Guided Bone Regeneration in the Treatment of a Lateral Periodontal Cyst: 2-Year Clinical and Radiologic Follow-up

Stefano Sivolella, DDS1
Chiara Perin, DDS2
Marco Capecchi, DDS2
Valerio Buongiorno, DDS2
Marialuisa Valente, MD3

Lateral periodontal cysts (LPCs) are rare odontogenic cysts of developmental origin. A 52-year-old man presented with an asymptomatic gingival swelling located between the mandibular left canine and first premolar, both of which were vital. Radiography showed a well-circumscribed radiolucent area and loss of the lamina dura around the tooth socket in contact with the lesion and of the interproximal buccal bone. The lesion was enucleated. The defect was immediately grafted with a 1:1 mixed autologous and heterologous bone graft covered with a collagen membrane. Histology confirmed the diagnosis of LPC. At 12- and 24-month clinical and radiologic follow-up, complete bone and periodontal healing was found, with no sign of recurrence. Int J Periodontics Restorative Dent 2018;38:747–754. doi: 10.11607/prd.2767

The lateral periodontal cyst (LPC) is defined as an odontogenic developmental cyst.1 It is an uncommon lesion, accounting for about 0.4% of all odontogenic cysts and 0.7% of all cysts in the jaw bones.2 The main features of LPC are listed in Table 1. The treatment of choice seems to be simple enucleation3–8 followed by spontaneous healing. Some authors have reported successfully using bone grafts to fill the defect left after enucleating an LPC.8–11 Whether a graft should be used to fill a defect secondary to the removal of a cystic lesion remains debatable.12,13 The decision can depend on the size and morphology of the residual defect,6 particularly the absence of residual bone walls around the defect,9 or the exposure of the roots of adjacent teeth.9,11 The aim is to maximize the host’s potential for osteoinduction and osteoconduction and ultimately to facilitate bone regeneration.8,9 The decision may also be influenced by the diagnosis, suspected or histologic (if a preoperative incisional biopsy is performed). The morphology of the residual defect can be predicted by accurate clinical and imaging tests.3 Cone beam computed tomography (CBCT) is the most accurate method for examining the maxillofacial region preoperatively, allowing for a careful assessment of maxillofacial lesions, their extent, and how they...
relate to one another.\textsuperscript{14} It is also the method of choice for the diagnosis, treatment, and follow-up of LPC.\textsuperscript{15,16}

The aim of this case report was to describe the outcome of a tissue regeneration approach based on guided bone regeneration (GBR) principles of a mandibular LPC, comparing the pre- and postoperative clinical and radiologic findings, with a 2-year follow-up.

### Case Presentation

A 52-year-old man, a smoker suffering from hypertension and routinely taking low-dose aspirin and beta-blockers, was referred to the authors by a colleague for an asymptomatic gingival swelling approximately 1 cm in diameter, elastic in consistency, with well-circumscribed margins, located in the vestibular region between the mandibular left canine and first premolar (Fig 1). The patient reported no trauma involving this site and that he had been unaware of the lesion until about 2 months earlier. The patient reported no symptoms. He experienced no pain on palpation or percussion of the teeth, and there were no periodontal pathologic signs or bleeding on probing. The adjacent teeth were

