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ORIGINAL RESEARCH

Resistance to displacement analysis of two resin cements in intra-root dentin

Análisis de resistencia al desplazamiento de dos cementos de resina, en dentina intrarradicular

Karla Eugenia Miguelena Muro,* Jorge Guerrero Ibarra,§ Alfredo Garcilazo Gómez,ll Enrique Ríos Szalay¶

ABSTRACT

Several factors must be taken into account when cementing an endodontic post reinforced with fiberglass, among them we can mention selection of the cementing agent. Market available cements differ with respect to application mode, working time, polymerization and chemical composition. It is therefore necessary to count with sufficient knowledge of all their characteristics and behavior, not only from the clinical approach, but also in the laboratory. The evolution of resin cements is nowadays geared to technique simplification so as to decrease time and margin of error during clinical process. Moreover, previous studies have demonstrated that these changes have decreased adhesion force to dentin. **Objective:** The purpose of the present study was to observe the behavior of two resin cementing agents, assessing their adhesion strength in intra-root dentin: the BisCem®, Bisco Inc. system, formed by a dual self-adhesive cement, and the ParaCore® Automix (Coltene/Whaledent) system which is a dual cement system requiring a chemical curing self-conditioning agent and dentin adhesives (ParaBond® Coltene Whaledent). **Material and methods:** Thirty six single rooted teeth we encapsulated in acrylic and worn down until reaching intra-root dentin. Following manufacturer´s instructions, 18 samples were executed for each cement, and then in a universal testing device they were subjected to shearing tests (guillotine test) at a speed of 1 mm per minute. **Results:** It was observed that BisCem® exhibited lesser adhesion force than ParaCore® Automix. After statistically analyzing outcome by means of a «T» Student test, results revealed significant difference between both cements. **Conclusion:** ParaCore® Automix, requiring previous dentin conditioning (ParaBond®), exhibited greater adhesion force.

RESUMEN

Para cementar un endoposte reforzado con fibra de vidrio se deben de tomar en cuenta varios factores, entre ellos, la selección del agente cementante. Los cementos disponibles en el mercado difieren por la modalidad de aplicación, tiempo de trabajo, polimerización y composición química, por ello es necesario contar con el conocimiento de todas sus características y su comportamiento no sólo clínico sino también en el laboratorio. Hoy en día la evolución de los cementos de resina va encaminada a la simplificación de la técnica con el fin de reducir tiempo y margen de error durante el proceso clínico, sin embargo, previos estudios han demostrado que estos cambios han reducido la fuerza de adhesión a la dentina. **Objetivo:** El propósito de este estudio es observar el comportamiento de dos agentes cementantes de resina, evaluando su fuerza de adhesión en dentina intrarradicular, el sistema BisCem® de Bisco Inc., el cual es un cemento autoadhesivo dual y el sistema ParaCore® Automix de Colténe/Whaledent; cemento dual que requiere de un agente autoacondicionador y un adhesivo dentinarios de curado químico (ParaBond® de Colténe Whaledent). **Material y métodos:** Se encapsularon 36 dientes unirradiculares en acrílico y se desgastaron hasta descubrir la dentina intrarradicular, siguiendo las especificaciones del fabricante, se realizaron 18 muestras para cada cemento y después se sometieron a pruebas de cizalla a una velocidad de 1 mm por minuto en una máquina de ensayo universal. **Resultados:** Se observó que BisCem® presenta una menor fuerza de adhesión que ParaCore® Automix. Después de analizar estadísticamente los resultados a través de la prueba «T» de Student, los resultados mostrando una diferencia significativa entre ambos cementos. **Conclusión:** ParaCore® Automix que requiere previo acondicionado de dentina (ParaBond®) presentan una mayor fuerza de adhesión.

Key words: Resin cements, self-adhesive cements, self-conditioning cements, resistance to displacement.
Palabras clave: Cementos de resina, cementos autoadhesivos, cementos autoacondicionantes, resistencia al desplazamiento.

INTRODUCTION

Presently, use of fiberglass endodontic posts is a common part of the daily routine of a dental practice. Posts made of composite resin reinforced with fiberglass must be cemented with resin cements in order to form a functional monoblock, since both possess an elastic model which is similar to that of dentin, generating lesser stress and risk of root fracture as well as protecting tooth remnants and restoration.

