Journal of Dentistry 46 (2016) 18–22

Contents lists available at ScienceDirect

Journal of Dentistry

journal homepage: www.intl.elsevierhealth.com/journals/jden

Bulk dentine replacement versus incrementally placed resin composite: A randomised controlled clinical trial

D. Hickey[a], O. Sharif[b], F. Janjua[c], P.A. Brunton*[,d]

[a] General Dental Practitioner, Chorley, Lancashire, UK
[b] Orthodontist, Eastman Dental Hospital, London, UK
[c] General Dental Practitioner, Fulham, London, UK
[d] Dean, Faculty of Dentistry, Sir John Walsh Research Institute, University of Otago, New Zealand

ARTICLE INFO

Article history:
Received 17 May 2015
Received in revised form 21 January 2016
Accepted 24 January 2016

Keywords:
Resin composite
Dentine
Sensitivity
Clinical trial

ABSTRACT

Objective: This randomized controlled clinical trial compared two techniques and materials for restoring carious teeth—Bulk dentine replacement versus incremental placement of a hybrid posterior resin composite material in terms of patient comfort (post operative sensitivity and tenderness on biting).
Material and Methods: Seventy-two carious teeth were randomized to one of two treatment groups: Group A—were restored with a bulk dentine replacement material or Group B—restored with incrementally placed hybrid composite. Patients were followed up by way of a structured phone call at day 2 and day 7 post-operatively. Patients reporting discomfort at day 7 were subsequently followed up on days 14, and 30.
Results: All patients were followed up. At day 2, 18/72 restored teeth had post-operative sensitivity; this figure fell to 10/72 at day 7. A Chi squared test revealed that at day 2 a greater level of sensitivity was reported by patients in Group A ($P=0.029$). However, at day 7 there was no statistically significant difference between the two groups in terms of sensitivity ($P=0.453$). 8/72 and 6 /72 teeth had tenderness to biting at days 2 and 7 respectively. A Chi squared test revealed no statistically significant difference between the two groups in terms of tenderness on biting at any time period ($P=0.722$). Interestingly, Class I cavities were found to be more tender on biting than Class II cavities. At day 30 2/72 teeth exhibited sensitivity and none of the teeth exhibiting tenderness on biting.
Conclusion: At day 7 there was no significant difference between the two groups in terms of postoperative sensitivity and tenderness on biting.

1. Introduction

Composite filling materials have been increasingly used as the restoration of choice for posterior teeth in recent years [1–3]. Reasons for this include, improved aesthetics, the perceived health risks of dental amalgam and the ability to prepare a cavity more conservatively as resins bond to and support adjacent tooth structure [4]. Contemporary resin bonded composite materials are ceramic filled dimethacrylates, their constituent components are: a monomer, often a diluent monomer, an inorganic filler, a silane coupling agent, a polymerization inhibitor, an initiator and a UV stabilser [5]. Fillers are used in the material to decrease the level of contraction shrinkage, however, this makes the material more difficult to manipulate.

Historically, there were a number of side effects associated with placing Posterior Resin Composite Restorations (PRCRs) including: prolonged post-operative sensitivity, marginal degradation and tenderness under occlusal forces [6]. PRCRs have been shown to shrink up to 3% [6] on curing and this predisposes to internal stresses and gap formation between the PRCRs and the cavity walls. Amongst other problems this leads to post operative sensitivity and pain on biting. To help minimize this it has been recommended that PRCRs be placed in increments of no more than 2 mm to allow for limited cure depth and also to ensure that only one surface is bonded at a time [7]. Whilst contraction on curing is often cited as a significant cause of postoperative sensitivity other factors have been suggested as having significant involvement, which include patient variables, cavity size, the type of tooth treated, the depth of the carious lesion, the operator and the dentine adhesive system used [8].

* Corresponding author at: 310 Great King Street, P.O. Box 647, Dunedin, New Zealand.
E-mail address: paul.brunton@otago.ac.nz (P.A. Brunton).

http://dx.doi.org/10.1016/j.jdent.2016.01.011
0300-5712/

Improvements in material sciences have meant that new generations of micro-filled hybrid composites compare favourably to amalgam restorations and are rapidly becoming the first choice for the restoration of posterior teeth [1–3]. With the introduction of new 'bulk-fill' composites allowing for a greater depth of cure, clinical time has been significantly reduced with no change in micro-hardness and shear bond strength [9]. Smart Dentine Replacement (SDR) by Dentsply is a new low viscosity bulk fill composite with a filler content of 68% by weight. Fillers are used to reduce the coefficient of thermal expansion and polymerisation shrinkage therefore improving the mechanical property of the composite [10]. A modulator is also included, helping the monomers to form a more relaxed network [11]. This reduces the overall effect of polymerisation shrinkage therefore enabling SDR to be placed in 4 mm increments. It is important to appreciate that larger particle filler size increases fracture toughness of the composite but makes it harder to polish [12]. The larger particle filler size incorporated in these bulk fill restorative materials requires it to be used in conjunction with a hybrid or mircrofilled composite to optimise the aesthetic result [13]. Bulk fill composite materials have been reported to have reduced shrinkage with an associated reduction in postoperative sensitivity and pain on biting [14].

