Original Article

Interdisciplinary management of large Periapical lesion with endodontic origin – a short review

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ABSTRACT

Periapical wound recuperating is an unpredictable and dynamic procedure of supplanting devitalised and missing cell structures and tissue layers. The way toward mending includes regenerative and repair stages. The regeneration is when healing takes place by proliferation of parenchymal cells, including primary and secondary healing. Whereas repair is when healing takes place by proliferation of connective tissues. The periapical surgery is believed to be the preferred approach in the management of large periapical lesions, which comprise of periapical abscess, radicular cysts, etc. It is well known that the essential three growth factors to achieve tissue healing are platelet derived growth factors, vascular endothelial growth factors, and transforming growth factors. However, the fibrin matrix of PRF gets slowly resorbed, and releases the growth factors such as PDGF, TGF, VEGF maintaining a viable and everlasting field to enhance the healing. The combination of bone graft along with PRF had the potential to enhance the bone formation. In investigation of the tissue regeneration of periapical tissues, these factors have been properly consolidated and applied to the target area to accomplish faster healing of the large periapical lesions.

Keywords: CBCT indices, bone graft, GTR membrane platelet-rich plasma, platelet rich fibrin, plasma rich in growth factors, concentrated growth factors.

Introduction

Periapical lesions develop as squeals to pulp diseases. They regularly happen without a scene of acute pain, and are found in routine radiographic examinations. Cysts occur within periapical lesions in the ranges of between 6 and 55%. The examination of periapical tissues, because of allowing the clinicians to diagnose the disease, check the progression or regression of the disease, and evaluate the treatment outcomes, is of high importance. [1-5] developed the most popular periapical index (PAI), which was based on two dimensional (2D) Periapical radiograph. [2,6-11] was the first to create the periapical index (CBCT PAI) in the light of criteria set up from the estimation related to the periapical radiolucency interpret on CBCT scans. [3,12-16] presented periapical and endodontic status scale (PESS) based on the periapical and Endodontic treatment quality assessment utilizing CBCT. Tissue regeneration is a complex process of healing and tissue growth, which involves the different biological elements and strategies. These include use of PRP, PRF, PRGF, CGF, GTR membrane, bone graft and combination of bone graft with platelet concentration [4,17-21]. These are performed to reconstruct bony defects of the upper and lower jaws and for the augmentation of the large bone defects. For recovery of the periapical tissues after periapical medical procedure, one of the vital prerequisites is enrollment and differentiation of the undifferentiated cells into pre-osteoblasts, pre-PDL cells and pre-cementoblasts. Several studies have reported beneficial treatment outcomes in terms of the enhanced bone and soft tissue regeneration [5,22-26].

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Indices

The periapical tissue evaluation analysis of the existing indices and the application of periapical and Endodontic status scale [PESS] have been in clinical practice [3,27-30]. CBCT PAI and complex periapical indexes were analyzed in detail using existing literature. Mostly, these two indices have been recommended for periapical surgery [6,31-34].

COPI

The CBCT PAI offers an accurate diagnostic method for use with high resolution images, which can reduce false negative diagnosis, minimize the observer's interference, and increase the reliability of epidemic studies, especially those referring to large periapical lesion prevalence and severity. CBCT PAI was the first periapical index developed by [2,35-37], which was based on CBCT technology.

Periapical bone destruction in CBCT was measured in three planes (buccopalatal, mesiodistal and diagonal) using dedicated software. CBCT-PAI score was determined by a large extension. CBCT-PAI consists of five categories plus two additional variables. From these CBCT-PAI indices, score 5, E, D have been commonly used for the periapical surgery (Table 1).

Table 1: Cone beam computed tomography periapical index score

SCORE	Quantitative bone alteration in mineral structure
0	Intact periapical bone structure

1	Diameter of periapical radiolucency>0.5-1mm
2	Diameter of periapical radiolucency>1-2mm
3	Diameter of periapical radiolucency>2-4mm
4	Diameter of periapical radiolucency>2-4mm
5	Diameter of periapical radiolucency >8mm
E	Expansion of periapical cortical bone
D	Destruction of periapical cortical bone

COPI

Complex Periapical Index (COPI) has been designed for the radiographic identification and classification of periapical bone lesions in case of large periapical lesions [6,38-41]. COPI is composed of three parameters that are related to the characteristics of the periapical lesion (1) size of the lesion(S),which may be directly related to endodontic treatment, (2) The relationship between root and lesion(R),Which is a significant pre-treatment factor, because the result of endodontic lesion treatment on multirooted teeth has been worse, (3) The bone destruction's location (D),that is probable to be dependent on more intricate endodontic or surgical treatment because of the relationship between radiolucency and the important anatomical structures or the destruction of the cortical bone [2]. The Complex Periapical Indices (COPI) have been designed for the identification and classification of periapical bone lesions in case of periapical lesions: S, R, and D evaluation scale (Tables 2,3, & 4).

