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Regenerative treatment of intraosseous defect in endodontic-periodontal lesion: Clinical case

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Abstract
Aim: The objective of this clinical case report is to demonstrate the importance of the origin of an endodontic lesion, to know how to diagnose it correctly, as well as to work in a multidisciplinary way to arrive at a correct treatment plan. In this case, guided tissue regeneration is an excellent treatment option for intrabony defects.
Case Report: 42-year-old female patient, healthy, attends the clinic of the Master of Periodontology of the Faculty of Dentistry of the Autonomous University of Coahuila, being referred from the endodontics department, since she presented injury to the dental organ left upper lateral incisor which had previously been treated endodontically, with a diagnosis of pulp necrosis, medicating intra canal with pure calcium hydroxide on two occasions, without presenting improvement, for which a computed tomography scan of the involved dental organ was requested, since the lesion did not subside and presented signs of inflammation, pain on percussion, with a periodontal probing greater than 8 mm and grade II mobility, for which it was decided to perform exploratory surgery, debriding the surrounding region of dental organ left upper lateral incisor, presenting a palatal groove that extended towards the cervical third of the root, it was decided to perform guided tissue regeneration, since the defect was contained, using autologous and alloplastic bone graft, as well as or platelet rich fibrin membrane, temporarily placing a dental splint to keep the teeth fixed.
Result: A monthly radiographic study (periapical radiographs) was performed to assess the previously treated endodontic lesion and assess the greater amount of hard tissue formed in the periapical area of dental organ left upper lateral incisor and eliminating dental mobility, as well as pocket depth, taking the tooth to periodontal health.

Keywords: Endodontic injury, periodontal injury, bone defect, root groove, guided tissue regeneration

Introduction

Endo - periodontal injury

The intimate relationship between the periodontium and the tooth has long been an area of interest due to its complex anatomy and physiology. When the inflammation associated with pulp and periodontal pathology occurs in a dental organ, it is classified as an endodontic-periodontal lesion [1].

An endo - perio lesion is defined as a pathological communication between the pulp and the periodontium of a dental organ, which can be triggered by a carious or traumatic lesion affecting the pulp tissue. It can also affect the periodontium due to periodontal disease and / or destruction that affects the root canals, or due to both present pathologies.

Main signs

- Deep periodontal pockets, extending to the apex of the tooth root.
- Negative or uncertain response to pulp vitality tests.

Other signs and/or symptoms may include:

- Radiographic evidence of bone loss in the apical or furcation region.
- Spontaneous pain or tenderness/percussion.
- Exudate / purulent suppuration.
- Dental mobility.
- Sinus tract / fistula.
- Alterations in the color of the crown and/or gingiva [2].

Pulp infection can cause a destructive process that begins in the apical region of a tooth towards the gingival margin or vice versa.

There are certain types of periodontitis.

- "Retrograde periodontitis"
- "Marginal periodontitis" (From the gingival margin towards the root apex).
- "Pulpodontia-periodontics" (Syndrome involving inflammation or degeneration with a BP adjacent to the same tooth.

Inflammatory changes can begin in the socket, in the apical and non-apical locations of the teeth [3]

Classification of Endo - Periodontal injuries.

1. **Primary endodontic lesion:** The problem is purely endodontic in nature, but the lesion is draining through the gingival tissue.
2. **Primary endodontic lesion with secondary periodontal intervention:** When a primary endodontic infection persists, it destroys the surrounding tissue and infiltrates the inter-root space. This leads to drainage through the gingival tissues, creating a site where plaque and calculus can accumulate, leading to periodontal disease.
3. **Primary periodontal injury:** There is bag formation, it occurs due to the accumulation of dentobacterial plaque or calculus that leads to the loss of the attachment.
4. **Primary periodontal lesion with secondary endodontic involvement:** When periodontal disease progresses through the root surface and leads to an area of communication with the pulp. When periodontal disease progresses towards the apical foramen, but it can also occur if other channels that communicate with the pulp are exposed.
5. **True Combined Injury:** When the two separate processes have started independently of each other, but merge.
6. **Concomitant pulp-periodontal injury:** It is the presentation of pulp and periodontal affections in the same tooth that seem to exist independently of each other [1].

