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# EFFECT OF CONTAMINATION ON BOND STRENGTH OF ORTHODONTIC LIGHT CURE ADHESIVE SYSTEM- A SYSTEMATIC REVIEW

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## ABSTRACT

Aim: The aim of the systemic review is to emphasize the effect of contamination on bond strength of orthodontic light cure adhesives. Methods: The search was carried out by electronic database- Advance PubMed. The studies were selected if they met the following criteria: It should be In-Vitro study. Specimen used should be human or bovine teeth. Media used for contamination are saliva, blood or water. Orthodontic brackets or buttons bonded to the enamel surface of the teeth with orthodontic light cure adhesives by direct bonding technique. Results: Thirty articles were selected based on the inclusion criteria. Bond strength of different orthodontic primers and adhesives were recorded as variables of interest. Conclusion: It was concluded that contaminations affect the bond strength of orthodontic light cure adhesives.

**Keywords:** Bond strength, moist contamination, orthodontics, light cure adhesives.

## INTRODUCTION

The conventional method for bonding the orthodontic brackets to enamel surface necessitates three different agents: an enamel etchant, a primer solution, and an adhesive resin. It is paramount to keep the tooth surface absolutely dry during bonding to provide proper bonding between the enamel and adhesives. This is estimated as bond strength of the material.

Clinically accepted bond strength for orthodontic bracket is range from 6 to 8 MPa (Reynolds 1975)[1].

Michael G Buonocore (1955)[2] revolutionized dentistry with his depicting finding of etching and bonding of acrylic to enamel. He embarked on his bonding research in July 1954 by etching the enamel for 30 seconds with 85% phosphoric acid and then rinsing the surface with water.

Retief et al[3] also illustrated the surface conditioning is essential for increasing the bond strength of bonding material to enamel. In 1962, Bowen introduced bisphenol A-glycidyl dimethacrylate (bisGMA) resin. Bis-GMA proved to be stronger and more stable than the acrylic and epoxy resins which were in use at that time[4]. In 1964, there was a revolution in the orthodontic society when Newmann[5] successfully bonded orthodontic brackets to the teeth, by means of the acid-etch technique and an epoxy-derived resin.

Bonding procedure includes:

a) Thorough prophylaxis to provide a clean bonding surface.
b) 37% phosphoric acid gel or aqueous solution applied for approximately 15 seconds to etch.
c) Rinsing with copious amounts of water.
d) Dry the surface with moisture and oil-free air to show the frosty, chalky white demarcated etched enamel surface.
e) Apply the primer and bond the bracket with composite under a dry field and cure it with light cure unit.

The presence of moisture contamination during bonding of orthodontic brackets is the most common reason for bond failure. Contamination

causes plugging of the porosities produced by acid etching and a reduction in surface energy. Eventually resin penetration is impaired, and micromechanical retention is compromised[6]. The contamination may be due to either water or saliva or blood or combination of these three. To overcome the effect of contamination, lots of newer adhesives have been introduced in the market with a minimal variation in composition.

The purpose of the systematic review is to emphasize the effect of contamination on bond strength of orthodontic light cure adhesives.

**Structured Question**

Does the contamination affect the bond strength of orthodontics light cure adhesive system?

**Search Strategy**

Electronic databases:

**Advance Pubmed**

## SEARCH METHODOLOGY

The search methodology applied in PUBMED was as follows: (adhesives or dental adhesives or light cure adhesives or light cure adhesive or composite or dental composite or light cure composite or light cure resin) and (saliva contamination or water contamination or blood contamination) and (bond strength or dental bond strength or shear bond strength or orthodontic debonding or bond failure or debracketing).(Fig 1)

**Inclusion Criteria**

Studies were selected if they met the following criteria:

1. In-vitro studies
2. Specimen may be human or bovine teeth
3. Media used for contamination are saliva, blood or water.
4. Orthodontic brackets and buttons bonded to the enamel surface of the teeth with orthodontic light cure adhesives.
5. Direct bonding technique.

**Exclusion criteria**

1. Ex-vivo or in-vivo studies are excluded.
2. Studies done using materials other than orthodontic adhesives.
3. Studies done using chemical cured and dual cured adhesives.

