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Compressive strength recovery by composite onlays in primary teeth
Substrate treatment and luting agent effects

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ARTICLE INFO

Article history:
Received 15 July 2005
Received in revised form
9 November 2005
Accepted 11 November 2005

Keywords:
Composite resins
Onlays
Sodium hypochlorite
Luting agents
Compressive strength

ABSTRACT

Objectives: To evaluate 1% NaOCl treatment and two resin luting agent effects on compressive strength recovery in composite onlays on primary teeth and to analyze the fractures type.

Methods: Forty sound primary molars crowns were prepared in the standard machine and randomly divided into four groups ($n = 10$): G1 (1% NaOCl/ 30 min + EnForce); G2 (without 1% NaOCl EnForce); G3 (1% NaOCl/ 30 min + Rely X); G4 (without 1% NaOCl + Rely X). The onlays were made using Z250 composite on plaster models. Ten sound teeth were used as control group (CG). All groups were submitted to compression mechanic test in a universal test machine INSTRON at 1 mm/min cross-head speed. After that, the data (kgf) were submitted to ANOVA test ($\alpha = 0.05$). Finally, the fracture types were classified in a crescent scale (1–5) related with severity degree and submitted to Fisher's Exact Test ($p < 0.05$). Scanning electronic microscope analysis was done in order to illustrate the fractures sites.

Results: The values of compressive strength of experimental groups did not differ each others neither from control group ($p > 0.05$). The results from fracture type showed that types 5 and 4 fractures (most severe) present the highest percentage to experimental groups. Conversely, the CG showed higher percentage of fracture types 2 and 3.

Conclusions: This research found that the composite onlays recovered the compressive strength compared to sound teeth, regardless of the substrate treatment and cement agent used. Nevertheless, no group showed similar type of fractures to CG, which had more frequency of less severe fracture types.

1. Introduction

The restorative composites have been improved markedly concerning the esthetic and mechanical properties;[1] therefore, they have been indicated for application in stress bearings areas in posterior teeth. In Pediatric Dentistry, when atypical prepares are present because of caries extension, the better option is the indirect composite restoration that provide a shorter clinical section and less contamination risk.[2]

The indirect composite restorations show many advantages compared to direct technique such as the replacement of natural convexities of teeth and control of occlusal and proximal contact points, better marginal fit especially in the gingival wall,[3,4] minimal shrinkage polymerization only due to

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0300-5712/$ – see front matter
doi:10.1016/j.jdent.2005.11.003

cement agents[1] and good polishing and finishing possibilities. Furthermore, in pediatric dentistry the additional cure of composite in indirect technique is not necessary because this could increase the wear resistance of some composites commercially available.[5] The increased wear resistance of composite restorations is not required to primary teeth since restorative composite materials have to follow the physiologic wear of deciduous dentition.[6,7]

Primary teeth present structural and compositional differences from permanent teeth, as lesser thickness of dentin and degree of mineralization.[8] Secondary dentin secretion and pulpar repair activity decreases with aging in primary teeth. This promotes a favorable condition to caries process reach the coronary pulp.[9] Consequently, a great number of teeth that require onlay indirect restorations need previous endodontic treatment.

There is a widely held belief that root-treated teeth are weakened and more susceptible to fracture than the vital ones specially because during the endodontic treatment there is a reduction of inner cuspal slopes that support cuspal angles from coronal tooth structure.[10]

Intracanal irrigants may also play a role in influencing the physical and mechanical properties of dentin. Sodium hypochlorite (NaOCl) is widely recommended as a root canal irrigant due to its antibacterial and organic tissue disintegration properties.[11,12] Since dentin is composed of 22% by weight of organic material, NaOCl solution could potentially affect the penetration of resin into the dentin structure and/or the monomer polymerization[13,14] from adhesive systems when composite restorations are used.

There is no information in the literature about mechanical properties of indirect composite restorations placed on endodontically treated primary teeth. The purpose of this study was to evaluate the compressive strength of composite onlay restorations in primary teeth, submitted to 1% NaOCl treatment, using two resin luting agents and to verify the fracture types. The hypothesis tested was that the treatment with 1% NaOCl solution would decrease the compressive strength recovery of onlay restorations in primary teeth, regardless the luting agents used.