Communication between endodontic and periodontal lesions

The periodontium communicates with the pulp tissues through many channels or pathways involved in the spread of pulp infections to the periodontium and vice versa.

There are canals, apical foramina and other communications that can generate apical granulomas of the necrotic pulps or of the lateral faces of the roots.

Alveolar ridge resorption can also occur due to communication between the dentin tubules and the vasculolymphatic drainage, causing periodontal damage of pulp origin, which occurs in the early stages of pulp disease. An apical lesion is seen extending or draining along the periodontium through the afore mentioned lateral canals and accessory holes that run along the periodontal ligament.

- Lingual/palatal grooves
- Root/tooth fractures
- Agenesis/hypoplasia of the cementum
- Root abnormalities
- Intermediate bifurcation ridges
- Fibrous communications and trauma-induced root resorption.

Root Grooves L/P

They are morphological defects, being a fold of the internal enamel epithelium and the epithelial root sheath of Hertwig.

They are found more frequently in the upper anterior (lateral) teeth with a prevalence of 2.8 to 8.5%, being a predisposing factor for PD.

They are very commonly easily overlooked as etiological factors, as they are covered by periodontal tissues [1].

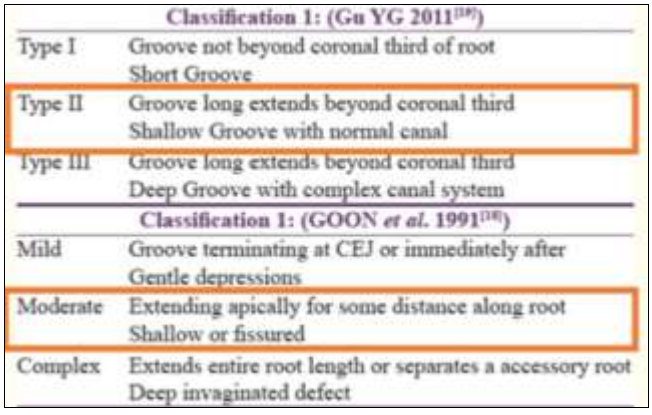
They are presented independently and were classified in two by Goon *et al*. and Gu YG. Depending on the type and root extension of the furrow. Figure 1.

When the groove is superficial and located only in the coronal structure, an odontoplasty and periodontal therapy are performed, however, if there is deep and pulp involvement, the treatment becomes complex [5]. They are the most common clinical/radiographic characteristics of endo-periodontal lesions. Just as the grooves are an important factor, the presurgical evaluation also includes establishing and verifying the non-vital status of the pulp, the extent and severity of the periodontal destruction and the therapeutic prognosis of the planned regenerative procedure. The following image shows some clinical and radiographic manifestations of the lesion. Figure 2. Pre-surgical phase (determination of the periodontal/regenerative prognosis).

1. Endodontic phase.
2. Periodontal surgical phase.
3. Post-guided tissue regeneration reassessment protocol. Figure 3.

Once the therapeutic prognosis of the periodontal regeneration procedure is determined to be favorable, endodontic therapy is provided. Intra-surgical evaluation includes the morphology of the periodontal defect, the type of defect, the material of choice to fill the defect and enhance healing, control of the patient's oral hygiene, and wound stabilization [6].

Surgical procedures involving the removal of granulation tissue, odontoplasty, scaling and root planning of the area with the groove, and endodontic therapy for the involved tooth have resulted in adequate periapical healing and effectively reduced gingival probing depth [5].



Classification 1: (Gu YG 2011[19])	
Type I	Groove not beyond coronal third of root Short Groove
Type II	Groove long extends beyond coronal third Shallow Groove with normal canal
Type III	Groove long extends beyond coronal third Deep Groove with complex canal system
Classification 1: (GOON *et al.* 1991[18])	
Mild	Groove terminating at CEJ or immediately after Gentle depressions
Moderate	Extending apically for some distance along root Shallow or fissured
Complex	Extends entire root length or separates a accessory root Deep invaginated defect

Fig 1: Classification of the Gu and Goon grooves

Reported clinical/radiographic manifestation	No. of cases*
Periapical radiolucency†	22
Deep pocket depths	12
No pocket depths	1
Swelling	6
Fistula, sinus tract	7
Pus discharge	1
Acute pain	2
Mobility	4
No vitality‡	25
Normal response to vitality tests	1
Percussion sensitivity	2
Continuous discomfort	1
Gingival irritation with bleeding	1
Root perforation	2

*Total of 26 teeth from 14 articles (3, 9, 16–27).
†Periapical radiolucency includes apical periodontitis and periapical pathology.
‡No vitality includes no responses to vitality tests, pulp necrosis, and previous root canal treatment.