---

**Table 1 Main Features of Lateral Periodontal Cyst**

| Demographic\textsuperscript{3–7,9,33,37} | No sex predilection (1.3 men : 1 woman)  
Age: 40–70 y; peak in prevalence in the sixth decade |
|---|---|
| Frequency\textsuperscript{3,5,9,33,37} | 0.4% of all odontogenic cysts  
0.7%–1% of all cysts of the jaw bones |
| Anatomica\textsuperscript{1,5–7,9,15,33,37} | Site/Location: alveolar bone, along the lateral surface of a vital tooth; 73.9% mandible (most often in the canine-premolar region); 26.1% maxilla (most in the anterior region)  
Adjacent teeth conditions: vital; often divergence of the roots; no root resorption |
| Clinical\textsuperscript{3–7,9,15,33,37} | Symptoms: generally asymptomatic; sometimes gingival swelling  
Clinical aspect: sulcular probing does not communicate with the cystic lesion; expansion of the overlying bone can occur  
Radiographic aspect: well-circumscribed radiolucency, presenting a round, oval, or teardrop-like shape and sclerotic margins; on the lateral surface of the root of vital teeth; preferentially between the apex and the cervical margin of the teeth |
| Histopathologic\textsuperscript{2–4,33,37} | Typical histologic description: cyst cavity is lined by a thin (1–5 cells thick) nonproliferating cuboidal to stratified squamous nonkeratinizing epithelium and supported by a connective tissue; usually free of inflammation; two main characteristic features: (1) epithelial thickenings or plaques and (2) glycogen-rich clear cells either in plaques or in the superficial layers of the lining of epithelium  
Variations: multicystic lesion, botryoid (BOC) |
| Origin\textsuperscript{3–6,9,15,33,37} | Development cyst  
Remnants of odontogenic epithelium  
Three possible sources of the epithelial lining: (1) reduced enamel epithelium of an erupting tooth; (2) rests of the dental lamina; (3) rests of Malassez  
Primordial cyst of a supernumerary tooth germ |
| Differential diagnosis\textsuperscript{3,5,6,33,36} | Gingival cyst  
Lateral radicular cyst  
Keratocystic odontogenic tumor  
Pseudocyst  
Radiolucent odontogenic tumor  
Glandular odontogenic cyst  
Periodontal socket |
| Treatment\textsuperscript{3,5,10,20,21,33,37} | Complete surgical enucleation  
Bone regeneration |
| Recurrence\textsuperscript{3,5,6,9,33} | Rare (3%–4%)  
BOC: 17%–33% |
intact and responded positively to the electric vitality test. A periapical radiograph (Fig 2a) revealed a well-defined, unilocular, rounded radiolucent area between the mandibular left canine and first premolar, the roots of which were intact and were not displaced. CBCT (NewTom 3G QR) (Figs 2b and 2c) clearly showed the radiolucent lesion between the roots of the two teeth, with loss of the lamina dura surrounding the roots of both teeth at the interface between the teeth and the lesion. The vestibular bone wall was also missing. There was no evidence of any displacement of the teeth or root erosion. The diagnostic hypothesis was LPC.

After informed consent was obtained from the patient, the mandibular lesion was enucleated surgically under local anesthesia and conscious sedation. A full-thickness flap was fashioned from the mandibular left lateral incisor to the first molar. The thin mucoperiosteal flap was gently detached from the wall of the cyst and an area of approximately 3 to 4 mm of healthy bone was exposed around the lesion (Fig 3a). A thin bone septum remained below the gingival papilla, between the canine and first premolar (Fig 3b). The enucleated le-
sion was approximately 10 × 7 mm in size (Fig 3c). It was placed in formalin and sent to a pathologist for histologic examination. The bone defect measured approximately 10 mm in height, 4 mm in width, and 5 mm in depth. Chips of autologous bone obtained with a bone scraper (Micross, Meta CGM) from the ipsilateral retromolar area (Figs 4a and 4b) were mixed in a ratio of approximately 1:1 with deproteinized bovine bone (Bio-Oss, small particles, Geistlich) and with venous blood drawn from the patient (Fig 4c). A resorbable collagen membrane (Bio-Gide, Geistlich) was trimmed and adapted to the defect (Fig 4d). The graft was inserted in the bone defect, slightly overcontouring the area and extending over the roots of the adjacent teeth (Fig 4e). The graft was covered with the resorbable collagen membrane, which was positioned to cover approximately 2 mm of the bone profile surrounding the lesion and stabilized with resorbable suture (5-0 polyglycolic acid, Safil Quick, B.
Braun Melsungen) (Fig 4f). After an incision was made in the apical periosteum, the flap was repositioned and fixed with a synthetic monofilament suture (5-0 Ethicon, Johnson & Johnson). The patient was given routine instructions on managing the surgical wound and appropriate medical therapy (antibiotics and analgesics). At the postoperative clinical follow-ups after 1 week and 1, 6, and 12 months, there was no evidence of problems with the healing of the mucosa, the mandibular left canine and first premolar remained vital, and periodontal probing was normal (Fig 5). CBCT at 1 year (performed using the same device and parameters as before the operation) showed complete filling of the bone defect, coverage of the roots of the adjacent teeth, and a reformed vestibular bone wall (Fig 6). The overcontouring had disappeared completely, leaving a regular vestibular profile. Clinical and radiologic (periapical radiograph) examination at 2 years confirmed the previous observations (Fig 7).

