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Prevalence of overnutrition and associated factors among school going adolescents in an urban area of Kishanganj district, Bihar, India

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ABSTRACT
OBJECTIVE: To evaluate and compare Shear bond strength of ceramic brackets with different base designs using light cure and self cure adhesive.
MATERIALS & METHOD: 120 therapeutically extracted maxillary fist premolars were divided into six groups of 20 samples each and were mounted in resin blocks. Each sample was bonded with bracket of particular group. The shear bond strength was measured using Universal testing machine. After debonding,the teeth and brackets were examined under SEM for enamel surface changes and adhesive remnant index respectively.
RESULTS: Ceramic brackets with mesh base design (Group C) yielded statistically highest shear bond strength followed by microcrystalline base (Group A) and dove tail base (group B) design. Statistically significant difference was seen between (Group I) light cure and (Group II)self cure adhesive.
CONCLUSIONS: Bracket base design is an important factor which can affect shear bond strength. Base design with more number of mechanical undercuts offers better shear bond strength.

I. INTRODUCTION

Ceramic bracket were introduced in 1980's and more than a decade later it has found its wide acceptance.[1]The introduction of ceramic bracket to orthodontics is only part of the rapidly expanding ceramic technology in many industries. All the currently available ceramic brackets are composed of aluminium oxide as polycrystalline aluminium or monocrystalline aluminium.[2]

Since the introduction of ceramic brackets manufacturers have began changing their bracket designs to eliminate the tooth damage.[3] Manufacturers have employed different mechanisms to decrease the bond strength of ceramic brackets including various designs like grooves, beads and polymer mesh to increase the surface area to allow mechanic interlocking of resin and brackets.

Several authors have investigated the bond strength of ceramic brackets having different base designs on SBS and enamel damage during debonding. Despite various modifications there is still lack of consensus regarding the effect of bracket base design on shear bond strength (SBS) when tested under conditions stimulating clinical use of those brackets. The purpose of the present study was to evaluate shear bond strength, adhesive remnants on bracket mesh and enamel surface changes after debonding of ceramic brackets of different base designs bonded to premolars. The specific objectives were:

1. To evaluate and compare SHEAR BOND STRENGTH of ceramic brackets with different base designs using light cure and self cure adhesive.
2. To evaluate and compare ADHESIVE REMNANT INDEX (ARI) on bracket mesh surface after debonding of ceramic brackets with different base designs.
3.To evaluate and compare ENAMEL SURFACE CHANGES after debonding of ceramic brackets with different base designs.

II. MATERIALS AND METHOD

The sample consisted of 120 maxillary 1st premolars (both right and left side) that were extracted for orthodontic purpose. All the samples were cleaned and stored in distilled water at room temperature. The teeth were mounted on acrylic blocks with only their crowns exposed and the acrylic blocks were color coded and divided into 2 groups with 60 teeth in each group. These groups were bonded using different adhesive systems as:

Group I - 3M Unitek Transbond XT (light cure) **Blue color coded**
Group II – Rely- a- bond (self cure) **Black color coded**

Group I - 3M Unitek Transbond XT (light cure) **Blue color coded**
Group II – Rely- a- bond (self cure) **Black color coded**

The samples were divided in 3 sub group of 20 samples with different base designs.
The designated groups were:
Group A: Irregular or microcrystalline base (Sapphire ROSA (GNI) 0.22” slot MBT)
Group B: Dovetail base (Clear aesthetic bracket (JJ Orthodontics) 0.22” slot MBT)
Group C: Mesh base (ICE crystal ceramic bracket (Metro orthodontics) 0.22” slot MBT)

After dividing all the samples in groups each sample was subjected to bonding procedure and a bracket of that particular group was bonded to it. The SBS was measured using Universal Testing Machine(Instron).An occluso-gingival load was applied to the bracket parallel to the buccal surface of the tooth. The force required to shear off the bracket was recorded in Newton at a crosshead speed of 0.5mm/min.

After debonding the teeth and brackets were examined under Scanning Electron Microscope of 200x and 50x magnification respectively. Any adhesive remaining after bracket removal was assessed according to theadhesive remnant index (ARI) by Artun and Bergland[11](Table 1) and enamel surface was detected for changes according to the (ESI) Enamel surface changes index by Zachrisson and Arthun[10] (Table 2). The data obtained was tabulated and statistically analyzed.

