

## Effectiveness of Self-Etching Primer Versus Conventional Etch and Bond Technique in Fixed Orthodontic Treatment

(Keberkesanan Teknik Primer Pengasidan Sendiri Berbanding Teknik Pengasidan serta Pengikatan Konvensional pada Rawatan Ortodontik Tetap)

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### ABSTRACT

*A good adhesive is an important factor to consider in orthodontic bonding. Frequent bracket failure prolongs treatment duration and causes inconvenience to patient and operator. This study aimed to compare the effectiveness of two bonding agents, i.e. the self etching primer (SEP) and the conventional etch and bond (CEB) by monitoring the incidence, time and sites of bracket failure. Eighty orthodontic patients were recruited after informed consent were obtained. A randomized split mouth technique was used where one side was bonded with CEB agent, while the other side was bonded using SEP agent. All bonded brackets were examined every 4 weeks for 20 months. Incidence of bracket failure was noted and comparison between the two groups was done using paired t-test. Time and frequent site of failure were also assessed. Out of 1314 brackets, only 33 brackets were debonded with 16 from SEP group and 17 from CEB group which statistically insignificant ( $p>0.05$ ). Almost 55% of bracket failure occurred during the first 3 months after bonding for both adhesives with lower premolars was most the frequent site to fail in both adhesives (39.4%). Bracket bonded on the left side failed significantly compared to the right side. In conclusion, both self-etching primer and conventional acid-etch bonding agents are equally effective in retaining brackets clinically. Bracket failure mostly occurs during the first 3 months after bonding. The premolar brackets and the left side are mostly debonded when compared to other sites.*

*Keywords: Bonding agent; bracket failure; orthodontic treatment; self etching primer*

### ABSTRAK

*Perlekatan yang baik adalah faktor penting yang perlu diberikan perhatian di dalam pengikatan ortodontik. Braket yang kerap tertanggal akan memanjangkan tempoh rawatan dan menyebabkan ketidakelesaian kepada pesakit dan perawat. Tujuan kajian ini adalah untuk melihat keberkesanan dua agen pengikat iaitu primer pengasidan sendiri dan pengasidan dan pengikatan konvensional dengan memerhatikan kejadian, masa dan tempat braket tertanggal. Lapan puluh orang pesakit ortodontik terlibat di dalam kajian ini setelah mendapat kebenaran. Teknik split mouth secara rawak telah digunakan dengan sebahagian mulut menggunakan agen CEB dan sebahagian lagi menggunakan agen SEP. Semua braket akan dipantau setiap 4 minggu sehingga tempoh 20 bulan. Kejadian braket tertanggal akan direkod dan perbandingan antara kedua-dua kumpulan akan dibuat menggunakan paired t-test. Masa dan tempat yang kerap braket tertanggal juga dinilai. Daripada 1314 braket, hanya 33 braket yang tertanggal, dengan 16 daripada SEP dan 17 dari CEB dan tiada perbezaan statistik yang signifikan antara keduanya ( $p>0.05$ ). Hampir 55% braket tertanggal pada 3 bulan pertama selepas perlekatan dan braket premolar bawah paling kerap tertanggal bagi kedua-dua agen perlekatan (39.4%). Braket yang dilekatkan pada sebelah kiri tanggal secara signifikan berbanding sebelah kanan. Kesimpulannya, kedua-dua agen perlekatan SEP dan CEB adalah berkesan untuk perlekatan braket secara klinikal. Kegagalan braket paling banyak berlaku pada tempoh 3 bulan pertama. Braket pada gigi premolar dan di sebelah kiri adalah tempat yang paling kerap tertanggal.*

*Kata kunci: Agen perlekatan; kegagalan braket; rawatan ortodontik; primer pengasidan sendiri*

### INTRODUCTION

Fixed orthodontic treatment is carried out using orthodontic appliance which is bonded to the teeth. A frequent come-off brackets and the need to replace them became a frustrated situation, both to the orthodontists and the patients and at the same time can be costly in terms of materials and time. Brackets that permanently stay in the patient's mouth until the end of treatment can promise a shorter time of treatment

and a better result. Ideal bond strength of a bonding agent should be able to withstand the intraoral forces throughout the treatment period and do not cause any damage to the enamel during debonding (Murfit et al. 2006).