## RESULT

1. Thirty articles were selected based on the inclusion criteria.
2. Bond strength of different orthodontic primers and adhesives were recorded as variables of interest. (Table 3)

## DISCUSSION

**Water Contamination**

Bonding the bracket directly to enamel surface is technique sensitive. It needs absolute dry environment. Contamination of etched enamel surface leads to an inappropriate sealing of the microporosites by primer. Thereby reducing the bond strength of the adhesives. Common contaminations in clinical practice are water, saliva and blood. This systemic review is concentrating on the bond strength of orthodontic light cure adhesives influenced by contamination.

Hobson et al[8] found that the saliva contamination is more complex than water. Saliva consists of water, polysaccharides, protein, enzymes (Eiriksson et al[9]). Saliva forms an organic smear layer on the etched surface. Blood has greater mechanical barrier compare to saliva due to its organic and inorganic substances.

As per the inclusion and exclusion criteria, there are 11 articles which showed the effect of water contamination under different primers and adhesives (table 2-6). The bond strength of Transbond XT primer (TXP) and Transbond XT adhesive (TXT) are found to be reduced under water contamination expect in the study by Vicente et al[10]. He found that the bond strength of TXP under water contamination is low compared to dry environment but there was no significant difference between the dry and wet condition.

Transbond moisture insensitive primer (TMIP) is a hydrophilic primer which is found to overcome the hydrophobic nature of TXT by adding HEMA and ethanol solvent. Four articles enumerate the effect of water contamination on the bond strength of TMIP and TXT. There was reduction in the bond strength under water contamination. The controversy to it is evident with Kula et al 2003[11] findings. There was no statistically significant difference between the dry and wet condition.

Transbond self etching primer (TSEP) has reduces two steps (etching and priming) into single step which in turn reduces the time consumption during bonding. Three articles enumerate about the effect of water after application of TSEP. There was no difference of bond strength in two articles expect Cacciafesta et al[12] findings where there was significant difference in bond strength under contamination after primer application.

There are four articles who evaluated the bond strength of Fuji Ortho LC, resin modified glass ionomer cement light cure adhesives. There was statistically significant difference in bond strength in both dry and wet condition as well as under etched and unetched surfaces.

**Salivary Contamination**

Saliva is the most common media for contaminating the etched surface. Precaution should be taken in bonding to prevent salivary contamination. Saliva will form an organic smear layer on the etched surface which prevents the penetration of primer into the microporosites thereby enhancing the bond failure rate.

Twenty two articles are dealing with effect of salivary contamination on bond strength of different adhesive system (Table 7-12). The combination of Transbond XT Primer and Transbond XT adhesives are evident in eight articles. All the articles reveal that, salivary contamination affects the bond strength of the TXP irrespective of contamination either before or after primer application.

Transbond Moisture Insensitive Primer can withstand the mild moist environment. TMIP and TXT show statistically significant difference in the bond strength with contamination of saliva after primer application. But contamination before primer application does not affect the bond strength. Nine studies proved it.

Transbond Self Etch Primer is a single step technique where etching and priming occurs simultaneously, contamination after primer application did not affect the bond strength. There are nine articles. Vittorio Cacciafesta et al[12] found that there was decrease in bond strength by contamination after primer application. Lorenz Brauchli et al[13] found increase in the bond strength after primer application. It is due to denaturation and degradation of saliva protein by its etching component.

Bond strength of Fuji Ortho LC under saliva contamination was evaluated in four studies. There was no statistically significant difference between dry and wet condition. Lorenz Brauchli et al[13] showed increase in bond strength after contamination. This was contrary to other studies. Adhesive system other than above mentioned adhesives have reduced bond strength under saliva contamination compared to uncontaminated groups.

**Blood Contamination**

Contamination by blood extremely affects the bond strength of the orthodontic adhesives (Table 13-17). This was proved in various studies (Brauchli et al[13], Sfondrini et al[14], Santos et al[15], Oztoprak et al[16], Sayinsu et al[17]). Blood contamination affects the bond strength irrespective of material used. There was decrease in the bond strength after the application of TSEP under blood contamination. Fuji Ortho LC also was affected by blood[16].

Decontamination of the contaminated tooth surface by rinsing with water can increase the bond strength and it will be approximating to the bond strength achieved without contamination.

Repeat etching is not needed in the decontamination procedure. It is just cleaning a contaminated surface with water and air which was sufficient to obtain adequate bonding forces (Brauchli[13]). Webster[18] compared a control group with a contamination group (without repriming) and a decontamination group (repriming only). They found significantly reduced bonding forces in both the situations. The decontamination in the investigation by Zeppieri[19] also consisted of repriming without previous rinsing with water. Only TSEP achieved successful bonding forces in the decontamination groups. In the studies by Eiriksson[20, 21] all self-etching primers achieved successful bonding forces after decontamination with water, air, and repriming.