Immediately after surgery, the specimen was fixed in formalin, dehydrated in crescent ethanol series, and embedded in paraffin. Sections 4- to 5-μm thick were stained with hematoxylin-eosin and periodic acid Schiff for histologic examination.

Histology showed a cystic cavity lined with a thin nonkeratinized squamous epithelium that sometimes penetrated the noninflammatory fibrous tissue of the wall forming invaginated plaques; no mitoses were seen (Fig 8). The clinical diagnosis of LPC was confirmed by the histologic examination.
Discussion

The preferred treatment for LPC, and for odontogenic jaw cysts in general, consists of enucleation of the cyst and primary closure, also called a Partsch cystectomy. The enucleation of jaw cysts of various sizes with safe closure of the surgical wound is usually considered a standard procedure. Meltzer reported treating a case of LPC in a 73-year-old woman without using any grafting or barrier techniques, achieving complete bony regeneration of the defect a year later. Angelopoulou and Angelopoulos described a case of mandibular LPC enucleation, reporting that periapical radiography showed an almost complete bone filling after 1 year.

Other authors have reported using resorbable and nonresorbable grafts for bone defects secondary to the removal of LPCs and other cysts with good outcomes. Nart et al. treated a mandibular LPC located between the mandibular right canine and first premolar in a 74-year-old woman. The lesion was about 12 mm in diameter, and no periodontal probing was present before surgery. The buccal plate was missing almost up to the apex of the adjacent teeth. No tomographic images were obtained, only pre- and postoperative periapical radiographs. At the time of surgery, GBR was applied to treat the defect, using a decalcified freeze-dried bone allograft and a bovine, cross-linked, collagen membrane. The clinical and radiologic follow-up was reported up to 7 months postoperatively, when a surgical reentry was performed. Lerhaupt et al. reported on a mandibular LPC that created a through-and-through bone defect in the buccal and lingual walls. This defect was also treated with a decalcified freeze-dried bone graft to maximize healing and limit the risk of recurrence. After 30 months, periapical radiography revealed good healing. A case of gingival cyst in an adult was presented by Kelsey et al. The treatment consisted of a combined regenerative approach to address the hard tissue defect associated with the lesion and the soft tissue defect due to excisional biopsy. They used a freeze-dried bone allograft, hydrated with sterile saline, covered with a bovine tendon collagen membrane. A nonresorbable grafting material was proposed by Meseli et al. After enucleation of a maxillary LPC, an alveolar bone defect in the form of a tunnel from the buccal to the palatal side was found. The authors grafted the bone cavity with bovine-derived xenograft, followed by placement of a resorbable collagen membrane. Clinical and periapical radiographies were presented at the 6-month follow-up, showing a satisfactory outcome.

The features shared by the present case and the above-mentioned cases of LPC treated with a GBR procedure are the presence of a large bone defect characterized by one or two residual bony walls, with exposure of the roots of the adjacent teeth and loss of periodontal tissue. The rationale behind the chosen treatment lies in the excellent clinical and radiographic results in terms of periodontal regeneration in the case of intrabony defects. Osteoconductive bovine-derived xenografts provide a scaffold for the patient’s regenerative cells in the bone cavity. The migration to the bone cavity of cells without regenerative properties is prevented by the collagen membrane, which acts as a physical barrier.