Table 1: Adhesive remnant index (ARI)

1	No adhesive on the bracket
2a	Less than 10 per cent of the base covered with adhesive
2b	Less than 25 per cent of the base covered with adhesive
3	25–50 per cent of the base covered with adhesive
4	50–75 per cent of the base covered with adhesive
5	75–100 per cent of the base covered with adhesive

Table 2: Enamel surface changes index(ESI)

Score 0	Perfect surface. No scratches, distinct intact perikymata
Score 1	Satisfactory surface. Fine scratches, some perikymata
Score 2	Acceptable surface. Several marked and some deeper scratches, no perikymata
Score 3	Imperfect surface. Several distinct deep and coarse scratches, no perikymata
Score 4	Unacceptable surface. Coarse scratches and deeply marred appearance

III. RESULTS

The study showed that Group C with mesh base design had the highest bond strength of 15.5 MPa followed by Group A- microcrystalline base having a bond strength of 12.5 MPa and least for Group B- Dove tail base with 7.1MPa. Adhesive remnant index and enamel surface changes index of all the groups were statistically insignificant.

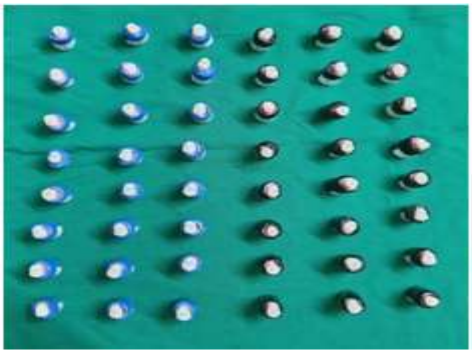


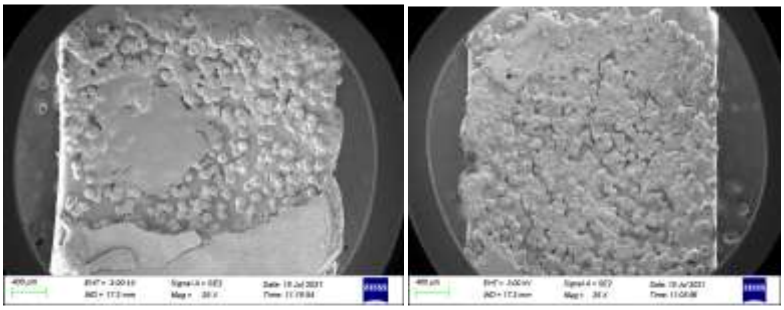
Figure:Test Sample on Instron Machinewith **Figure :Result shown in computer**