The data that was outliner in all the articles is Adhesive Remnant Index (ARI). It was used to assess the amount of adhesive left on the enamel surface. ARI scores were used as a complex method of defining bond failure rate among the enamel, the adhesive and the bracket base (Caccisafesta et al 2003[12]).

## INFERENCE

Contamination by water, saliva or blood affects the bond strength of all orthodontic adhesives either before or after the application of primer. Effect of these contaminations on TSEP after its application is found to be less. Fuji Ortho LC is unaffected by these contamination irrespective of its nature.

Decontamination procedure after contamination increases the bond strength of TSEP.

## CONCLUSION

Contamination affects the bond strength of the orthodontic light cure adhesives, but the extent of effect is different for different adhesive system.

## SUMMARY

This systematic review is to emphasize the effect of contamination on the bond strength of orthodontic light cure adhesives. Search was done in Advance PubMed and after applying inclusion and exclusion criteria, thirty articles are related to the topic of interest. The bond strength of adhesives with or without contamination is listed out. The reading is evaluated for both before or after primer application of different adhesives. It was concluded that effect of contamination affect the bond strength of the orthodontic light cure adhesives and it affects less on TSEP.

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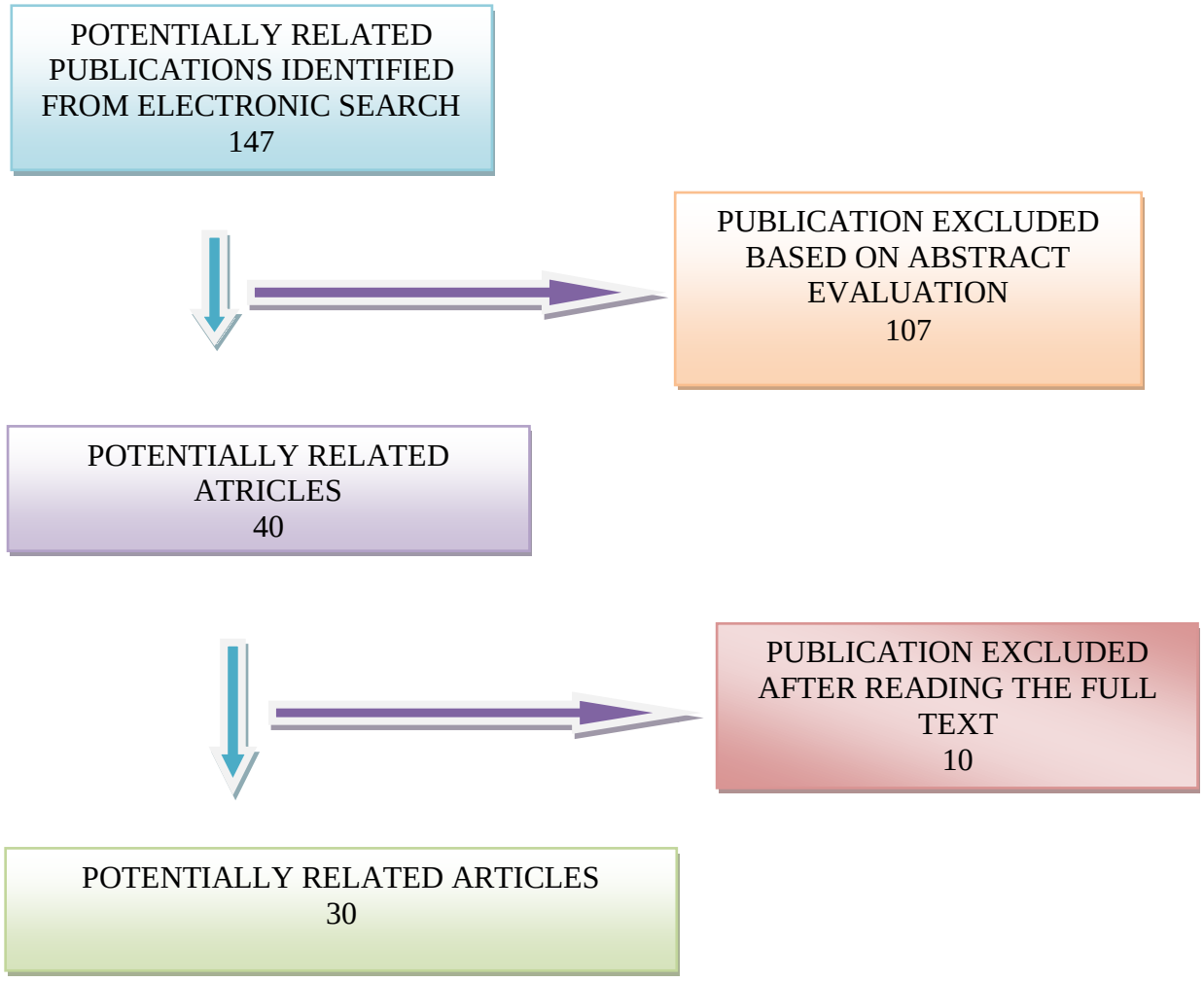
**Fig 1: SEARCH FLOWCHART:**



