THE USE OF IONOMER CEMENTS IN SUBGINGIVAL RESTORATIONS AND FURCATION DEFECTS. CURRENT CONCEPTS.

O USO DE CIMENTOS DE IONÔMERO DE VIDRO EM RESTAURAÇÕES SUBGENGIVAISS E EM DEFEITOS DE FURCA. CONCEITOS ATUAIS.

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ABSTRACT

Clinical applications for glass ionomers include restoration of erosive lesions, prosthesis cementation, core material and pediatric restorations. In addition, glass ionomers have also been used as orthopedic granular bone substitute. The treatment of periodontal furcation defects normally consists of scaling and root planning, apically-positioned flaps, tunneling, root amputation, root resection, guided tissue regeneration or bone graft. Recently, glass ionomer cement was introduced as an option for the treatment of infra bony and furcation defects. The aim of this study is to provide the reader an update on the scientific evidences on the use of glass ionomer cements in the treatment of root caries and furcation defects.

Keywords: Dental materials; Furcation defects; Glass ionomer cements; Permanent dental restoration.

INTRODUCTION

Many dental restorative materials are placed in contact with the contiguous gingival tissues. These materials must be biocompatible with the physiological environment, providing successful dental treatment to patients.

Glass ionomer cement (GIC) was first introduced by Wilson and Kent as an attempt to develop an ideal restorative material for the replacement of tooth tissue. GIC is obtained from an acid-basic reaction in which the basic component is a calcium alumino-silicate glass containing fluoride, and the acid is a homopolymer or copolymer of alkenoic acids. There are many types of glasses and polyacids with cement-forming ability. They have been used in restorations, cementation, cavity lining and basing, post-and-core build-up and preventive applications. Most recently, modifications have produced materials called resin-ionomer cements or compomers. These materials are set in two stages: (1) light activation, which allows the polymerizable molecules to interconnect and (2) after absorbing water from the moist environment of the mouth, an ionic acid-base reaction takes place that crosslinks with the established matrix. These newer materials possess the following characteristics and advantages: insolubility in oral fluids, increased adhesion to tooth

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structure and other dental substrates, dual-cure capabilities, low cure shrinkage, low coefficient of thermal expansion, radiopacity, fluoride release and biocompatibility12,24.

Reports also suggest that they may have broader dental and orthopaedic applications as a granular bone substitute in maxillofacial surgery and also as an interface material for joint replacement. In addition to mechanical and physical properties in vivo and in vitro studies have shown that they are materials with potentially good osteogenic properties7,16,23.

Recently, some reports have suggested that the use of resin-ionomer cements in periodontal surgery may be beneficial in regenerative procedures12. The purpose of this study is to update the reader upon scientific evidences for the use of GICs for the treatment of cervical and subgingival root lesions and for the treatment of furcation bone defects.

RESPONSE OF PERIODONTAL TISSUES TO GLASS IONOMER CEMENTS

The biocompatibility of GIC is affected strongly by the compounds that can be leached such as silica, aluminium, calcium, phosphate and fluoride. Calcium and phosphate are involved in the formation of hydroxyapatite in teeth and bones and their release can be useful and beneficial. Fluoride can be released from GIC for at least 18 months, and can bind to the apatite of hard tissues to form fluoroapatite21.

Fluoride, constantly leaking from the solubilizing surface of GIC, could interfere with the initial adherence of bacteria to the pellicle. However, no significant differences in numbers of lactobacilli, S. mutans and total streptococci recovered from enamel surface, and 1-year old fillings of GIC could be seen in patients with customary oral hygiene procedures or after a 14-day period of experimental plaque formation26.

The placement of GIC into rat dental alveolus immediately after tooth extraction and its biocompatibility was analyzed by Bretegani et al.6 There was progressive new bone formation in parallel with a decrease in the percentage fraction of connective tissue in the trail areas around the GIC, revealing that the tested material is biologically compatible, being progressively incorporated into the alveolar bone in the wound healing process.

Leyhausen et al.18 evaluated the cellular compatibility of modern light-curing (lc) glass-ionomer cements (GICs) and compared to one conventional (co)
GIC, through cell culture tests. They used human primary fibroblasts of the attached gingiva (HGF) and permanent mouse fibroblasts (3T3) for the experiments. Although some GICs induced no growth inhibition in any of the assays, GIC Vitrebond was very cytotoxic and the authors suggested that they may also induce alterations in vivo. GIC Compoglass™ demonstrated to be an excellent and Ionoseal and Ketac fill showed good cellular compatibility.

