CLINICAL-RADIOLOGICAL STUDY ON THE ROLE OF BIOSTIMULATING MATERIALS IN IATROGENIC FURCATION LESIONS

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CLINICAL-RADIOLOGICAL STUDY ON THE ROLE OF BIOSTIMULATING MATERIALS IN IATROGENIC FURCATION LESIONS (Abstract): Root perforation is an unwanted incident which may occur at any stage of endodontic treatment and can adversely affect tooth prognosis. **Aim:** To compare the recovery rate after treatment of root perforations in the intraradicular area of the molars, using two different materials: MTA and ceramic nanoparticles mineral cement DiaRoot® BioAggregate, by a clinical-radiological and statistical analysis over a period of up to 24 months. **Material and methods:** The study was conducted on 28 molars from patients of both sexes, mean age 33.29 ± 6.2DS, with iatrogenic perforation of pulp chamber floor. The teeth were divided into 2 groups according to the applied material: group 1 - gray MTA (ProRoot® MTA, Dentsply, Tulsa Dental), and group 2 - BioAggregate (Diadent® Group International, Vancouver). Patients included in the study were monitored and assessed by radiological examinations at 6, 12 and 18 months. **Results:** Pulp chamber floor perforations are significantly associated with tooth location ($\chi^2 = 35.60$, $r = 0.67$, $p = 0.00359$, 95% CI). Both when the perforation was repaired with MTA and BioAggregate, the clinical improvement was significant ($\chi^2 = 17.608$, $r = 0.58$, $p = 0.0035$, 95% CI). **Conclusions:** Based on the results of this study, both MTA and BioAggregate are excellent materials for root perforation repair. **Key words:** ENDODONTIC TREATMENT, ROOT PERFORATION, REPAIR MATERIALS.

Endodontic treatment is a delicate clinical procedure, unfortunately resulting sometimes in failures. Root perforation is an unwanted incident which may occur at any stage of endodontic treatment and can adversely affect tooth prognosis. Although caries or resorption processes may also cause this type of tissue destruction, most root perforations are iatrogenically induced. Perforations usually produce an artificial communication between the radicular canal and the periodontal space. They can be located at different levels of the root, from the accidental perforation of the pulp chamber floor to the side walls of the canal, continuing to the root apex, with inflammatory and resorptive implications. Numerous research papers show the possi-
bility of applying modern techniques and materials to restore damaged structures, based on animal experiments and histological studies (1, 2).

In addition to providing a good seal, the material of choice for root perforation repair must be biocompatible, nontoxic, insoluble in the presence of tissue fluids, and able to promote periradicular tissue regeneration. Untreated, perforation results in a chronic inflammatory reaction of the periodontium, sometimes with serious complications, such as suppuration, abscess, fistula or bone resorptive processes that can lead to irreversible loss of tooth attachment. Seltzer et al. (4) have shown that successful root perforation repair is conditioned by their location, shape, size, and the time before sealing.

This study aimed at comparing the recovery rate after root perforation treatment with two different materials: MTA (ProRoot ® MTA, Dentsply, Tulsa Dental) and DiaRoot ® BioAggregate (Diadent ® Group International, Vancouver), both mixed to a paste consistency according to manufacturer's instructions.

After tooth isolation and cavity cleaning, the communication between pulp chamber and periodontal space was detected and in case of bleeding hemostasis was achieved using cotton pellets soaked in 5% sodium hypochlorite. The material was applied with a special carrier, (MTA-gun) and then easily condensed with a plunger. Over it a pellet soaked in distilled water was placed, because both materials are setting in a wet environment and finally provisional cement (Citodur, DoriDent, Austria) for 2-3 days. At the next visit, the provisional cement was removed, MTA strength and the degree of perforation coverage were checked with a palpation probe, followed by the standard mechanical, chemical and drug treatment of root canals.

**RESULTS**

After physical examination, history taking, and interpretation of radiographic images, the data were recorded in case-record forms including all relevant radiographs. The analysis showed that of the studied 28 teeth, 10 presented untreated pre-existing perforations with associated chronic periapical pathology, 7 presented perforations previously incorrectly and ineffectively treated with persistent interradicular radiolucency, and 11 perforations made during endodontic treatment or retreatment (fig. 1).