## TABLE 1: GENERAL INFORMATION OF INCLUDED ARTICLES

| S. No | Author Journal & year | Number of samples | Specimen used | Type of contamination | Groups | Results |
|---|---|---|---|---|---|---|
| 1. | Lorenz Brauchli et al<br>Ajodo 2010 | N= 600 | Bovine teeth | blood, saliva | G1= acid etching+ txp+ txt<br>G2= acid etching+ txp+ blood+ txt<br>G3= acid etching+ txp+ saliva+ txt<br>G4= acid etching+ txp+ blood+ txp+ txt<br>G5= acid etching+ txp+saliva+ txp+ txt<br>G6= acid etching+ tmip+ txt<br>G7= acid etching+ tmip+ blood+ txt<br>G8= acid etching+ tmip+ saliva+ txt<br>G9= acid etching+ tmip+ blood+ tmip+ txt<br>G10= acid etching+ tmip+ saliva+ tmip+ txt<br>G11= tsep+ txt<br>G12= tsep+ blood+ txt<br>G13= tsep+ saliva+ txt<br>G14= tsep+ blood+ tsep+ txt<br>G15= tsep+saliva+ tsep+ txt<br>G16= 10% polyacylic acid+ fuji ortho lc<br>G17= 10% polyacylic acid+ blood+ fuji ortho lc<br>G18= 10% polyacylic acid+ saliva+ fuji ortho lc<br>G19= 10% polyacylic acid+ blood+(decontamination)+ fuji ortho lc<br>G20= 10% polyacylic acid+ saliva+(decontamination)+ fuji ortho lc | Contamination with blood without decontamination, resulted in strongly reduced bond strengths for all tested adhesives. Simple decontamination with water, air, and repriming gives sufficient bond strength for all tested adhesives. |
| 2 | Hsiang Yu Cheng et al<br>EJO 2011 | n=100 | Human premolar | water | G1= acid etching+ no contamination+ fuji ortho LC<br>G2= acid etching+ contamination+ fuji ortho LC<br>G3= no contamination+ fuji ortho LC<br>G4= contamination+ fuji ortho LC<br>G5= acid etching+ transbond | RMGIC is capable of achieving the same or greater bond strength as Transbond, even on unetched or uncontaminated teeth. |
| 3 | Maria Francesca Sfondrini et al<br>BLOMFS 2011 | N= 160 | Bovine incisor | Blood | G1= acid etching+ txp+ txt+ bracket<br>G2= acid etching+ blood+ txp+ txt+ bracket<br>G3= acid etching+ txp+ blood+ txt+ bracket<br>G4= acid etching+ blood+ txp+ blood+ txt+ bracket | Contamination of enamel by blood during bonding lowers the strength of the bond, more so with orthodontic brackets than with bondable |