**GICS FOR THE TREATMENT OF CERVICAL AND SUBGINGIVAL ROOT LESIONS**

Garcia et al. 13 compared the gingival fluid flow (GCF) and gingival index of well contoured glass ionomer fillings with unrestored cervical abrasion lesions. After 12 months, well finished GIC cervical restorations did not adversely affect the depth of the gingival crevice as well as the GCF flow, which was also supported by Van Dijken and Sjöström. In an experimental study in dogs, Gomes et al. 14 evaluated the periodontal response to GIC and amalgam subgingival restorations. The sulcular epithelium adjacent to GIC restorations presented signs of normality independent of plaque control. Amalgam was associated with more severe inflammatory response. Dragoo's restored 50 sub- gingival lesions using two resin-ionomer restorative materials (Dyract/ Dentisply and Geristore DenMat) and one hybrid-ionomer material (Photac-Fil/ Espe) in 25 patients. Postoperative gingival recession was minimal at 1-year follow-up period. There was a decrease in probing depths and gain in attachment with all three material tested. Histological findings suggested epithelium and connective tissue adherence to the resin-ionomer restorative materials during the wound healing process. These results represent a significant improvement in the ability to restore teeth previously considered hopeless. Mandarino 18 obtained similar results in a human clinical trial. The response of a healthy periodontium after class V GIC restorations placed 1.0mm coronally of the alveolar bone crest was evaluated after four to six months. There was minimal gingival inflammation with a mean clinical attachment loss of 0.76mm.

Gultz and Scherer 15 described the subgingival placement of a resin-ionomer for several restorative procedures, including root caries, resorption, endodontic perforation and root fracture. The cases presented by authors indicate that a resin-ionomer may be used as a subgingival restorative material and may be placed in lesions originally thought to be unrestorable.
Subgingival resin-ionomer restorations were used to restore both anterior root and molar furcation defects. After surgical procedure the gingival tissue presented signs of health, with minimal probing depths at the surgical area. This fact demonstrated the clinical success of an alternative treatment procedure for restoring subgingival mechanical root or periodontal lesions.

Paolantonio et al. used amalgam, glass ionomer cement, and composite resin in subgingival restorations. Clinical and microbiological evaluation was performed in the mid-buccal aspect of each experimental (test) tooth to be restored and in one adjacent, non-treated control tooth. These procedures were repeated every 4 months over the following year. The results showed that clinical parameters did not change significantly among the experimental groups. The authors observed no significant changes on the microbiological investigation among amalgam, glass ionomer cement, and control groups. However, there was a significant increase in the total bacterial counts, and a significant decrease in Gram-positive, aerobic bacteria, which was associated with a significant increase in the Gram-negative, anaerobic microbiota.

TREATMENT OF FURCATION BONE DEFECTS

Treatment of periodontally diseased multi-rooted posterior teeth has conventionally consisted of scaling and root planning, apically positioned flaps, tunneling, root amputation, root resection, guided tissue regeneration, osseous graft and the combination of osseous graft and barrier membrane techniques. Most of these techniques have limited degrees of success.

Furcation lesions treated by guided tissue regeneration (GTR) using non-resorbable membranes, particularly e-PTFE barriers, present some disadvantages, such as a second surgical procedure to remove the membrane, require more postoperative visits and have the potential for more postsurgical complications. GIC may present some advantages such as easy placement into a furcation, elimination of sutures and the second stage procedure for retrieval, epithelial attachment, bacteriostatic properties due to fluoride release and lower cost.

Recently, GIC have been suggested as a treatment choice of molar furcation lesions, functioning as an
occlusive barrier. Resin-ionomer cement can also be used to lute a polytetrafluoroethylene (e-PTFE) membrane in place of furcation defects. When used as a luting medium for an e-PTFE membrane, the membrane can be placed more subgingivally, precluding the risk of exposure to the oral environment and avoiding sutures to secure the membrane in place

The use of GIC to fill furcation defects was tested by Lagou. Ten patients with adult periodontitis presenting class I or II buccal molar furcations were evaluated. Eleven furcation defects were filled with restorative material during surgery and 8 furcation defects were treated conventionally and served as non-restored controls. Both groups exhibited overall improvement in various clinical parameters 3 months after treatment. The restorative material exhibited good gingival biocompatibility and both test and control sites exhibited healthy gingival with good color, shape, size and consistence, suggesting that GIC may be safely used to fill furcation defects.

