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Natural Bone Regeneration with L-PRF and Healing Advantages after Enucleation of Large Radicular Cyst in Lower Jaw: Case Report

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Case Report

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ABSTRACT

Objectives: The aim of the study is to show how cysts of larger dimensions can be treated, achieving early recovery with good predictability results, a low surgical impact on the patient and a follow-up of modest clinical relevance through high-level technological procedures in which the fibrin scaffold represented by L-PRF (Leukocyte–Platelet Rich Fibrin) is the biological signature that promotes the rapid healing.

Material and Methods: Microsurgery procedures were used for bone regeneration in a large cystic lesion. The cystic lesion was initially treated with LASER LBO 532 nm with the aim of obtaining debridement of the cystic lumen. Subsequently the osteolytic lesion was filled with L-PRF (Leukocyte and Platelet Rich Fibrin) membranes; L-PRF is one of the 4 main families of platelet concentrates for surgical use, and it is frequently used in oral and maxillofacial surgery as a surgical adjuvant to improve healing and promote tissue regeneration. In order to direct and stimulate bone regeneration further, the patient underwent postoperative sessions with Combined Magnetic Fields (CMFs).

Results: Using this surgical procedure, positioning of the implants was possible on regenerated bone after only 4 months. Histological exams were made harvesting bone samples during implants placement.

Conclusion: L-PRF was used for the regeneration of large mandibular cysts, taking advantage of the regenerative abilities of blood in addition to those of physical medicine. This resulted in a notable time reduction in the regeneration of vast bone lesions.

INTRODUCTION

Ontogenetic maxillary cysts are lesions which are characterized by a liquid filled cavity, externally delimited by a connective fibrous capsule and internally covered by epithelium.

Inside these cavities, which are well delimited by a mono-layer or pluristratified epithelium, ortho or parakeratinised, secernent or non-secernent, a yellowish liquid is found which is rich in cholesterine crystals.

If the liquid content of the cysts encounters infection, the liquid assumes a purulent aspect [1]. The maxillary cysts grow, compressing the surrounding structures that consequently lead to bone or dental degradation.

Their classification has been subject to numerous debates, however OMS has now been universally acknowledged WHO [2].

Despite the fact that the lesions are frequent, their accretion mechanism is not clear. However, two theories have been proposed, trying to explain this:

1. Hydrostatic theory: Metabolism and cellular turnover waste products, which are deposited inside the cystic lumen, would lead to an increase in osmotic pressure that would consequently cause liquid recall from the pericystic space to the intracystic space. Hydrostatic pressure, created by enlargement of the cyst, would activate in this way the osteoclastic system with consequent bone resorption.

2. Prostaglandin theory: The PGE-2 prostaglandin and the prostacyclins produced by the connective capsule and by the epithelial cyst tissue would intervene in the cystic accretion mechanism [3-5]. The release of these peptides would constitute the base of osteoclast activation.

The treatment of maxillary cysts, both of disembriogenic and inflammatory origin is essentially surgical. The first choice surgical approach is most definitely the complete enucleation of the cystic lesion according to Partsch II, in which careful attention must be paid to complete elimination of the cystic wall. A second surgical method is the Partsch I marsupialisation technique which involves the creation and maintenance of a communication of cystic space within the oral cavity.

However, others prefer to use a combination of the two techniques instead, which involves marsupialisation first, followed by complete enucleation of the cyst [1].

Whatever technique is chosen, rigorous respect of asepsis is fundamental.

CLINICAL CASE

The clinical case in question refers to a residual cyst in a male patient of 60 years of age, in a good state of general health shown by his recent medical history and the hematological test. No allergies to drugs or orthodontic materials were reported.

The patient came spontaneously to our attention because of his symptoms, which were pain during chewing and intermittent episodes of paresthesia in lower left hemiface. Objective signs observed during our visit were mild swelling and pain with palpation in buccal and submandibular area.

MATERIALS AND METHODS

The patient came to our attention with a cystic radiological lesion of the mandible which extended up to the inferior cortical, consequently affecting the mandibular canal **(Figure 1).**

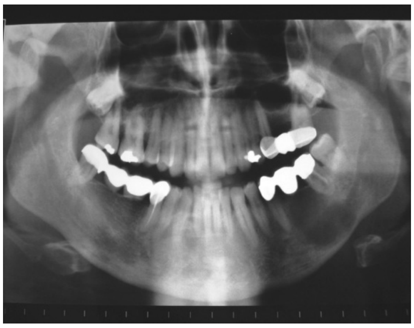

Figure 1. OPT: Cyst in low jaw with the involvement of the inferior alveolar nerve.