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|---|---|---|---|---|---|---|
| | | | | | G5= acid etching+ txp+ txt+ button<br>G6= acid etching+ blood+ txp+ txt+ button<br>G7= acid etching+ txp+ blood+ txt+ button<br>G8= acid etching+ blood+ txp+ blood+ txt+ button | buttons. |
| 4 | Sergio ricardo campos maia et al<br>AJODO 2010 | N= 135 | Bovine incisors | Saliva and water(SW), Artifial saliva(S) | G1= no contamination+ transbond plus self etch primer (TPSEF)+ adhesives<br>G2= sw+ tsep + adhesives<br>G3= s+ tsep+ adhesives<br>G4= no contamination+ adhese+ adhesives<br>G6= sw+ adhese+ adhesives<br>G7= s+ adhese+ adhesives<br>G8= no contamination+ self etch bond(SB)+ adhesives<br>G9= sw+ sb+ adhesives<br>G10= s+ sb+ adhesives | Saliva contamination influences enamel shear bond strengths of the adhesives tested. |
| 5. | Bianca mota santos et al<br>AO 2010 | N= 160 | Bovine incisors | Water, saliva, blood | G1= tsep + dry+ tpcc<br>G2= 37%h2po4+ dry+ txp+ txt<br>G3= tsep + water+ tpcc<br>G4= 37%h2po4+ water+ txp+ txt<br>G5= tsep + saliva+ tpcc<br>G6= 37%h2po4+ saliva+ txp&txt<br>G7= tsep + blood+ tpcc<br>G8 =37%h2po4+ blood+ txp&txt | TPCC/TSEP showed higher SBS values than TXT/ XT under all moisture conditions. |
| 6. | Ascension vicente et al<br>MOPOCB 2010 | N= 50 | Human prmolars | water | G1= acid etching + dry+ txp+ txt<br>G2= acid etching+ water+ txp+ txt<br>G3= tsep+ dry+ txt<br>G4= tsep+ water+ txt<br>G5= acid etching+ concise primer+ dry+ concise<br>G6= acid etching+ tmip+ water+ concise<br>G7= acid etching+ dry+ fuji ortho lc<br>G8=acid etching+ water+ fuji ortho lc<br>G9=acid etching+ dry+ smart bond<br>G10= acid etching+ water+ smart bond | No significant differences were detected in SBS for each system between wet and dry enamel with the exception of SmartBond. |
| 7. | Luciana borges retamoso etal<br>JAOS 2009 | N= 72 | Human third molars | saliva | G1= acid etching+ dry+ txp+ txt<br>G2= acid etching+ saliva+ txp+ txt<br>G3= dry+ adhese primer+ adhese paste<br>G4= saliva+ adhese primer+ adhese paste<br>G5= dry+ xeno III primer+ xeno III paste<br>G6= saliva+ xeno III primer+ xeno III paste | Saliva contamination showed little influence on the immediate shear bond strength of orthodontic brackets. |

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| 8. | Ascension vicente et al AO 2009 | N= 240 | Bovine incisor | Water, saliva | G1= TSEP+ Dry +Transbond XT<br>G2= TSEP+ Water+ Transbond XT<br>G3= TSEP+ Saliva+ Transbond XT<br>G4= Acid etching+ TMIP+ Dry+ Transbond XT<br>G5= Acid etching+ TMIP+ Water+ Transbond XT<br>G6= Acid etching+ TMIP+ Saliva+ Transbond XT<br>G7= TSEP+ Dry+ Transbond PLUS<br>G8= TSEP+ Water+ Transbond PLUS<br>G9= TSEP+ Saliva+ Transbond PLUS<br>G10= Acid etching +TMIP+ Dry+ Transbond PLUS<br>G11= Acid etching+ TMIP+ Water+ Transbond PLUS<br>G12= Acid etching+ TMIP+ Saliva+ Transbond PLUS | TSEP/Transbond PLUS, TMIP/Transbond PLUS, and TSEP/Transbond XT showed greater tolerance to wet conditions than was shown by TMIP/Transbond XT. |
| 9. | Ekaterini paschos et al AO 2008 | N= 150 | Human premolars | saliva | G1= acid etching+ dry+ txp+ acp II<br>G2= acid etching+ saliva+ txp+ acpII<br>G3= tsep+ dry+ acpII<br>G4= tsep+ saliva+ acp II<br>G5= i bond+ dry+ acp II<br>G6= i bond+ saliva+ acp II | Saliva contamination significantly decreased the bond strength when the conventional acid-etching method was used. The self-etching primers were influenced the least. |
| 10. | Tamer turk et al AO 2007 | N= 240 | Human premolars | saliva | G1= tsep+ dry+ txt- 24 hours<br>G2= tsep+ dry+ txt- 30mins<br>G3= tsep+ dry+ txt- 15mins<br>G4= tsep+ dry+ txt- 5mins<br>G5= tsep+ saliva+ txt- 24 hours<br>G6= tsep+ saliva+ txt- 30mins<br>G7= tsep+ saliva+ txt- 15mins<br>G8= tsep+ saliva+ txt- 5mins<br>G9= saliva+ tsep+ txt- 24 hours<br>G10=saliva+ tsep+ txt- 30mins<br>G11= saliva+ tsep+ txt- 15mins<br>G12= saliva+ tsep+ txt- 5mins<br>G13= saliva+ tsep+ saliva+ txt- 24 hours<br>G14=saliva+ tsep+ saliva+ txt- 30mins<br>G15= saliva+ tsep+ saliva+ txt- 15mins<br>G16= saliva+ tsep+ saliva+ txt- 5mins | TSEP may produce clinically acceptable bracket bonding, after 5, 15, and 30 minutes from time of placement on the teeth, even with light and heavy saliva contamination |
| 11. | Andreas faltermeier et al | N= 80 | Human third molars | Saliva, blood | G1= acid etching+ txp+ dry+ txt<br>G2= acid etching+ tmip+ dry+ txt | In wet conditions (after saliva and blood |