2. Materials and methods

This study was submitted to the Research Ethics Committee of FOP/UNICAMP (approval no. 108/2003) according to the Resolution of the National Commission of Ethics in Research. Fifty freshly-extracted primary molars were cleaned, disinfected and frozen stored until experiment. The teeth were distributed into five groups ($n = 10$), according to the treatment:

G 1—1% sodium hypochlorite + EnForce (Dentsply);
G 2—EnForce (Dentsply);
G 3—1% sodium hypochlorite + Rely X (3M/ESPE);
G 4—Rely X (3M/ESPE);
G C (control group)—sound teeth.

Each group was comprised by five mandibular first molars, two maxillary first molars, two maxillary second molars and one mandibular second molar.

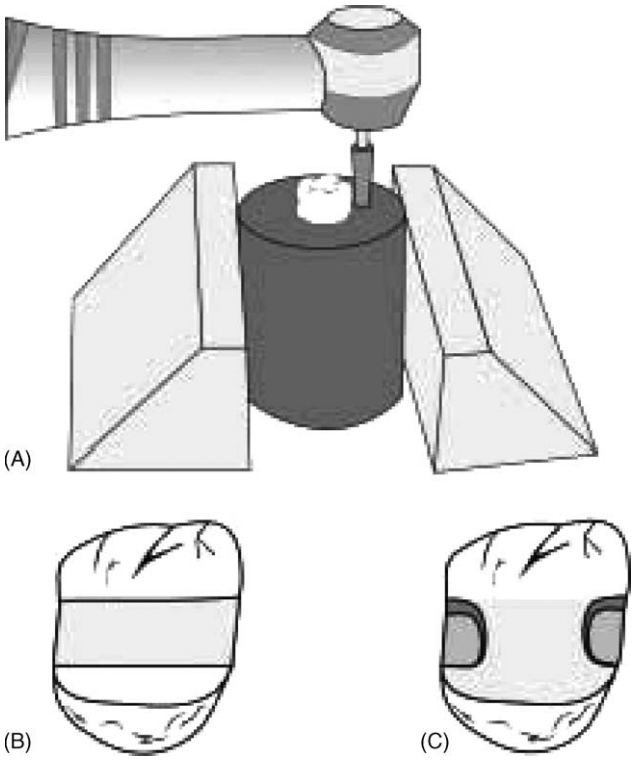

Fig. 1 – Sequence of tooth cavity preparation using a high speed handpiece. (A) A first maxillary primary molar positioned into a machine in order standardize the cavity dimensions of each tooth. (B) Oclusal box was made beginning with grinding in a slot shape. (C) The proximal boxes were made in the machine followed by manual additional grinding of the biggest cusp.

2.1. *Specimen preparation*

Each tooth was embedded in PVC cylinders (21 mm in diameter and 25 mm in height) using polystyrene resin (Piraglass Ltda., Piracicaba, SP, Brazil). The crowns were positioned 1 mm below the cement-enamel junction and totally out of the resin.

The teeth were prepared in a machine in order to standardize some areas of cavities (Fig. 1) using diamond trunk-conic burs with a six degree inclination (KG Sorensen, São Paulo, SP, Brazil) specially designed for this experiment, that were changed after every 5th preparation. The teeth were prepared with the following characteristics:

Oclusal box: the isthmus width was approximately half the buccal-lingual distance without cavosurface grind and the depth ranged according to the anatomy of teeth. To first molars, the depth of pulpar wall was 2.0 mm below the tallest cuspid present. To second molars, the depth of pulpar wall was 2.5 mm below the tallest cuspid.

Proximal box: the depth was determined according to the remaining distance of each tooth with polystyrene resin base due to the cervical-occlusal height variation. The inner angles of prepared teeth were rounded.

All teeth had an additional grinding of the greatest cusp: distal-lingual cusp in the mandibular first molars, palatine