Research on dental material, especially in bonding agent are moving towards patient comfort and simplifying the treatment procedures. The need for a bonding system that is consistently reliable, biocompatible, unaffected by saliva contamination and most of all, easy to use, has led to

the development of products that do not require the initial step of etching the enamel surface. In these new systems, etching, priming and bonding are all in one component. Recent advances in dental bonding chemistry allow the combination of the etchant and primer into one product called a self-etch primer (SEP) bonding agent. This single step bonding agent can reduce the clinical time (Banks & Thiruvenkatachari 2007; Elekdag-Turk et al. 2008; Korbmacher et al. 2002; Sunna & Rock 1998) and at the same time will cause less problematic moisture control (Jing & Juan 2004). Many studies have been done on comparing the Self Etch Primer (SEP) and conventional etch and bond (CEB) techniques in various aspects and involving many brands from different manufacturers.

Several studies have looked at the bracket's failure rate of SEP and CEB system which produced different results. A study done by Murfitt et al. (2006) stated that self-etch primer had a significantly higher bond failure rate compared to conventional etch and prime system. Other researches stated that there was no statistically difference between the self-etch and conventional etching system for bracket failure (Banks & Thiruvenkatachari 2007; Basaran et al. 2006; Elekdag-Turk et al. 2008; Manning et al. 2006; Sunna & Rock 1998).

This study aimed to compare the effectiveness of two types of adhesives, the self etching primer (SEP) and conventional etch and bond (CEB) by monitoring the bracket failure rate, time interval of bracket failure and site of bracket failure.

#### MATERIAL AND METHODS

The sample was selected from postgraduate orthodontic waiting list, Faculty of Dentistry UKM, Kuala Lumpur. The approval of the Ethic Committee and consent from patients/parents were obtained prior to the start of this study. The sample size calculation was based on a study by Littlewood et al. (2001) where the minimum of samples of 33 subjects should be recruited. All subjects were selected based on the inclusion criteria listed in Table 1.

Patients were treated by a single operator to avoid procedure bias. Split mouth technique was used where patients were randomized to either the SEP group on right or left side. The CEB agent was used on the opposite side

which acted as control for this study. The patients were monitored every month for the total of 20 months.

#### ORTHODONTIC CLINICAL PROCEDURES

All patient received 0.56 mm × 0.71 mm slot preadjusted straight wire appliance (MBT prescription, Mini Master, American Orthodontics), from incisors to the second premolars. Bands were placed on all first molars. A standardized protocol based on manufacturer's instructions was followed for tooth preparation and bracket bonding procedures for both groups.

The control group received conventional etch and bond bonding agent (CEB), (Transbond XT, 3M Unitek, Monrovia, CA, USA). The test group received self-etching primer bonding agent (SEP) (G-Bond, GC Corporation, Tokyo, Japan). Bonding procedures for both adhesive systems are illustrated in Figure 1. Bonding procedures was performed at one side at a time to ensure good moisture control. All orthodontic adhesives were light cured using Mectron Halogen Bluelight (230 Vac plus minus 10%-79W-50/60Hz, Mectron Medical Technology) on mesial and distal area. The same curing light was used throughout the study. Any excess composite was removed with a sharp probe prior to curing. Patients were then instructed to brush their teeth with a manual toothbrush, fluoridated tooth paste and in combination with inter-dental brush. A written instruction on caring of the fixed appliance was also provided to the patient. In case of any bond failure from either in the control or test group, a new bracket will be placed using the same allocated bonding system. This bracket will not be considered again in calculating for the bond failure rate, however it will still be considered for site and period of time of which the bracket failure occurred.

#### ASSESSMENT OF BRACKET FAILURE

Each subject was monitored for bond failure at every 4 weeks. The following data was recorded regarding each bond failure number of teeth debonded; tooth which the bond failure occurred; time when the bracket debonded.

Once a bracket failure was discovered, a new bracket was bonded using CEB agent. The tooth was then excluded from the survival population.