The use of a mixed 1:1 graft consisting of autogenous and heterologous bone stemmed from the need to take advantage of the properties...
of both materials at the same time: vital bone cells, growth factors, natural bone scaffold coming from the autogenous bone, scaffold properties, and volume maintenance over time thanks to the deproteinized bovine bone (DBB) component of the graft. Previous studies on DBB grafting for ridge preservation have demonstrated a lesser reduction of the alveolar ridge with DBB grafts and a better preserved graft volume after the addition of Bio-Oss to autologous bone.\textsuperscript{24,25} The volumetric reduction is also significantly influenced by the ratio of Bio-Oss to autogenous bone.\textsuperscript{26} Urban et al\textsuperscript{27} presented a successful prospective case series in which they examined the use of a resorbable natural collagen membrane with a 1:1 mixture of autogenous bone and anorganic bovine bone-derived mineral (ABBM) for lateral ridge augmentation and subsequent implant placement. Mordenfeld et al\textsuperscript{28} reported that using a mixture of 60:40 (deproteinized bovine bone:autogenous bone) was associated with significantly less graft width reduction after lateral ridge augmentation than when a mixture of 90:10 was adopted. Simon et al\textsuperscript{29} published a histologic and histomorphometric study on the efficacy of a 1:1 mixture of deproteinized bovine bone mineral (DBBM) and autogenous bone associated with an expanded polytetrafluoroethylene (e-PTFE) membrane for vertical ridge augmentation in humans. The authors found that using DBBM had a positive effect in enhancing the lasting stability of the vertically augmented bone thanks to its very slow resorption and replacement by new bone. Finally, two different graft mixtures for maxillary sinus augmentation were studied, consisting of autologous bone and anorganic bovine bone in ratios of 50:50 and 20:80. Histologic, histomorphometric, and immunohistochemical analyses conducted on bone core biopsy samples after a 6-month healing period showed a higher cellularity, particularly regarding the number of osteocytes, in specimens from the 50:50 ratio group.\textsuperscript{10}

The use of a slow resorbable graft as a filler material may be contraindicated in case of bony lesions of unknown entity. Over the long term, recurrences could be overlooked or misdiagnosed due to the filler material mimicking bone regeneration (radiographically). On the other hand, the lack of evidence of radiotransparency in two- or, better, three-dimensional postoperative radiologic examination normally confirms the absence of recurrence. A surgical reentry is not recommended in absence of any clinical and radiologic signs. In the present case, the radiologic and clinical data were consistent with the preoperative diagnosis of LPC.

The size of the defect may also influence bone healing and defect filling. LPCs are usually no more than 10 mm in diameter. The multilocular variant, or botryoid cyst, is generally larger and may even reach several centimeters in size,\textsuperscript{16,31–33} consequently requiring bone grafts more often. Frei et al\textsuperscript{16} reported using CBCT for the preoperative and 9-month postoperative assessment of a patient with a botryoid odontogenic cyst in the posterior mandible. Partial reossification was observed in this case, in which no graft was used.

CBCT is useful in assessing jaw bone lesions for treatment planning and follow-up.\textsuperscript{14} On any kind of radiograph, it is difficult to differentiate between regenerated physiologic jaw bone and persisting bone substitute. The method allows for assessing the 3D filling of the postoperative defect or recurrent disease\textsuperscript{34–36} without any need for surgical reentry, as described by Nart et al\textsuperscript{9} and Meltzer.\textsuperscript{18}

Conclusions

In this case report, the authors describe the use of tissue regeneration in the treatment of an alveolar bone defect secondary to LPC enucleation involving the roots of adjacent teeth and characterized by loss of buccal bone. The outcome on CBCT at 1 year and observation at 2 years was satisfactory, without signs of recurrence and with a complete alveolar bone and periodontal ligament regeneration.

Acknowledgments

The authors reported no conflicts of interest related to this study.

References