* Graduate, Fixed Oral Prosthesis Specialty.
§ Professor, at the Dental Materials Department.
ll Professor.
¶ Coordinator of the Advanced Restorative Dentistry Specialty.

National School of Dentistry, National University of Mexico (UNAM).

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Success of any restoration largely depends on the cementing agent, which is defined as the means of fixation of two solid surfaces; according to Machi R., cement is a liquid which flows, humidifies surfaces, penetrates into its irregularities and fills spaces between both surfaces, to later harden ensuring contact between those surfaces.[1]

Constant research has favored the development of new cements offering greater adhesion force combined with a simple and effective placement technique. These cements are biocompatible, insoluble to the oral environment, esthetic and possess mechanical properties which outperform the rest of the cements.[1]

Resin cements possess a composition similar to that of resin used as reconstruction material. Nevertheless, they contain lesser amounts of inorganic filling material so as to render it more fluid. In general, they are composed of an inorganic matrix, monomers, diluting agents and inorganic filling material composed of silanized micro-filling (silica or zirconium).[2]

Conventional resin cements require previous application of an adhesive system able to penetrate into the dentin to polymerize within it; adhesion can be understood as the state in which both surfaces are kept together by means of interfacial forces or energies, based on chemical and mechanical mechanisms, or both, with the mediation of an adhesive agent (ISO/TR 11405;1994 [E]).[3]

A suitable adhesive agent must be able to humidify or impregnate the surface, possess low surface tension so as to be able to flow into the irregularities of the solid matter, as well as be able to change from liquid phase to solid without experiencing major dimensional changes.[4]

This concept, applied to dentistry since 1955 by Michael Buoncore, presently refers to a process of resinous monomers' demineralization and infiltration, with the aim of creating a mechanical lock between adhesive and tooth structure, seal dentine tubules and thus recover and preserve homeostasis of the internal milieu of the dentin-pulp complex.[5]

Evolution of adhesive systems requires dentin conditioning prior to their placement. This dentin conditioning implies all chemical alterations of the dentin surface by means of acid or chelating agents with the purpose of removing or modifying the structure of dentin debris and simultaneously de-mineralizing dentin surface.[6,7]

Development of adhesives is geared to technique simplification, nevertheless, all of them contain conditioning agents in varied amounts, a primer and an adhesive,[8] therefore, four categories can be established:

1. Conditioner and rinse, primer and adhesive (3 steps).[8]
   The primer counts with an hydrophilic monomer which bonds with collagen fibers and polymerizes, forming a hybrid or inter-diffusion layer[9,10] as well as adhesive resin which, when co-polymerizing with the previous component, forms resin prolongations and anastomosis (Tags and micro-Tags).[11,12]
2. Conditioning and rinsing, primer-adhesive (2 steps).
3. Self-conditioning primer and adhesive (2 steps).
   This technique does not require use of acids. Dentin conditioning is achieved by incorporating an acid resin into the primer which, when applied to the dental sub-stratum, modifies dentin debris and creates a small demineralization front; after acting for a few seconds, acid radicals neutralize with the de-mineralized hydroxyapatite crystals, resulting in a de-mineralized and infiltrated tissue to which liquid resin is later applied.[13]
4. Conditioner-primer-adhesive (1 single step).
   This is a combination of one solution conducted in a single step from a single container.

During the last decade self-adhesive cements have been introduced to clinical dental practice. They are portrayed as an ideal alternative since they exhibit in a single product all advantages of conventional cements, the ability of self-adhesion, fluoride release like glass ionomers as well as mechanical properties of dimensional stability and micro-mechanic retention provided by resinous cements.[1]

Application technique is one of the main reasons for using this type of cements, where application is solved in one single clinical step; after mixing base paste and catalyst paste, or activating capsules, it is directly applied into the surfaces to be adhered, therefore, manipulation errors are curtailed.[14]

Even though dentin morphology, especially intra-radicular dentin, bears influence on adhesion force, it is of the utmost importance to achieve excellent tissue preparation and material handling when preparing the space which will lodge the post and its cementing material.

During cementation process the following factors are of the foremost importance: removal of dentin debris composed of materials resulting from the de-obturation process, dentin, plasticisized gutta-percha caused by drill frictions, sealing elements, etc,[15] in addition to irrigation materials and cements like eugenol[16,17] which are used during root canal treatments;[18] the time elapsed from the moment after endodontic treatment and post manufacturing, access difficulty to the canal in order to achieve adequate