Of all study patients, 16 (6 upper molars and 10 lower molars) had a radiolucency at the furcal area on the initial radiograph, accompanied by painful symptoms, confirming the presence of chronic inflammation in that area (fig. 2).
Clinical-radiological study on the role of biostimulating materials in iatrogenic furcation lesions

Of the 12 upper molars studied, 6 presented perforation of the pulp chamber floor located in the disto-buccal area, 2 perforations located in the mesio-buccal area, and 4 central perforations. In the mandible, of the 16 studied molars, 7 perforations were located medially, 5 distally, and 4 centrally. The statistical analysis showed that there is a significant association between pulp chamber floor perforation and tooth location ($\chi^2 = 35.60$, $r = 0.67$, $p = 0.00359$, 95% CI); thus, in the upper molars perforations are more frequent in the disto-buccal area (21.43%), while in the lower molars in the mesial area (25%) (fig. 3).

The cause of pulp chamber floor perforations was significantly correlated with tooth type, as demonstrated by the higher frequency of untreated pre-existing perforations in the lower molars (37.5%), and perforations made during endodontic treatment especially in upper molars ($\chi^2 = 26.505$, $r = 0.59$, $p = 0.00547$, 95% CI) (fig. 4).
Fig. 3. Case distribution according to the location of pulp chamber floor perforation
La lower molars - mesio-

Fig. 4. Radiological examination of pulp chamber floor perforations
One-year postoperatively, all molars in group 1 were asymptomatic, had no attachment loss or fistula. Radiological examination revealed, however, in two cases, the persistence of a radiolucent furcal area in molars with larger initial lesions (one lower and one upper). The same was seen in group 2 molars, except for one case, with a larger initial lesion, that still had an area of osteolysis, lesser than the initial one, accompanied by mild pain when chewing (fig. 5).

![Fig. 5. Association of the type of repair material with postoperative course](image)

Radiological images showed better results especially in group 2, where the used material was BioAggregate. Thus, the type of repair material significantly influenced the postoperative course ($\chi^2 = 6.15, r = 0.46, p = 0.03, 95\% CI$).

To illustrate the ability of the above mentioned materials to induce periradicular tissue recovery and healing, we here mention one of the cases included in this study. A 42-year-old female patient was referred to the clinic for a mild pain when chewing in the lower left molar. After the removal of the massive crown restoration a 1.5-2 mm communication area between the pulp chamber and the furcal periodontium was seen. Radiologically, a large interradicular radiolucent area was revealed, implying the presence of a local irritation factor. The tooth was treated with BioAggregate cement, according to the protocol used in all group 2 teeth (fig. 6)

**DISCUSSION**

The main goal in the treatment of root perforations is stopping further loss of periodontal attachment by preserving healthy tissue at the perforation site. Several studies (5, 6, 7) have shown that if the lesion is already present, it is important to restore the attachment tissue. It was found that important factors in determining the success of a perforation repair procedures are perforation location, time between the occurrence of perforation and its repair. The results of this study are consistent with those obtained by other authors in their research on similar subject (8, 9).
Fig. 6. A. Lower left molar with restorative material and pulp chamber floor perforation. B. MTA application over the communication. C. Preoperative radiograph shows an incomplete endodontic treatment and a well defined interradicular radiolucency. D. The 6 months radiograph indicates a reorganization of demineralized trabecular bone with furcal recovery. E. The radiographic exam after two years shows complete healing of interradicular and periradicular bone with complete restoration of the periodontal space.

CONCLUSIONS
Researches have shown that treatment plan for perforation repair depends on the visibility and accessibility of perforation, its size, periodontal status, and strategic importance of the tooth. Successful repair of root perforations is conditioned by its the location, shape, size, and the time be-
before it is sealed. One of the most important parameters affecting treatment outcome have proved to be the location on the root surface and the type of repair material, which appears to significantly influence the postoperative course.

REFERENCES