TABLE 1. Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
1. patient that require fixed appliance therapy	1. teeth with facial caries or restoration
2. patient that have no previous history of wearing fixed appliance	2. teeth that have congenital enamel defect
3. absence of occlusal interference	3. patient with gingival hyperplasia
4. balanced extraction cases	4. teeth that require surgically expose
5. patient that cooperative and motivated	5. teeth where the bracket placement was delayed
6. patients with good oral hygiene	6. patient with craniofacial anomaly
	7. orthognathic cases
	8. asymmetry extraction cases
	9. uncooperative patient

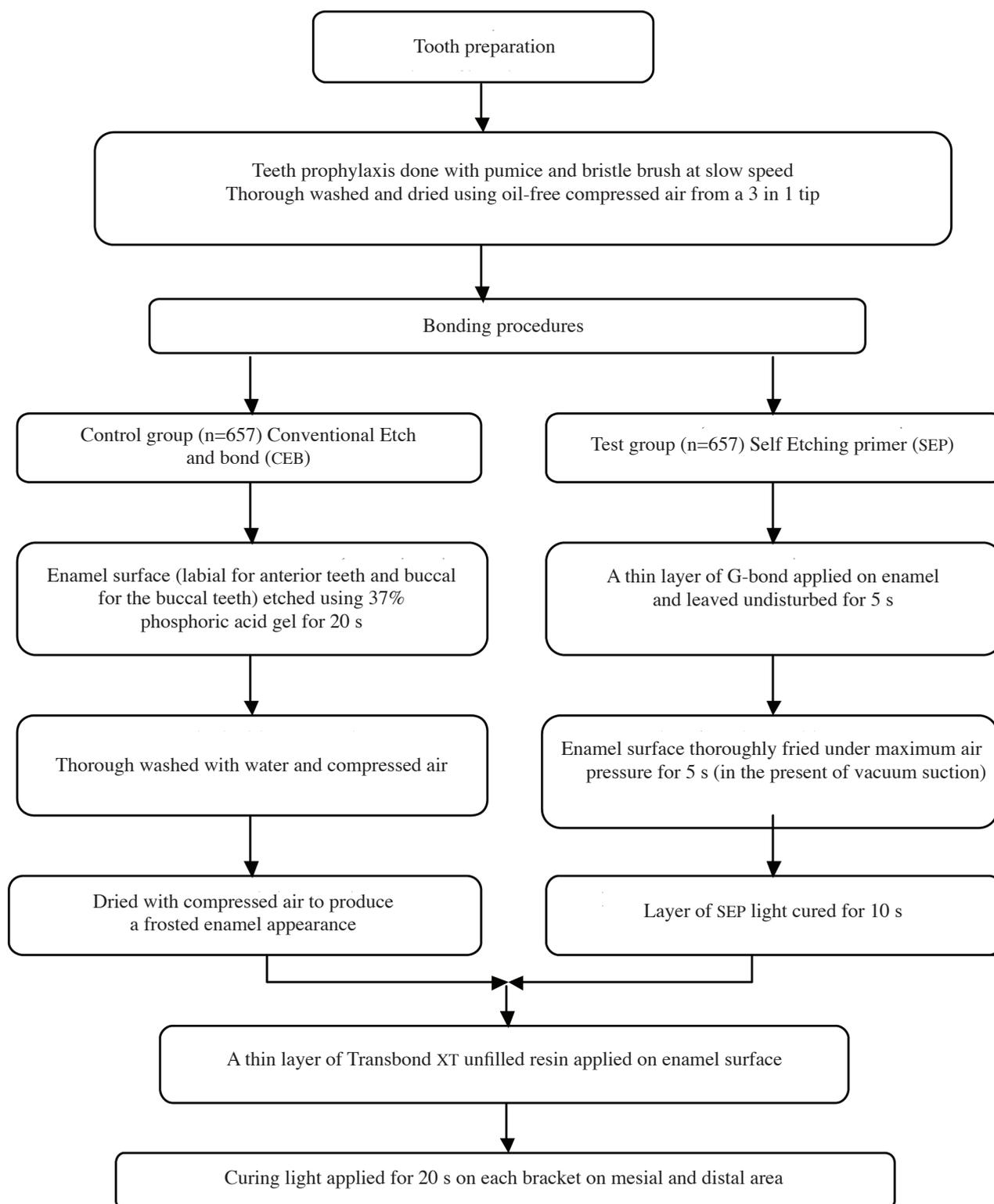


FIGURE 1. Working flow chart for bonding procedures

#### STATISTICAL ANALYSIS

The Statistical Package for Social Sciences (SPSS) program version 18.0 was used to analyze the data. The number of bracket failure, time interval and sites of bracket failure

were analyzed descriptively. The comparison study was carried out using paired t-test. Significant was set at  $p$  value of  $< 0.05$ .