Figure 1: Premolar samples mounted in acrylic blocks and labelled

Fig 2: Representative sample of ceramic bracket

a. **MICROCRYSTALLINE BASE**
b. **DOVE TAIL BASE**
c. **MESH BASE**

GROUP I -BLUE A3 **GROUP II -BLACK A1**



GROUP I -BLUE B5 GROUP II -BLACK C2

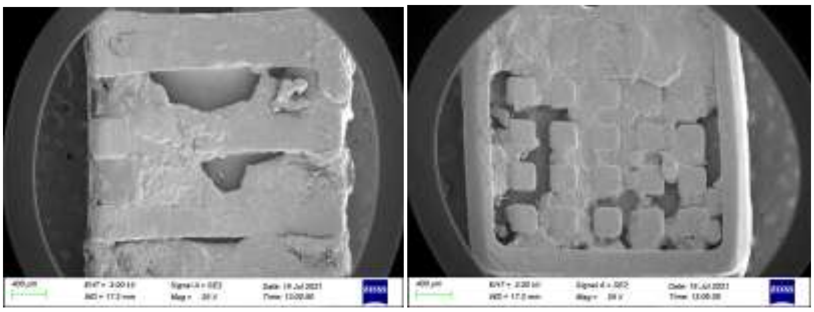


Fig. REPRESENTATIVE SEM IMAGES OF BRACKET BASES

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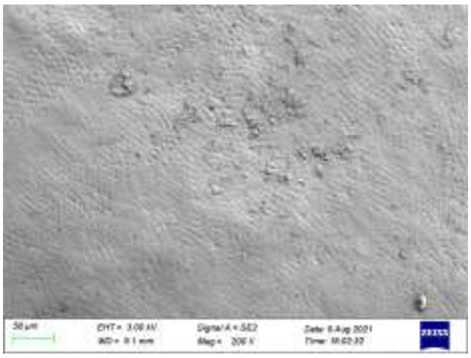
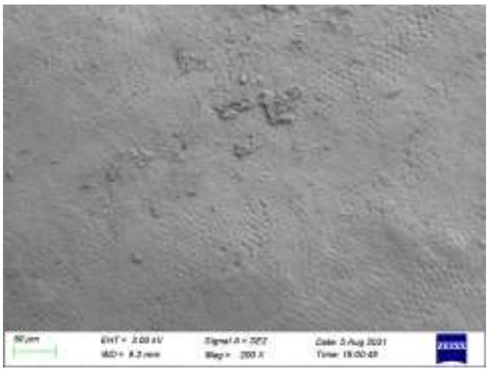
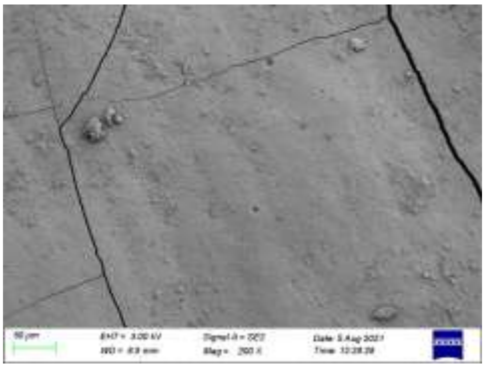


GROUPI-A4 **GROUP II-A6**





GROUP I -C5 **GROUP II-C2**

Fig. REPRESENTATIVE SEM IMAGES OF DEBONDED ENAMEL SURFACE

Table. Pair wise comparison of Shear Bond Strength between Light &Self cure *Statistically significant .

Groups		**Mean**	**SD**	**P value**
A	Light cure	12.5	3.4	0.000*
	Self cure	2.5	0.3	
B	Light cure	7.1	1.7	0.000*
	Self cure	3.4	0.6	
C	Light cure	15.5	4.9	0.000*
	Self cure	3.6	0.7	

Table. Pair wise comparison of ARI Light and Self cure

Groups		**Mean**	**SD**	**P value**
A	Light cure	3.2	0.8	0.139
	Self cure	3.7	0.9	
B	Light cure	3.5	1.1	0.278
	Self cure	3.2	0.8	
C	Light cure	2.8	0.6	0.091
	Self cure	3.5	1.2	

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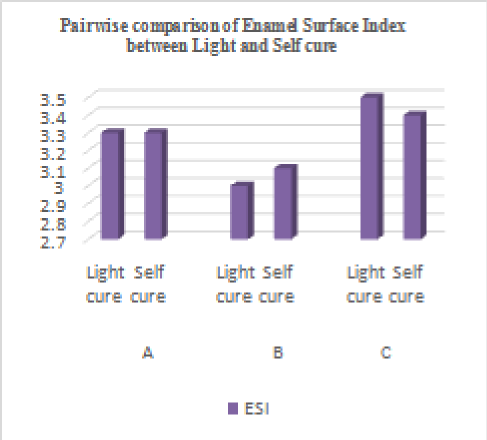
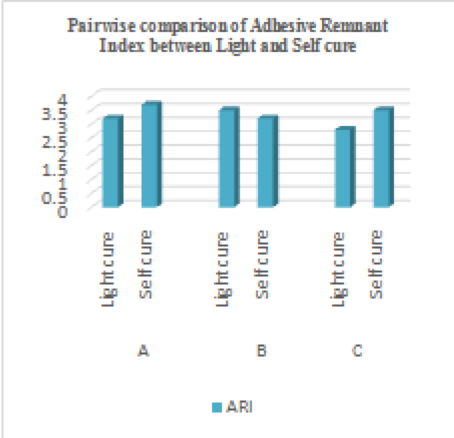
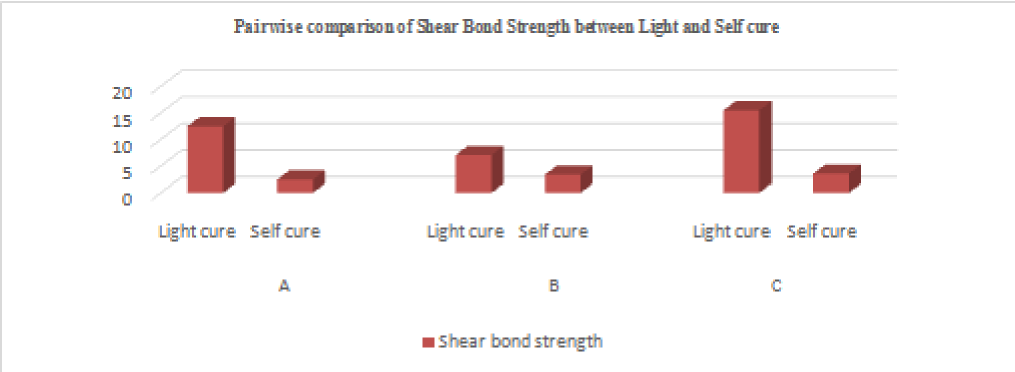
Table. Pair wise comparison of Enamel Surface Index between Light & Self cure. The p value >0.05 i.e Statistically insignificant

