision was made extending from the right to the left lateral incisor, with a vertical releasing incision on the left side to gain excess. A full-thickness mucoperiosteal flap was raised, and the cyst lining was removed and sent for histological examination (refer to Figures 3a to 3d). After excision, an oval-shaped bony defect measuring 3mm x 10mm was left, which was treated by GBR using an indigenously prepared DFDBA particulate graft and ACM (Figure 4a to 4d).



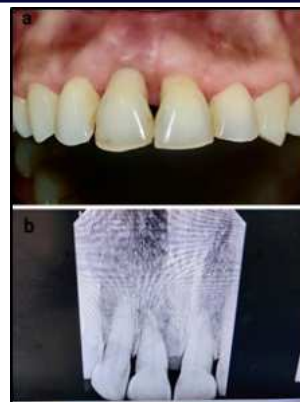
Figures -3a and 3b Intraoperative photographs showing granulation tissue and cystic lining after raising full thickness mucoperiosteal, Figure 3c Showing cystic lining and Figure 3d Showing the bony defect after complete enucleation of the cyst.



Figures 4 (a) and (b) Intraoperative photographs showing the placement of indigenously prepared DFDBA particulate graft into the defect, Figure 4(c) Intraoperative photograph showing graft is covered by indigenously prepared DFDBA particulate graft and ACM membrane and Figure 4(d) showing indigenously prepared DFDBA particulate graft and ACM.

A six-month radiographic evaluation revealed satisfactory bone regeneration and resolution of the lesion, indicating successful healing (refer to Figures 5a and 5b).

On microscopic examination, the studied section shows bits of fibro-collagenous connective tissue cyst wall having a parallel arrangement of collagen fibres with spindle fibroblasts. Three to four layers of non-keratinized stratified squamous epithelium at the focal area are noted. A small bit of tissue is lined by non-keratinized stratified epithelium in an arcading pattern. Varying-sized blood vessels are seen. Diffuse dense chronic inflammatory cell infiltrate is noted with large areas of haemorrhage (Figures 6a and 6b).



Figures 5a and 5b Postoperative clinical photographs after 6 months of follow-up showing healthy gingiva around the right maxillary central incisor and postoperative radiographic photographs showing complete bone fill in the defect

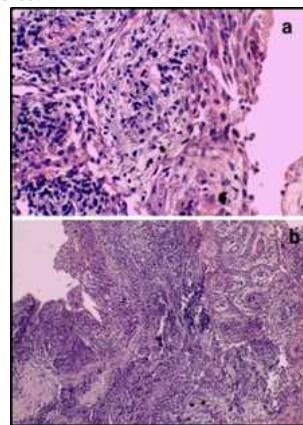


Figure 6 Photomicrograph shows 6(a) haematoxylin and eosin stained section of 40X showing hyperplastic non-keratinised stratified squamous epithelium. The cyst wall is loosely collagenous with dense chronic inflammatory cell infiltrate (as shown by the arrow) and is visible with areas of haemorrhage. 6(b) Microscopic examination of haematoxylin and eosin stained section of 10X shows non-keratinised stratified squamous epithelium with 4-6 cell layer thick lining fibrovascular cyst wall with dense chronic inflammatory cell infiltrate composed of lymphocytes and plasma cells.

Discussion And Literature Review

This case report presents a detailed study of LPC, focusing on its enucleation and guided tissue regeneration using DFDBA particle graft and ACM membrane, as well as its clinical, radiological, and histological features. The earliest documented mention of LPC in literature dates back to 1958, reported by Standish and Shafer.⁹ LPC a rare odontogenic cyst, is often found near the root surface, suggesting its possible origin from Malassez's epithelial rests.¹⁰ LPC is asymptomatic and commonly detected incidentally during routine radiographs, although it may become inflammatory if secondary infected.^{3,9-13} In this case, despite the swelling, the case exhibited the typical characteristics of LPC, including painless swelling near the upper central incisor which is a rare presentation. LPC accounts for less than 3% of odontogenic cysts, with the majority (70%) located in the mandibular canine to premolar regions (table-1). Finding LPC in the maxillary central incisor region is exceptionally rare and accounts for only a small number of cases.¹³⁻¹⁴