Fig 2: Clinical/radiographic manifestations of the lesion

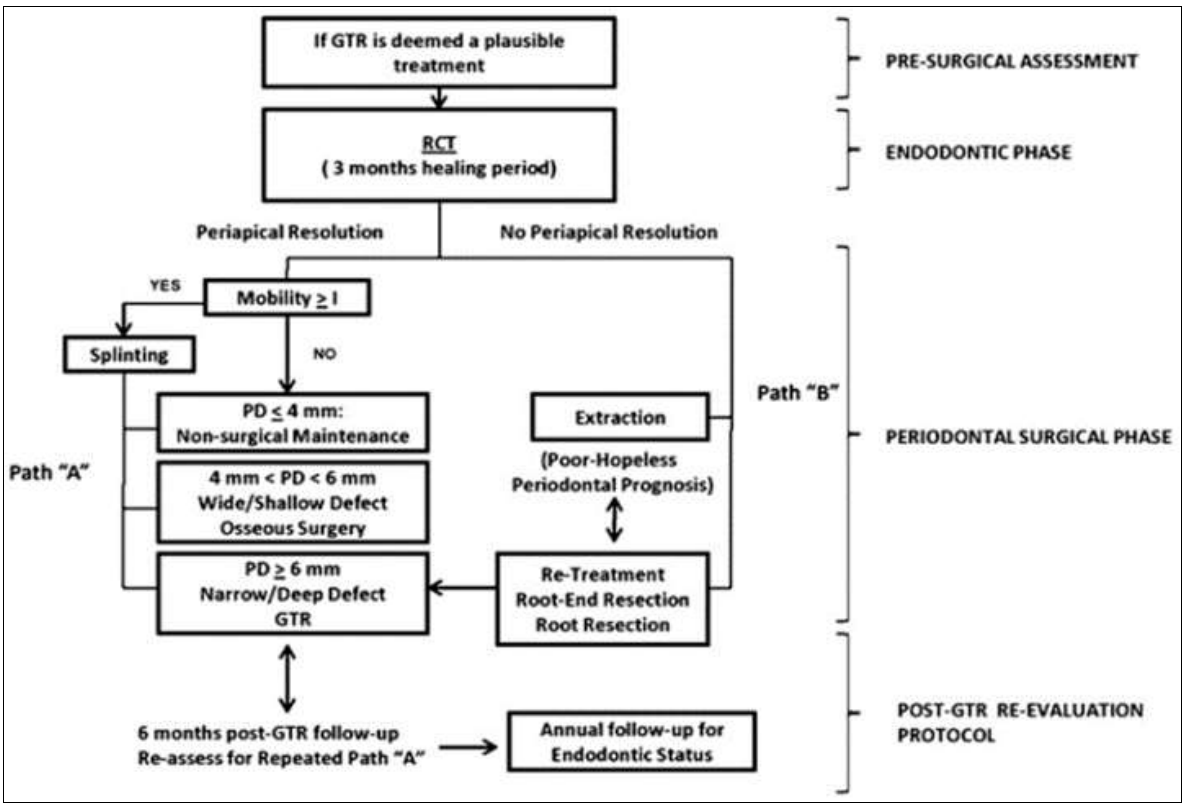


Fig 3: Treatment algorithm for periodontic - endodontic combined lesions

Guided tissue regeneration (GTR)

Routine endodontic and periodontal treatments may be insufficient to stabilize teeth in cases where bone loss is excessive. Therefore, respective and regenerative treatment options should be considered.

Currently, intrabony defects can be treated by a variety of treatments, including guided tissue regeneration (GTR) using barrier membranes, different types, or a combination of bone graft materials, enamel matrix proteins, and autologous platelet concentrates. The results are successful when GTR is performed since the membrane prevents the migration of epithelial cells to the defect area with or without bone graft materials. The bone graft materials form a scaffold for the host's resident cells, promoting osteoinductive or osteoconductive pathways.