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|---|---|---|---|---|---|---|
| | EJO 2007 | | | | G3= acid etching+ txp+ saliva+ txt<br>G4= acid etching+ tmip+ saliva+ txt<br>G5= acid etching+ txp+ blood+ txt<br>G6= acid etching+ tmip+ blood+ txt<br>G7= acid etching(insufficient removal)+ txp+ txt<br>G8= acid etching(insufficient removal)+ tmip+ txt | contamination) a significant decrease in SBS for Transbond XT bonded brackets was found in comparison with Transbond MIP. |
| 12. | Mehmet oguz oztoprak et al AJODO 2007 | N= 120 | Human premolar | Saliva, blood | G1= acid etching+ dry+ txp+ txt<br>G2= acid etching+ blood+ txp+ txt<br>G3= acid etching+ saliva+ txp+ txt<br>G4= tsep+ dry+ txt<br>G5= tsep+ blood+ txt<br>G6= tsep+ saliva+ txt<br>G7= acid etching+ dry+ smart bond<br>G8= acid etching+ blood+ smart bond<br>G9= acid etching+ saliva+ smart bond<br>G10= acid etching+ dry+ assure+ txt<br>G11= acid etching+ blood+ assure+ txt<br>G12= acid etching+ saliva+ assure+ txt | Saliva had no effect on the bond strength of Transbond XT adhesive bonded with Transbond Plus SEP. |
| 13. | Korkmaz sayinsu et al AO 2006 | N= 180 | Human premolar | Saliva, blood | G1=acid etch +TMIP+TXT<br>G2=acidetch+TMIP+LC+TXT<br>G3= acid etch +TMIP+blood+TXT<br>G4=acidetch+TMIP+LC+blood+TXT<br>G5= acid etch +TMIP+saliva+TXT<br>G6=acid etch+TMIP+LC+saliva+ TXT<br>G7=acid etch +assure primer+assure adhesive+LC<br><br>G8-= acidetch+ assure primer +LC+ assure adhesive +LC<br>G9= acid etch + assure primer +blood+ assure adhesive +LC<br>G10= acidetch+ assure primer +LC+blood+ assure adhesive +LC<br>G11= acid etch + assure primer +saliva+ assure adhesive +LC<br>G12= acid etch+ assure primer +LC+saliva+ assure adhesive +LC | Curing the primer before contamination revealed higher bond strengths. |
| 14. | Ma Dolores Campoya et al AO 2005 | N=70 | Human premolars | Saliva | G1= tsep+ txt<br>G2= tsep+ saliva+ txt<br>G3= saljva+ tsep+ txt | Significant differences were also observed between the control group and the group |

