تقييم الحاصرات التقويميّة الخزفيّة الملصقة إلى الميناء باستخدام مادتي إلصاق لمدة 12 شهراً: تجربة سريريّة معشاة

رانيه حداد*

الملخص

خلفية البحث وهدفه: في الأدبيات الطبيّة القليل من التجارب السريريّة طويلة الأمد هدفت إلى تقييم نسب فشل الحاصرات الخزفية. هدفت هذه التجربة السريريّة المعشاة التي قام بها باحث وحيد إلى مقارنة نسب فشل الحاصرات الخزفية خلال مدة 12 شهر والملصقة باستخدام مادتي كمبوزيت إلصاق.

مواد البحث وطرائقه: أجريت هذه الدراسة على 46 مريض ممن يخضعون لمعالجة تقويمية لا تستدعي قلع أسنان في قسم تقويم الأسنان والفكين في كلية طب الأسنان/جامعة دمشق. استخدم كمبوزيت تقليديّ لربعي فك متقابلين لدى كل مريض (مادة Transbond™ XT كمجموعة شاهدة) واستخدمت مادة مؤلفة من مكون وحيد في الربعين المتبقيين (مادة OrthoCem كمجموعة اختبار). وسجّل فشل الحاصرات خلال مدة 12 شهراً وذلك خلال عامي 2016 إلى 2018.

النتائج: كانت نتائج نسب الفشل للمجموعة الشاهدة ومجموعة الاختبار متقاربة دون أي فارق إحصائي (4.6 و 6.3 على التوالي). أظهرت الحاصرات على الفك السفلي نسب فشل أعلى بشكل دال إحصائياً عن مثيلاتها في الفك العلوي (P= 0.048، 6.9% و 4.1 على التوالي).

الاستنتاج: كان للمادتينTransbond™ XT و OrthoCem نسب فشل متقاربة وبالتالي أداء سريري متقارب. أبدت الحاصرات الملصقة على أسنان سفلية خطورة فشل أعلى.

كلمات مفتاحية: نسبة الفشل، حاصرات خزفية، كمبوزيت إلصاق.

* أستاذة مساعدة – قسم تقويم الأسنان والفكين– كليّة طبّ الأسنان– جامعة دمشق.

A 12-Month Evaluation of Orthodontic Ceramic Brackets Bonded to Enamel Using two Adhesives: A Randomized Clinical Trial

Rania Hadad*

Abstract

Background and aim: Few long-term clinical trials have addressed the evaluation of the failure rates of ceramic brackets in literature. The aim of this single-operator, randomized clinical trial (RCT) was to compare the bonding failure rate at 12 months of ceramic brackets bonded with two orthodontic composite adhesives to enamel.

Materials & Methods: Forty six patients, receiving non-extraction orthodontic treatment at the Orthodontic Department in the Faculty of Dental Medicine/Damascus University, with a total of 920 bonded brackets were recruited in this study.

Two diagonal quadrants in each patient were randomly assigned to the traditional composite group (Transbond™ XT that is the control group) and the contralateral diagonal quadrants to the single component composite group (OrthoCem that is the experimental group). Incidents of brackets' failures over 12 months follow up period were recorded during all through the 2016-2018.

Results: Failure rates for both control and experimental groups were comparable with no significant differences (4.8%, and 6.3% respectively). Brackets located in the mandible had significant higher failure rates than those in the maxilla (P= 0.048, 6.9% and 4.1% respectively).

Conclusion: Transbond™ XT and OrthoCem have similar failure rates and accordingly a similar clinical performance. Brackets bonded to teeth located in the mandible possess a higher failure risk.

Index Words: Failure rate, Ceramic brackets, Composite adhesive.

* Associated professor at the OrthodonticDepartment Faculty of Dentistry, Damascus University.

Introduction

Orthodontic treatment success is largely dependent on adequate bonding between brackets and enamel[1]. Thus, brackets failure is frustrating problem and time consuming for both the patient and the orthodontist[2]. Many times this is due to mechanical loading levels, surface conditioning, and type, properties and thickness of adhesive used[3,4,5].

The increasing number of adult patients seeking orthodontic treatment encouraged the use of ceramic brackets as the esthetic alternative to the metal ones. The skills of clinicians, along with the type, morphologic, clinical characteristics and physical properties of ceramic brackets besides their location in the dental arch may affect their adhesion to enamel and their resistance to failure during orthodontic treatment [6,7,8,9,10]. Furthermore, Although, many studies reported the clinical reliability of different types of orthodontic adhesives, yet no clear evidence on which to depend when choosing the type of orthodontic adhesive to be used clinically [2]. On the other hand, eliminating the need to apply primer to etched enamel reduces the clinical time of bonding stages while it does not affect the survival of brackets.[11]

Good adhesive results are provided when using the conventional bonding of orthodontic brackets to enamel via etching and rinsing bonding approach [4,12,13]. However, the series of steps that has to be followed in such bonding approach makes it a time-consuming when comparing to new systems allow elimination of one stage.