RESULTS

DEMOGRAPHIC DATA

A total of 80 patients, 33 males and 47 females and age between 13 to 33 years old were involved in this study (Table 2). A total of 1314 brackets were bonded and were divided equally for both adhesives (Table 3).

TABLE 2: Profile of patients included in this study

Patients' profile	n (%)
Gender	
Male	33 ( 41.25)
Female	47 ( 58.75)
Mean of age ( $\pm$ SD)	
Male	15 ( $\pm$ 0.05)
Female	17 ( $\pm$ 0.05)

TABLE 3. Total number and percentage of bracket bonded and number of bracket failure for both adhesives  
Comparison of bracket failure between SEP and CEB was done using paired t-test with  $p = 0.848^*$

Material	Number of bracket bonded (%)	Number of bracket failure (%)
CEB	657 (50%)	17 (2.59)*
SEP	657 (50%)	16 (2.43)*
Total	1314 (100%)	33 (2.51)

BRACKET FAILURE

Thirty three brackets were debonded for both adhesives (16 for SEP and 17 for CEB) (Table 3). It is clearly seen that the bracket failure for both adhesives was not statistically significant ( $p=0.848$ ).

TIME INTERVAL OF BRACKET FAILURE

Most of the bracket failure occurred in the first 3 months of treatment. Eighteen brackets failed at this time (10 from CEB and 8 from SEP). The other 15 brackets were debonded between 6 months and 20 months (Table 4).

TABLE 4. Bracket failure at time interval for both adhesives

Type of adhesive	Time interval (months)						
	3	6	9	12	15	18	20
CEB	10	2	2	1	1	1	1
SEP	8	1	2	1	2	1	0
Total	18	3	4	2	3	2	1

SITE OF BRACKET FAILURE

The site of which the bracket failed is represented in Figure 2. Lower premolar had the most bracket failure ( $n=13$ ). More bracket debonded on the left side ( $n=11$ ) compared with the right side ( $n=2$ ). The upper incisor had the least bracket failure ( $n=3$ ). More brackets debonded on the lower arch ( $n=21$ ) compared with upper arch ( $n=12$ ). More brackets debonded on the left side ( $n=22$ ) compared with right side ( $n=11$ ) and were statistically significant ( $p=0.001$ ).

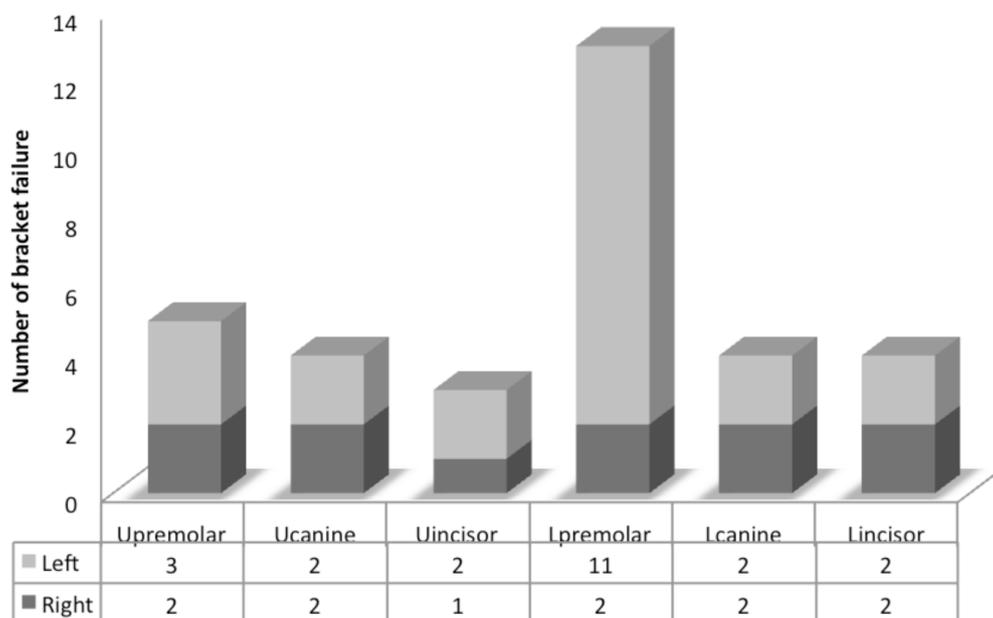


FIGURE 2. Sites of bracket failure comparing teeth on left and rightside  
Paired t-test was used with  $p=0.001$ ; U-upper, L-lower