Groups		Mean	SD	P value
A	Light cure	3.3	0.7	0.367
	Self cure	3.3	0.7	
B	Light cure	3.0	0.8	0.363
	Self cure	3.1	0.6	
C	Light cure	3.5	0.5	0.320
	Self cure	3.4	0.5	







IV. DISCUSSION

Choosing the best bonding system has become a challenge for a clinician due to evolution in bonding systems. The various drawback associated with the bonding of teeth have forced the orthodontists into a continuous search for ideal orthodontic adhesives. The main criteria considered were adequate bond strength and very little or no enamel damage on removal.

The purpose of this study is to examine the bond strength in ceramic brackets of different base designs with light cure and self cure adhesive systems and to compare the enamel loss after debonding.

Bishara[4]conducted a study to determine the effect of changing the crosshead speed of the testing machine on the shear bond strength of orthodontic bracket and concluded that , changing the crosshead speed during shear bond testing from 5.0 to 0.5 mm/min increased shear bond strength by approximately 57% and alsodecreased the ratio of the standard deviation to the mean value by half, from 66% to 33%. Therefore, identifying the various parameters included in shear bond testing would make the results more useful for comparative purposes. So the cross head speed in this study was standardized to 1mm/min to avoid any bias.

Sudhakar[5], Sudhir Sharma[6], Chandresh Shukla[7]Compared the bond strength of different adhesive materials: Transbond XT and Rely-a-bond They concluded that the shear bond strength of light cure composites was higher than self cure composites.In our study similar results were obtained as light cure adhesive had higher SBS compared to self cure adhesive.

Mohd. Younus Ansari[1], Gaurav Choudhary[8], Kang DY[9]compared the effect of base designs of different ceramic brackets on Shear bond strength, and determined the fracture site after debonding. They concluded that different base designs of metal and ceramic brackets influence shear bond strength to enamel and all values in these studies were clinically acceptable. There was no statistically significant difference between the ARI scores with different base designs which is in accordance to the results in our study.

Different base designs have different effects on shear bond strength. Base design characteristics were the reason for these results. Several factors such as method of enamel conditioning, composition of adhesive, bracket retention mechanism as well as method of debonding influence the forces applied for debonding the brackets. In our study ceramic brackets with mesh base design yielded statistically highest shear bond strength among all groups followed by microcrystalline base, and dovetail base design. Bracket base design is an important factor which can affect shear bond strength. Base design with more number of mechanical undercuts offers better shear bond strength. The adhesive remnant index and enamel surface changes of all groups had no statistically significant difference which shows that it is safe to remove ceramic brackets with the pliers recommended by the manufacturer.

V. CONCLUSION

Following conclusions were drawn from the present study:

The Shear bond strength mean values of all groups of light cure adhesive exhibited higher values than the minimum orthodontic bracket bond strength range of 6-8MPa. While the self cure adhesive had lower values than the acceptable limits.

Ceramic brackets with mesh base design yielded statistically highest shear bond strength among all groups followed by microcrystalline base, and dovetail base design. Bracket base design is an important factor which can affect shear bond strength. Base design with more number of mechanical undercuts offers better shear bond strength andthe extent of damage to the enamel surface following the use of mesh base ceramic bracket was optimal.

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