Table -1 Data from reported cases of LPC in the literature in different locations

Study	Gender	Mean age (Years)	Race	Location
Krier 1980	Male	37	Caucasian	Mandible
Cohen et al. 1984	Male: 12 Female: 12	54	Caucasian: 13 Nigerian: 11	Mandible: 18 Maxilla: 6
Rasmusson et al. 1991	Male: 21 Female: 11	55	Not reported	Mandible: 28 Maxilla: 4

Buchner et al. 1996	Male	38	Nigerian	Mandible
Carter et al. 1996	Male: 13 Female: 12	46	Caucasian: 13 Nigerian : 8 Not reported: 4	Mandible: 21 Maxilla: 4
Tolson et al. 1996	Male	50	Nigerian	Mandible
Meltzer JA 1999	Female	73	Caucasian	Mandible
Kerezoudis et al. 2000	Male	58	Caucasian	Mandible: 1 Maxilla: 1
Mendes et al. 2006	Male: 1 Not reported: 1	59	Not reported	Mandible: 2
Ortega et al. 2007	Male	31	Not reported	Maxilla
Nart et al. 2007	Female	74	Caucasian	Mandible
Formoso Senande et al. 2008	Male: 6 Female: 5	37	Not reported	Mandible: 3 Maxilla: 8
Nikitakis et al. 2010	Male: 1 Female: 1	61	Caucasian	Mandible: 1 Maxilla: 1
de Carvalho LF et al.	Female	50	Caucasian	Mandible
Siponen M et al. 2011	Male: 2 Female: 2	50	Caucasian	Mandible :4
Ramalingam S et al. 2019	Male	42	Asian	Mandible
Barbirato, D et al. 2022	Male	53	Not reported	Maxilla
Wen, S. Q., et al. 2023	Male	72	Asian	Maxilla

The LPC commonly presents as a unicyst, although there is also a polycystic variant known as the 'botryoid odontogenic cyst', (from the Greek word "botrios") which has been documented in several studies (Standish & Shafer, 1958; Weathers & Waldron, 1973; Lynch & Madden, 1985; Phelan et al., 1988).¹⁵ The botryoid cyst is a histopathological variation characterised by a grape-like multilocular cystic appearance within the bone.¹⁶ Altini and Shear introduced a categorization of LPC into unicystic, multicystic, or botryoid types, all displaying comparable histopathological features.¹⁶ Intriguingly, BOC has high recurrence rates as compared to LPC¹¹. As in the presented case, there was a unicystic radiolucency observed lateral to the root surface and histopathological examination revealed a unilocular cystic appearance therefore, the botryoid variant was ruled out. Distinguishing LPC from other cysts can be challenging such as radicular cysts are commonly encountered and often need to be distinguished from LPC.

Even though managed conservatively, the enucleation of LPC leaves behind a significant bone cavity, which in the long term might affect the periodontal health of related teeth.^[11] Various methods of tissue regeneration have been documented as effective in attaining optimal postoperative periodontal health after surgical treatment for LPC.¹¹ In the present case, we employed the principles of GBR, whereby we filled the bone cavity with an indigenously prepared DFDBA particulate graft and ACM. Indigenously prepared DFDBA has osteoconductive property that provides the space and a substratum for the cellular and biochemical events progressing to bone formation.⁷ The ACM serves as a barrier, preventing epithelial cells from migrating into the bone cavity. Which have antimicrobial properties and an extracellular matrix rich in growth factors thus reducing scarring and promoting wound healing.⁸

CONCLUSION

Unicystic LPC can be diagnosed with proper clinical and radiographical examination, relying on its characteristic features. It can be treated with surgical enucleation along with regenerative techniques to regenerate the new bone in the bony defect for better healing and outcomes. Nonetheless, extensive long-term clinical trials with larger sample sizes are necessary to determine the effectiveness of this treatment approach.

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