Examination of the patient's remote medical history showed that he had undergone extraction of tooth, 20 years before.

The residual bone cyst is defined by the World Health Organisation as a periapical inflammatory lesion that lingers and continues to grow even after the extraction of the necrotic tooth that caused it.

Its onset is ascribed to an incomplete removal of the epithelial wall of the periapical lesion that preceded it, the persistence of which causes a relapse of the lesion.

It presents itself radiographically as a unilocular radiotransparent zone with margins that are clearly distinguishable from the surrounding bone.

Its development does not differ from that of other cysts, therefore causing bone resorption [2]. Before the start of surgery, the technique involves preoperative treatment of the area with CMF.

Access to the lesion takes place laterally with triangular flap design, designed with principal crestal incision, at full thickness, and distal releasing incision, to avoid involvement of the mental branch of the inferior alveolar. After disconnection, access is gained through a lateral bone window obtained with piezoelectric osteotomy. The toilette of the site was achieved through the use of LBO 532 nm laser in 2, 5 watt surgical mode, 20 mj fluence.

With the LASER action, micro-photoablation and decontamination of the cystic cavity are obtained and finally it performs an action of photo-induced induction on the biological elements with exaltation of the reparative capacities of the cellular components implicated in the first phase of tissue repair [6-11].

The decontaminating and photobiomodulation action was obtained using the following regenerative procedure:

Laser procedure

Power 1, 25 Watt - Frequency 15 Hz, Fibre of ø 320 micron - defocalised to 2 mm distance per 1 min. 5 consecutive irradiations in 2 sessions during surgery. Theoretical density power 1865 w/cm^2, fluence/theoretical pulse 124.33 J/cm^2, theoretical cumulative fluence 746 J/cm^2.

The lumen of the cystic cavity is blasted with L-PRF, one of the main 4 families of platelet concentrates for surgical use [12,13], which provides a dense and highly polymerised fibrin scaffold, which, after having filled the cavity, allows biophysical and biochemical bridging between all bone margins of the cystic lesion, promoting tissue regeneration [14,15]. The relationship of continuity obtained through the filamentous proteins of the scaffold allows an electrical communication system between the cystic margins, directing the subsequent formation of the collagenous network and therefore reparative neo angiogenesis. Neo angiogenesis follows the vectors imposed by the collagenous network which directs the reparative information from one margin to the other in one direction, as a diode would do **(Figure 2)** [16].

Figure 2. OPT: 1 month after the intervention of excision and regeneration with L-PRF.

The L-PRF therefore has the role of imposing a fibrin scaffold, which will be then induced by Combined Magnetic Fields (CMFs) [17], which initiates a morphogenetic phase that recreates the inferior alveolar position.

The postoperative phase sees the induction through CMF of reparative osteo-morphogenesis [7]. The induction with CMF in this phase has different objectives, starting with the alignment of prime fibrin molecules and collagen **(Figure 2)** and the reactivation of osteogenetic chemical cascades and modelling of the osteoclastogenetic ones [18].

Postoperative CMF procedure

1. Bone regeneration programme: 6 cycles of therapy
2. Antibacterial and antimycotic program
3. SMI

RESULTS

The recovery of the cystic area took place in approximately four months while following a radiologically reparative route **(Figures 1, 2 and 3)**, showing the bone deposition to be progressive and guided by the communication system imposed by the fibrin scaffold.

Figure 3. OPT: Control after 3 months.

After only 120 days **(Figure 4)**, the level of bone maturation achieved allows the positioning of implants **(Figure 5).**

Figure 4. OPT: Control after 4 months.

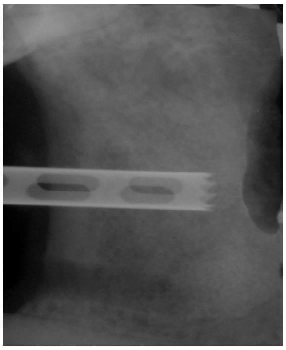

Figure 5. OPT: Control during bone harvesting on 4 months.

Probing and histological tests carried out during the positioning of the implants phase served to highlight bone tissue with lamellar and vascular organization superimposed on healthy bone, with some areas that underwent maturation which proves the propensity of the tissue to redistribution **(Figures 6-10).**

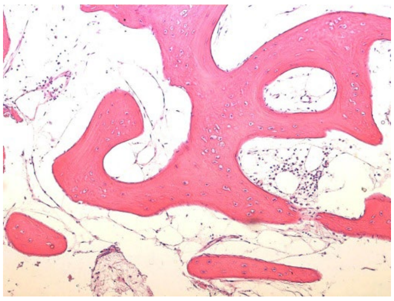

Figure 6. Regular trabecular structure in cancellous bone (Hematoxylin- Eosin 50X).