Anderegg and Metzler treated seventeen adult periodontal patients with Class III furcation defects involving all 3 furcations in maxillary molars. All teeth had “poor to hopeless” prognosis. After reflection of full thickness mucogingival flap, the area was debrided, scaled and root planned. The roots were etched with a phosphoric acid solution for 1 minute followed by a water rinse. A bonding agent was applied and the resin-ionomer placed into furcation defects. Excess resin was removed and the area was polished. The flaps were repositioned and sutured. One year after treatment, decreasing probing depth, bleeding upon probing and mobility when furcation areas were sealed with a resin-ionomer, retained 15 teeth.

The use of GIC as an occlusive barrier as a treatment of class II furcation defects was tested in 3 beagle dogs. Eighteen Class II furcation defects were surgically created and treated with a GIC barrier, polylactic acid membrane or open flap surgery. Bone fill and periodontal regeneration was similar for both GIC barrier and polylactic membrane.

Fowler and Breault used a resin-ionomer restoration to seal a furcation defect of a molar in a patient with severe periodontitis. Early healing was uneventful, but at 11 weeks, it was noted that suppuration was present in the buccal surface of the molar. The area was treated with local chemotherapeutics, but nine months after surgery, the tooth was extracted, showing failure of this material to treat furcation involvement.
DISCUSSION

Restoration of subgingival root lesions should be done with materials that present biocompatibility, adhesiveness, fluoride release, radiopacity, surface hardness, insolubility in oral fluids, absence of microleakage and low cure shrinkage.\(^8\)

GIC is biologically compatible\(^5\) and can be in contact to gingival and bone tissues. Different studies\(^8,14,19,25\) evaluated GIC in subgingival cavities and concluded that the gingival tissues were not adversely affected by this material. On the opposite, according to Van Dijkken and Sjöström\(^{25}\), amalgam elicited a more severe inflammatory response. Clinical results were confirmed by histological evaluation\(^8\), making GIC the material of choice to treat subgingival cavities.

Since GIC is biocompatible to bone and to connective tissues, it was tested to fill furcation defects as an occlusive barrier. It seems that the adhesiveness of the material to the root surface is critical to the success of the treatment. Anderegg and Metzler\(^6\) and Breault et al.\(^5\) treated furcation defects with resin-ionomer cements and the material remained in place during the entire follow-up period. Abitbol et al.\(^1,2\) used resin-ionomer as a barrier to treat class II furcation defects and concluded that it can be used as a low cost substitute to conventional barrier.

CONCLUSIONS

Based on the literature, we can conclude that the resin-ionomer cements demonstrate a biocompatibility to both soft and hard tissues. The results presented in this review encourage the use of this material in subgingival lesions and periodontal defect. Studies suggest that the long-term prognosis of posterior teeth with furcation involvement may be improved through the use of resin ionomer, but the clinician must consider the multifactorial etiology of periodontal breakdown within a furcation defects.

RESUMO

A aplicação clínica do cimento de ionômero de vidro inclui restaurações de lesões tipo erosão, cimentação de prótese, material de preenchimento e restaurações em odontopediatria. Este material também tem sido usado como substituto de osso granular em ortopedia. O tratamento periodontal de defeitos de furca convencionalmente tem consistido de raspagem e aislamento radicular, retalho posicionado apicalmente, tunelização, ressecção e amputação de raiz, regeneração tecidual guiada, ou enxerto ósseo. Recentemente, o cimento de ionômero de vidro tem sido
apresentado como uma opção para o tratamento de lesões de cárie e defeitos de furcas e defeitos infra-óseos. O objetivo deste trabalho é atualizar o leitor sobre as evidências científicas do uso de cimento de ionômetro de vidro em lesões de cáries radiculares e para tratamento periodontal de defeitos de furcas.

**Palavras-chave:** Restauração dentária permanente, Materiais dentários, Cimentos de ionômetro de vidro, Defeitos da furca.

**REFERENCES**