Another technique that has proven its efficacy in the treatment of intrabony defects is the use of autologous platelet concentrate to obtain regenerative biomaterials. Platelet Rich Fibrin (PRF) is a bioactive scaffold used to achieve regeneration of hard and soft periodontal tissues. As wound healing begins with fibrin clot formation, platelet adhesion and aggregation, followed by the release of multiple growth factors by platelet alpha granules, including platelet-derived growth factor (PDGF), vascular endothelial growth factor (VEGF) and transforming growth factor (TGF).) -α and -β, said growth factors, promote chemotaxis, proliferation, contraction, deposition of the extracellular matrix and re-epithelialization of fibroblasts in wound healing [7].

Because PRF is autologous, the risk of rejection or disease transmission is avoided, and it is inexpensive, its release continues for at least 7 days [5].

The management of endoneurium lesions without regenerative therapy has a success rate of 27-37%, while the use of regenerative therapies has a rate of 77.5% [8].

Types of bone graft

Depending on their action on bone tissue, their ability is attributed to:

1. Osteogenic
2. Osteoinductive
3. Osteoconductive

Types of bone grafts

- Autologous graft (Extracted from the patient himself)
- Allogeneic grafts (freeze-dried mineralized and demineralized allogeneic grafts of bone cortical)
- Alloplastic bone grafts (hydroxyapatite, beta-tricalcium phosphate)
- Xenograft grafts (porcine and bovine bone) [9].

Case report

A 42-year-old female patient with an ASA I classification in agreement of the system of clasification of physical state of the American Society of Anesthesiologists (ASA-PS; 2014) [10] attends the clinic of the Master of Periodontology of the Faculty of Dentistry of the Autonomous University of Coahuila, Torreón Unit, being referred from the endodontics department, since she presented lesion in dental organ left upper lateral incisor (DO 22) which had previously been endodontically treated, with a diagnosis of pulp necrosis, medicating intra canal with pure calcium hydroxide on two occasions, without presenting improvement, for which a computed tomography scan (CT) scan of the involved dental organ was requested, since the lesion did not subside and showed signs of inflammation, pain on percussion, with a periodontal probing for vestibular of 3 mm per mesial, 3 mm medial, 8 mm distal, as well as palatal 8 mm per distal, 10 mm medial and 3 mm mesially, which indicated that the lesion was affecting the periodontium, so it was decided to perform exploratory surgery. Figure 4.

Corroborating with the periapical radiography and CT, we can observe a radiolucent lesion, with well-defined borders and margins, located in the periapical area of the dental organ involved, with absence of vestibular table, seen from a sagittal view, however, in the coronal section, we can observe a circumferential lesion around the coronal third, indicating the presence of a bone defect. Figure 5.

The surgical procedure began with asepsis and antisepsis of the perioral area with 0.2% chlorhexidine, then it was locally infiltrated into the muco-oral fold of DO 22, as well as the nasopalatine nerve block with lidocaine HCI 0.2% with epinephrine [1: 100,000], a circular flap was raised extending from DO 11 to DO 24 to have greater visibility of both the buccal and palatal, a full thickness flap was raised on both sides, where a large amount of granulation tissue could be observed, both in the periapical zone, as in palatine. Figure 6.

The granulation tissue was removed by means of an ultrasonic reamer and Gracey 5/6 and Columbia type 2R/2L periodontal curettes. Once the debridement has been carried out, using the periodontal probe we make sure that the initial measurements that were taken in the diagnostic phase coincide with the current ones, both concurring, as an important finding on the palatal side of the dental organ, we found a groove that extended from the dental crown, up to the coronal part of the root, it was decided to perform root groove plasty, as well as enameloplasty of the dental clinical crown by palatine to avoid communication of the oral environment towards the periodontium. Figure 7.