To date there have been no studies comparing incrementally placed PRCRs and a bulk fill composite system in terms of immediate post-operative sensitivity and discomfort after placement. The aim of this randomized controlled trial therefore was to compare a bulk fill composite system and an incrementally placed hybrid PRCRs in terms of patient comfort (post operative sensitivity and tenderness on biting). The null hypothesis (H_0) was therefore that there was no significant difference in terms of post operative sensitivity and tenderness on biting between the two materials (bulk fill composite system versus an incrementally placed hybrid PRCR) tested. In contrast the test hypothesis (H_1) was that there was a significant difference between the two materials tested in terms of post operative sensitivity and tenderness on biting.

2. Material and methods

2.1. Study design

This study was reviewed and approved by the Leeds Dental Institute Research Ethics Committee (Application Number 280111/DH/55); all patients were provided with a patient information sheet prior to being asked to give informed consent for inclusion in the study.

Seventy-two patients, who were aged 18–70 years, were recruited from Southport Road Dental Practice, Chorley and all treatment provided by one of the general dental practitioners in the practice. One carious tooth per patient was randomly allocated to two treatment groups: Group A—restored with a bulk filled resin composite system (SDR) or Group B—restored with incrementally placed hybrid composite. This randomisation was carried out via a randomly mixed envelope system, whereby the different treatments (36 of each) were placed in 72 envelopes and opened when the patient selected one at random, which, determined their treatment group.

2.2. Inclusion criteria

To be included in the trial the following criteria had to be satisfied:

- The patient was willing and able to provide valid informed consent.
- The tooth with the carious lesion was vital, in occlusion, and required operative intervention to restore a proximal or occlusion lesion.
- The tooth with the carious lesion was suitable for restoration by virtue of its depth with a bulk fill material.
- The patient was not taking any pain modulating medicaments.
- The patient had not experienced excessive tooth wear nor was a tempro-mandibular disorder(s) evident.

2.3. Exclusion criteria

In contrast subjects were excluded if:

- They reported any sensitivity or had any other symptoms.
- The carious lesion was within 2 mm, as verified by bite wing radiograph, of the pulp.

2.4. Methodology

Once patients were enrolled into the study, all teeth to be treated were tested to confirm vitality with a sensibility test to a cold stimulus using Endo Frost [15]. If the subject indicated pre-operative symptoms (sensitivity or pain on biting) they were investigated fully to either resolve these, if resolution was not possible the patients were excluded from the study.

2.5. Treatment common to both groups

Teeth were anaesthetized (using Artikent from Kent express 4% Articaine and 1:100,000 adrenaline) and a rubber dam placed. The carious lesion was prepared according to accepted operative procedures. The enamel margins were etched with a 36% phosphoric acid gel (Ultradent, Salt Lake City, USA), for 15 s, subsequently the etch was extended onto dentin for a further 15 s. The preparation was then washed for 15 s and gently dried with an oil-free three-in-one syringe. A dentine adhesive (Scotchbond NT, 3MESPE, Bracknell, UK) was applied and light cured according to manufacturer's instructions. The curing light was tested, with a light curing meter, to ensure that an output in excess of 400 mw/cm^2 was achieved throughout the study. In addition prior to restoring the proximal (Class II) cavities, a thin sectional matrix (V-ring Triodent) was placed, wedged and closely adapted to the tooth to facilitate restoration of the contact area.

2.6. Treatment specific to each group

2.6.1. Group A

The teeth in this group were restored with a bulk fill restorative material (SDR) (Dentsply, Weybridge, UK) placed according to the manufacturer's instructions (one bulk increment up to 4 mm) as needed to fill the cavity up to 2 mm short of the occlusal surface. In deeper preparations, the material was placed in 4 mm increments, light curing each increment according to the manufacturer's instructions. The last 2 mm was restored, finished and polished with a hybrid resin composite (Z250, 3MESPE, Bracknell, UK). The teeth were restored according to manufacturer's instructions using a standard incremental build-up technique (increments no greater than 2 mm). The occlusion was then checked using the EDEc Principle [16].