## DISCUSSION

### BRACKET FAILURE

In this prospective study, the failure rate of the brackets of the two adhesives were equally low (2.43% for SEP and 2.59% for CEB) and was not statistically significant ( $p > 0.05$ ). This was in agreement with the work by Cal-Neto et al. (2009) and Pandis et al. (2006). They stated that there was no difference between the clinical bond failure rates of brackets bonded with SEP and conventional multi-step system. Both systems had low bond failure rates and were adequate for orthodontic bonding needs. Manning et al. (2006) stated that at 6 months, the overall bond failure rate for both groups (1.8%) was low compared with other published studies. *In-vivo* study done by Lill et al. (2008), found that bond failure rates were also low and well within an acceptable range when the manufacturer's instructions were followed, making SEP a suitable alternative to conventional acid-etch techniques for orthodontic bonding.

A few other studies found result contrast to the present study. A study by Ireland et al. (2003), House et al. (2006) and Murfit et al. (2006) found that the use of the self-etching primer leads to high bond failure rates as compared with conventional acid etching. A research done by dos Santos et al. (2006) came up with different result. They found that the failure rates of the self-etch were lower compared with conventional adhesive. The differences in failure rates and contradictory evidence from several studies may imply that culturally influenced dietary habits and sex differences can affect the *in vivo* failure rate of brackets (Pandis & Eliades 2005).

### BRACKET FAILURE AT TIME INTERVAL

In our study, the first 3 months was the time when most of the brackets debonded for both groups. This finding is also supported by Compoy et al. (2010) where they found that the probability of bond failure is greater immediately after bonding and during the first 3 months of bracket life. Reasons that can contribute to the early failure include poor moisture control during bonding (Brantley & Eliades 2001), excessive force during initial stage, hard diet taking, poor adaptation of the patient to the new bracket and inadequate light curing.

### SITE OF BRACKET FAILURE

In the present study, the lower premolar had the most bracket failure and upper incisor has the least bracket failure. This finding was supported by studies from Sunna and Rock (1998), Manning et al. (2006), Cal-Neto et al. (2009) and Elekdag-Turk et al. (2008). According to Sunna and Rock (1998), the possible explanations for this situation include difficulty in clinical access and isolation from moisture in the posterior regions, higher occlusal forces on posterior teeth compared with anterior teeth and more aprismatic enamel on premolars. Pandis et al. (2006) stated that although

significantly more failures were found for the mandibular arch, no difference was identified in failure rate between anterior and posterior teeth. However, Bherwani et al. (2008) found that there was a significantly higher failure rates observed for posterior than anterior teeth. Linklater and Gordon (2003) stated that more bracket failure occur on the mandibular arch. In the maxillary arch, bracket failure on the incisor occurred considerably less often than did canine failure, whereas in the mandibular arch incisor and canine failures were matched. The potential contributing factors as described by Linklater and Gordon (2003) include increased masticatory loading on the canines that are the cornerstones of the dental arch and in which excursive interferences might not always be apparent, moisture contamination, direct trauma (e.g. clumsy tooth-brushing technique) and damage on maxillary incisors when patients chew hard or tough foods.

In our study, we found that the left side had the most bracket failure compared with the right side and it was statistically significant. This result was in agreement with Sunna and Rock (1998). Right-handed operator which produces a better moisture control on the right side could be the explanations for this situation. The other reason that could also play a role for this result was the one side chewing habit. An *in vivo* study by Mavropoulos et al. (2003) and Basaran et al. (2006) found that there was no different between the bracket failure on the right and left side.

## CONCLUSION

This split mouth technique clinical study has been used to compare the effectiveness of 2 bonding agents i.e. self etching primer and conventional etch and bond in orthodontic fixed appliance patients. The result showed that only 2.51% of bracket debonded from this study with 16 brackets from self etching primer group and 17 from conventional etch and bond group. Both adhesive, SEP and CEB, are equally effective in retaining brackets. Bracket failure occurs most frequently within the first 3 months of treatment. Lower premolar is the commonest site for bracket failure while upper incisor has the least bracket failure.

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