Since the measurements of the vestibular periodontal defect were 8 mm vertically and 10 mm horizontally, it was decided to perform a regenerative treatment, the root surface was scraped and smoothed, then the area of the periapical defect and the tooth root was detoxification by means of chemical therapy with metronidazole (solution) and hydrogen peroxide for one minute each. Figure 8. Autologous bone was then taken from the adjacent areas, as well as an alloplastic material (Ossix bone) to fill the bone defect that had remained both in the vestibular and in the palatal area. Figure 9. To cover the defect, 2 PRF membranes were placed in each specific site on the grafted bone and a partial flap was made to displace coronally and have a passive primary closure using simple and mattress sutures vertical (nylon 4-0). Figure 10. At the end of the surgical procedure, she was given indications and postsurgical care, prescribing amoxicillin 500 mg every 8 hours for 7 days, ibuprofen 600 mg every 8 hours for 5 days, ketorolac 10 mg every 8 hours for 5 days, chlorhexidine rinses. 0.12% (rinses) every 12 hours for 15 days.

Fig 4: Periodontal Probing

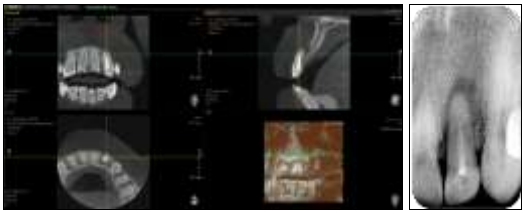


Fig 5: CT scan and periapical radiography

Fig 6: Full thickness flap incision and elevation

Fig 7: Removal of granulation tissue and root groove plasty

Fig 8: Measurement and detoxification of the bone defect

Fig 9: Collection of autologous bone and packaging of Ossix Bone

Fig 10: Placement of the PRF membrane and stitches

Postoperative

After 7 days the patient attended for the removal of stitches, presenting good hygiene and stability of the soft tissues, the dental organ involved presented mobility grade II, for this reason it was decided to splint with 0.010 braided orthodontic wire, covering beyond adjacent teeth for greater stability and aesthetics, leaving DO 22 out of occlusion. Figure 11.

The patient was told that she would last approximately 6 months with the splint and that she would have to attend monthly control and maintenance appointments to assess bone formation and tooth mobility.

Fig 11: Splinting

Results

After a month the patient came to the consultation, presenting good oral hygiene habits, the dental mobility that she presented was grade I and a control periapical X-ray was taken, observing bone consolidation. Figure 12.

Month after month the patient attended her control and maintenance appointments, in the figure 13 we observe a decrease in the diameter of the lesion at 4 months. Figure 13.

For the sixth month it was decided to remove the splint, since the bone formation time had passed and the tooth did not show mobility, it was decided to probe the treated tooth, presenting a 4 mm per mesial, 2 mm medial, 2 mm vestibular probe distal, as well as palatal 2 mm distal, 2 mm medial, and 5 mm mesial, which indicated that proper bone formation had occurred and that a new junctional epithelium had formed surrounding the DO 22.

He was referred back to the endodontics department to perform the final filling of the root canal using gutta-percha and to place definitive restorative material such as resin in the dental clinical crown, as well as a new control periapical radiograph at the 6 months. Figure 14.

Fig 12: Control X-ray one month after the surgical procedure

Fig 13: Control X-ray at the 4 month after the surgical procedure

Fig 14: Root canal filling with definitive filling material (gutapercha). Light-curing resin on the palatal portion, radiography at the 6 months

Discussion

The scenarios where there is an endo-periodontal lesion require a careful diagnosis and treatment plan, since it must be treated from different approaches, seen from a multidisciplinary point of view.

When we have a primary or secondary endodontic-periodontal lesion, or a true combined lesion, the type of defect we have must be taken into account in order to choose the best possible regenerative procedure, either by means of GTR (collagen and PRF membranes) or According to the conditions, it is respective, this to result in the reduction of the loss of clinical attachment, the depth of the periodontal pocket, since when it is repaired, a new junction epithelium will be formed between the regenerated tissues and the root surface.

Conclusions

Endodontic therapy should be considered as an alternative to periodontal treatment when performing a regenerative procedure.

The success rate of combined endodontic-periodontal injury without a concomitant regenerative procedure ranges from 27% to 37%.

It has been suggested that a long junctional epithelium formed on the surface of the dehiscent root is a factor that contributes to a poor therapeutic prognosis, because a regenerative treatment is always sought to give a better prognosis to the dental organ involved.

It is a challenge for the clinician to have knowledge of the wound healing process that involves both the endodontic and periodontal complex, in order to provide the patient with the best treatment [6].

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