Accordingly, the main objective of this study was to clinically evaluate the failure rates of ceramic brackets bonded with two different orthodontic composite adhesives. The secondary objective was to evaluate the ceramic brackets failure rates between the upper and lower arches and the anterior and posterior segments; with an observational period of 12 months. The null hypothesis was that there is no significant difference in

brackets failure rates between the two bonding systems, nor between the anterior and posterior segments of upper and lower arches.

Materials and methods

A total of forty six consecutive patients requiring non-extraction orthodontic treatment with fixed appliances were involved in this RCT with a total of 920 bonded brackets at the Department of Orthodontics, Faculty of Dental Medicine/Damascus University. During all through the 2016-2018. Patients had to agree to participate in this study and to satisfy the following inclusion criteria:

- complete permanent dentition
- skeletal class I
- non-extraction treatment
- no dental/enamel anomalies
- no genetic syndromes connected with oral cavity anomalies
- no labial or buccal restorations, no oral habits
- no need for the use of adjunctive orthodontic device (lip bumper, facialmask, headgears, etc.)

First molars were not included. A split mouth design was applied, and the patients were randomly divided into two equal groups (n= 23 patients, n= 460 brackets) according to the type of the composite adhesive used (Transbond™ XT as a conventional bonding material and OrthoCem which eliminates the use of primer).

A total of 920 ceramic MBT brackets (3M Unitek, Monrovia, Calif)) of 0.022-inch slot were bonded with one of the adhesive materials used in this study. In both groups the enamel surfaces were etched with 37% phosphoric acid (CondAc 37, FGM) for 30 seconds and then rinsed thoroughly using an air–water spray for 20 seconds. The enamel surfaces were air-dried until they appeared frosty. The brackets were bonded following the manufacturer's instruction. As soon as a bond failure was detected brackets were replaced, without including the new bonded brackets in the study.

Chi squared test was conducted to study the significant differences in brackets failure rate recurrence between the two groups according to bracket localization in the upper and lower arches.

Results:

As the CONSORT flow chart (Figure 1) shows, no patient dropped out of this trial over the 12 month observation period. A total of 46 patients were involved with 920 bonded brackets overall; 460 with Transbond™ XT and 460 with OrthoCem. All patients underwent bimaxillary orthodontic treatment with fixed appliances and were followed up for 12 months (range ±14 days). The distribution and number of bonded brackets for patients recruited in the trial are shown in Table (1)

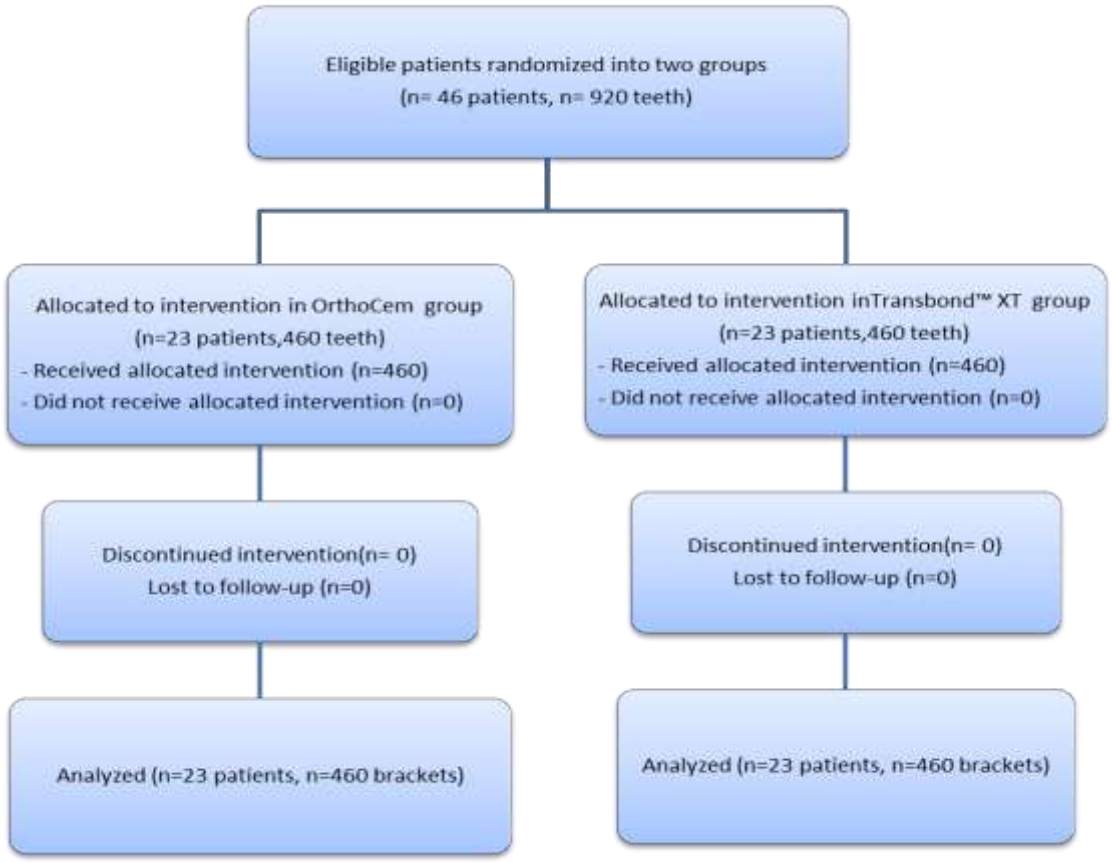

Figure 1: CONSORT flow chart

Table 1: Distribution and number of bonded brackets for patients recruited in the trial.