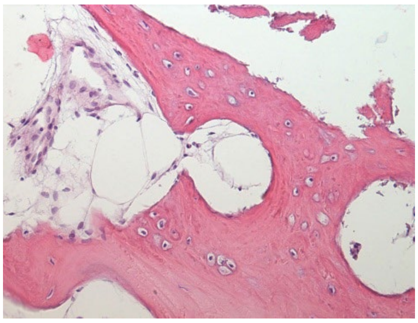

Figure 7. Osteocytes lacunae containing evident and vital osteocytes (Hematoxylin-Eosin 200X).

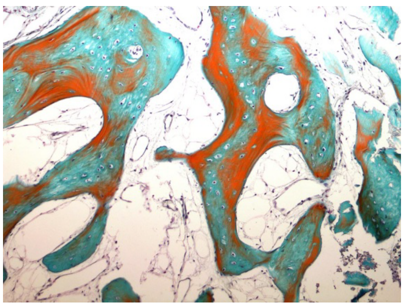

Figure 8. Papanicolaou stain shows better regular lamellar structure (50X).

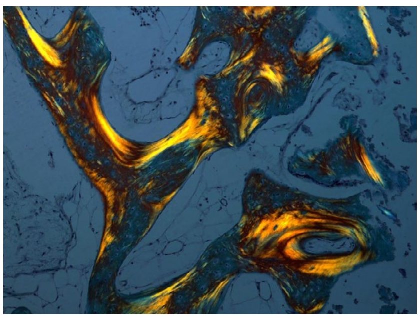

Figure 9. The polarizing microscope detects a normal laminar Haversian structure (Polarization of Trichrome, 80X).

Figure 10. Final restoration over implants.

DISCUSSION

Even if this kind of operation presents an important demolition of hard tissues, the patient had an absolutely fine post-operative progress without any neurological consequence to the mandibular nerve.

In only two weeks an optimal healing of soft tissues has been achieved, and in almost four months the complete healing of the huge bone gap, as showed in histological results.

Maxillary cysts, whether they are of an inflammatory or primitive nature, are commonly conditions encountered in clinical practice as they can affect all ages with no prevalence of sex or race. The major therapeutic problems are found in mandibular cysts of larger dimensions, where often surgical difficulties arise due to the large quantities of resorbed bone tissue, thus making an estimation of bone recovery time impossible with repercussions on postoperative rehabilitation therapy time. The high prevalence of large mandibular cysts encountered has thus led to the necessary development of a prudent and conservative surgical technique, supported by operatory stereo-microscope, which could be simultaneously definitive and could respond to different clinical requirements. The materials used are LASER LBO 532 nm and Complex Magnetic Fields (CMF), while the biotechnical ones are from L-PRF. L-PRF is a new concept of natural guided regeneration; L-PRF membrane release a significant quantity of autologous growth factors (particularly PDGF-AB, TGFβ and VEGF) [19], cytokines and healing proteins (fibronectin, etc.) during more than 7 days *in vitro* [20]. It is known that at least 30 growth factors and 7 antimicrobial proteins are located into Alpha granules, and these, placed into the platelets, are their main storage which play an active role in the process of healing [21]. L-PRF improves the early healing phases (hemostasis and epithelial closure), reducing the inflammatory process and the risk of infection [22]. This material is particularly useful and efficient in complex situations, when some walls are destroyed and the bone regeneration is difficult [23].

After the operation, the patient did not have any episode of paresthesia, nor continuous neither intermittent. Even through radiological images, a morphogenesis of the channel can be seen, showing that this protocol, with non-invasive procedures and without the use of any filler but the natural clot (obtained by L-PRF), has led not the repair but the complete regeneration of the damaged area with clear reduction of the resorption phase, since any solid alloplastic harvest has not been used [24].

CONCLUSION

Surgical technique, new technologies and LPRF have proved valuable in the repair of the surgical area of a full-thickness mandibular cyst operated microscopically, notable for very reduced recovery times and for the quality of bone obtained.

Histology has shown such well-structured early repair that it was possible to carry out implant prosthesis without difficulty 120 days after the cyst removal. This method shows increased predictability compared to the standard techniques and a notable reduction of surgical risk and postoperative symptoms, thus increasing satisfaction both of patient and surgeon.

Our results let us realize that the efficacy of this protocol has been confirming both in the healing time and in recovered tissue quality. Of course the reduction of surgical impact and the solution in short times of pathological situations are perfectly in order with even more demanding requests of our patients. Further studies will be necessary with the contribute of the scientific community to confirm the effectiveness of the obtained results.

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