Table 2. S (Size of the radiolucent lesion)

S0	Widening of the periodontal ligament not exceeding two times the width of the lateral periodontal ligament
S1	Diameter of small well-defined radiolucency up to 3 mm
S2	Diameter of medium well-defined radiolucency 3 -5 mm
S3	Diameter of large well-defined radiolucency >5 mm

Table 3. R (Relationship between root and radiolucent lesion)

R0	No radiolucency, when widening of the periodontal ligament is not exceeding two times the width of the lateral periodontal ligament
R1	Radiolucent lesion appears on one root
R2	Radiolucent lesion appears on more than one root
R3	Radiolucent lesion with involvement of furcation

Table 4. D (Location of bone destruction)

D0	No radiolucency, when widening of the periodontal ligament is not exceeding two times the width of the lateral periodontal ligament
D1	Radiolucency around the root
D2	Radiolucency is in contact with important anatomical structures
D3	Destruction of cortical bone

Regenerative Material used During Periapical surgery-

Regenerative materials have been classified into various types, viz,

1. Bone Graft
2. Autologous platelet concentrates (PRF, PRP, PRGF, CGF)
3. Combination of Bone Graft and PRF.

Bone Graft

Bone grafts are used as restorative and scaffold to facilitate bone formation, and promote wound healing. These bones graft one of the regenerative materials used in large periapical lesions. These grafts are bio absorbable materials and have no antigen-antibody reactions. These bone grafts act as a mineral pool which induces new bone formation. In bone grafting which is a surgical procedure, the missing bone is substituted by the materials from the patient's own body, instead of artificial, synthetic, or natural substitutes. When there is enough space, the bone tissue can regenerate there. Therefore, bone grafting was possible here. While growing, the natural bone substitutes the graft material entirely, making a new fully integrated bone region [7,42-46].

PRP

In 1998, PRP was the first generation of platelet concentrates which was used in clinical practice by Marx. PRP is made by drawing peripheral venous blood from the patient's arm. An anti-coagulant is instantly added to the harvested blood to stop clotting, and after that the two-step gradient centrifugation method is used to concentrate the platelets. In this procedure, the first spin which is called the hard spin, separates the red blood cells (RBCs) from the plasma containing platelets, leukocytes and clotting factors. The platelets and leukocytes, from the plasma are separated by the soft spin. The soft spin creates PRP, and detaches it from the Platelet Poor Plasma (PPP). It is also free from the intervention linked with the large number of RBCs.

Commonly, with the systems which are commercially available, in order to separate the RBCs, buffy coat layer and plasma into three distinct layers, a one-step method is used. The collection of buffy coat including platelets and leucocytes makes PRP.

Platelet-poor plasma as the top plasma layer, is taken away. Therefore, to attain guided tissue regeneration, the PRP is injected into the surgical sites [8,47-50].

PRF

The second generation of the platelet concentrates was PRF which was used in clinical practice by [9,51-53]. The preparation of PRF is similar to PRP consisting of collecting peripheral venous blood from the patient's arm. Except that, no anti-coagulant is used during the blood harvesting. To activate the platelets, the blood is centrifuged immediately for 10 minutes after the collection. This leads to the start of the coagulation cascade. The blood is divided into three distinct layers after the centrifugation: cellular platelet poor plasma on top, a PRF clot in the middle, and RBCs at the bottom of the test tube. After the centrifugation, the PRF clot is obtained 2 mm below the lower dividing line, and the other layers are taken away by using scissors [10,54].

PRGF

The third generation of the platelet concentrates was PRGF which was applied in clinical practice by [11]. A small amount of the patient's peripheral venous blood which is obtained by a one-step centrifugation using sodium citrate as the anti-coagulant, is applied to prepare PRGF. PRGF continuously extricates a pool of proteins and growth factors, which speed up the soft tissue healing along with the bone regeneration, after the activation [12]. It has powerful bacteriostatic properties and excellent therapeutic potentials. The fibrillar and cellular scaffold-like PRGF can be used to fill tissue defects as a part of periapical surgery [13].

CGF

CGF was the fourth generation first developed by [14]. Similar to PRF, CGF is created using a one-step centrifugation method, but it requires a special programmed centrifuge with Medifuge MF200. These latest regenerative materials are used in large defects. CGF has positive effects on the ISQ value at the first and fourth week. Further laboratory studies are required to illustrate the positive effects of blood products on the osseointegration process at the histopathological level [15].

GTR Membrane

Periradicular surgery has been established as a treatment option in endodontic surgery. The main objective of this surgery is getting periradicular tissue regeneration. Its another objective is creating new attachment apparatus without any dangerous noxious agents within the physical limits of the affected root. Although, in numerous cases, the endodontic lesion includes an accompanying marginal periodontal lesion which can the healing success more complicated [16]. The guided tissue regeneration (GTR) principle using a barrier membrane has been widely scrutinized and successfully applied in periodontology. Therefore, it aided in endodontic surgery. The current paper presented a classification system of endodontic and periodontal lesions regarding the application of the membrane technique and reviewed the related literature pertinent to this classification system. At this moment, GTR techniques may progress the result of bone regeneration after surgical endodontic treatment carried out in cases with certain periapical lesions, such as large periapical lesions, and through-and-through lesions. It is expected that using a resorbable membrane over a non resorbable membrane or a graft alone may result in favourable outcomes. Large-scale prospective clinical research studies are required to further assess the possible benefits of GTR techniques in endodontic surgery [17].

Bone Graft with PRF

PRF acts as a matrix maintaining the integrity of the bone graft material, and enhances revascularization between the bone graft particles through neo-angiogenesis. The fibrin matrix of PRF gradually gets resorbed, and extricates the growth factors, such as PGDF, TGF and VEGF that provide a viable and everlasting field to improve healing. A lot of research studies have stated that the mixture of bone graft with PRF had the power to improve bone formation [18].

Conclusion

In conclusion, platelets concentrates represented innovative tools in periapical surgery. The results showed that the concentrates were active in improving bone and soft tissues healing. Moreover, using PRP, PRF and CGF along with autogenous bone graft, recombinant human growth factors such as recombinant BMP, and also the biomaterials can result in well-enhanced bone regeneration. But, the interpretation and corroboration are parts of an exact protocol for the long-term progression of using these regenerative materials. So, further research is required to establish a standardized protocol for the use of these concentrates in the treatment of tissue regeneration.

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