Localization	Ttansbond™ XT (n= 460)	Orthocem (n= 460)	All (n= 920)
Maxilla	230 (25%)	230 (25%)	460 (50%)
Mandible	230 (25%)	230 (25%)	460 (50%)
Anterior segment	276 (30%)	276 (30%)	552 (60%)
Posterior segment	184 (20%)	184 (20%)	368 (40%)

Fisher's exact test showed no significant differences in the total bracket failure rate between the two groups Table (2). A total of 51 brackets (5.5%) bonded with Transbond™ XT and OrthoCem failed over the 12-month period. (4.8% and 6.3% respectively per group). Chi squared test showed no significant relationship between the position of the anterior and posterior brackets in one arch and the type of materials used in failure rate, as shown in Tables (3, and 4). While this test showed significant relationship between the upper and lower brackets failure and the type of materials used in failure rate, brackets located in the mandible had significant higher failure rates than those in the maxilla (P= 0.048, 6.9% and 4.1% respectively) Table (5).

Table 2: The number and percentage of bracket failure rates in the two groups used in the trial

Studied group	Bonded brackets	Brackets failure n(%)
Ttansbond™ XT	460	22 (4.8%)
OrthoCem	460	29(6.3%)
Total	920	51 (5.5%)
Fisher's exact test	(P>0.05)Not significant	

Table 3: The number and percentage of bracket failure rates in the two groups used in the trial according to bracket localization in the upper arch

Studied group	Total upper arch	Brackets failure n (%)	Upper anterior section	Upper posterior section
Ttansbond™ XT	230	8 (3.5%)	2 (0.9%)	6 (2.6%)
OrthoCem	230	11 (4.8%)	3 (1.3%)	8 (3.5%)
Total	460	19 (4.1%)	5 (1.1%)	14 (3.04%)
Chi-squared test		ns	ns	ns

Table 4: The number and percentage of bracket failure rates in the two groups used in the trial according to bracket localization in the lower arch

Studied group	Total lower arch	Brackets failure n (%)	Lower anterior section	Lower posterior section
Ttansbond™ XT	230	14 (6.1%)	3 (1.3%)	11(4.8%)
OrthoCem	230	18 (7.8%)	3 (1.3%)	15(6.5%)
Total	460	32 (6.9%)	6 (1.3%)	26 (5.6%)
Chi-squared test		ns	ns	ns

Table 5: The number and percentage of bracket failure rates in the two groups used in the trial according to bracket localization in both arches

Studied group	Total lower arch	Lower arch brackets failure n (%)	Total upper arch	Upper arch brackets failure n (%)	Chi-squared test
Ttansbond™ XT	230	14 (6.1%)	230	8 (3.5%)	
OrthoCem	230	18 (7.8%)	230	11 (4.8%)	
Total	460	32 (6.9%)	460	19 (4.1%)	S (P= 0.048)

Discussion:

The main objective of this study was to determine which used adhesive obtained efficient and reliable bond strength of ceramic brackets to enamel. Bonding of orthodontic brackets to enamel using conventional bonding approach is successful yet time consuming.[12] A system that combines both the primer and the adhesive into a single paste syringe, allows the elimination of the primer application step required for conventional bonding systems. One of these new products is the OrthoCem

The results of our study showed that under clinical circumstances, the performance of OrthoCem was similar to the conventional Transbond™ XT. Although the latter had less brackets failure rates, the difference was not significant between the two studied groups. Since there was no significant difference between the bond strength of the two used materials, it is suggested that the use of OrthoCem may reduce the time needed for bonding procedures. This may considered as an advantage when using OrthoCem.

The risk of enamel damage when using ceramic brackets, that usually exhibit high clinical bond strength, is a major concern for clinicians.[14] Thus it might be good clinical choice to use OrthoCem in bonding ceramic brackets as it could be concluded from this study that it has slightly higher failure rate and consequently lower bond strength.

Significantly more failures were found for brackets bonded to the mandibular teeth, no difference was identified in failure rate between anterior and posterior teeth. That is may be due to the fact that the lower teeth are more likely to get contaminated with saliva during bonding procedures[10]. The results of the total brackets failure rate in this study agree with those of previous reports [12,15,16,17]. A higher brackets' failure rates were reported in previous studies [13,18]. It is likely that the self-etch system used in their studies could have played a role in the different failure rate found.[19,20]

Conclusion:

Both materials performed similarly clinically and had comparable bond strength; no significant differences were observed in bracket failure rates between Transbond™ XT and OrthoCem. The lower posterior segments in both groups exhibited higher bracket failure rates compared to those observed on upper sides.

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