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|---|---|---|---|---|---|---|
| | | | | | G4= saliva+ tsep+ saliva+ txt | in which saliva contamination occurred before and after the application of the SEP. |
| 15. | Vittorio cacciafesta et al AJODO 2004 | N= 120 | Bovine incisors | blood | G1=fuji ortho lc<br>G2= 10% polyacrylic acid+ fuji ortho lc<br>G3= 37% phosphoric acid+ fuji ortho lc<br>G4= sep+ fuji ortho lc<br>G5=blood+ fuji ortho lc<br>G6= 10% polyacrylic acid+ blood+ fuji ortho lc<br>G7= 37% phosphoric acid+ blood+ fuji ortho lc<br>G8= sep+ blood+ fuji ortho lc | Blood contamination of enamel during the bonding procedure of Fuji Ortho LC did not affect its bond strength values, no matter which enamel conditioner was used. |
| 16. | Vittorio cacciafesta et al AJODO 2004 | N= 120 | Bovine incisor | blood | G1= acid etching+ txp+ acp II<br>G2= acid etching+ blood+ txp+ acp II<br>G3= acid etching+ txp+ blood+ acp II<br>G4= acid etching+ blood+ txp+ blood+ acp II<br>G5= acid etching+ tmip+ acp II<br>G6= acid etching+ blood+ tmip+ acp II<br>G7= acid etching+ tmip+ blood+ acp II<br>G8= acid etching+ blood+ tmip+ blood+ acp II | Under blood-contaminated conditions, both primers produced significantly lower bond strengths. |
| 17 | Rangaswamy Rajagopal et al AO 2004 | 100 | HUMAN PREMOLARS | SALIVA | G1= txp+ txt<br>G2= tmip+ txt<br>G3= tsep+ txt<br>G4= saliva+ txp+ txt<br>G5= saliva+ tmip+ txt<br>G6= tsep+ saliva+ txt | Under contaminated conditions, MIP showed the highest bond strength, followed by self-etch primer and conventional primer. |
| 18. | Maria francesca sfondrini et al AJODO 2004 | N= 120 | Bovine incisors | Blood | G1= acid etching+ txp+ acp II<br>G2= acid etching+ blood+ txp+ acpII<br>G3= acid etching+ txp+ blood+ acpII<br>G4= acid etching+ blood+ txp+ blood+ acpII<br>G5= acid etching+ tsep+ acp II<br>G6= acid etching+ blood+ tsep+ acpII<br>G7= acid etching+ tsep+ blood+ acpII<br>G8= acid etching+ blood+ tsep+ blood+ acpII | Under blood-contaminated conditions, both primers showed significantly reduced shear bond strengths |
| 19. | Vittorio cacciafesta et al AJODO 2003 | N= 180 | Bovine incisors | Water, blood, saliva | G1= fuji ortho lc<br>G2= 10% polyacrylic acid+ fuji ortho lc<br>G3= 37% phosphoric acid+ fuji ortho lc<br>G4= tsep+ fuji ortho lc<br>G5= water+ fuji ortho lc<br>G6= 10% polyacrylic acid+ water+ fuji ortho lc | The bond strength of the groups conditioned with 10% polyacrylic acid was significantly lower than that of the groups etched with 37% phosphoric acid |

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|---|---|---|---|---|---|---|
| | | | | | G7= 37% phosphoric acid+ water+ fuji ortho lc<br>G8= tsep+ water+ fuji ortho lc<br>G9= saliva+ fuji ortho lc<br>G10= 10% polyacrylic acid+ saliva+ fuji ortho lc<br>G11= 37% phosphoric acid+ saliva+ fuji ortho lc<br>G12= tsep+ saliva+ fuji ortho lc | |
| 20. | Irene l zeppieri et al<br>AJODO 2003 | N= 162 | Human premolars | saliva | G1= acid etching+ txp+ ortholux<br>G2= acid etching+ tmip+ ortholux<br>G3= acid etching+ tmip+ saliva+ tmip+ ortholux<br>G4= acid etching+ saliva+ tmip+ ortholux<br>G5= acid etching+ saliva+ tmip+ saliva+ tmip+ ortholux<br>G6= acid etching+ tsep+ ortholux<br>G7= acid etching+ tsep+ saliva+ tsep+ ortholux<br>G8= acid etching+ saliva+ tsep+ ortholux<br>G9= acid etching+ saliva+ tsep+ saliva+ tsep+ ortholux | Saliva had no effect on the bond strength of Transbond XT adhesive with Transbond SEP. |
| 21 | Arndt Klocke et al<br>AO 2003 | N= 100 | BOVINE INCISORS | SALIVA | G1= acid etching+ tmip+ txt<br>G2= acid etching+ saliva+ tmip+ txt<br>G3= acid etching+ water+ tmip+ txt<br>G4= acid etching+ saliva+ tmip+ saliva+ txt<br>G5= acid etching+ water+ tmip+ water+ txt | Contamination after primer application resulted in an increased risk of bond failure at clinically relevant levels of stress. |
| 22. | K s kula et al<br>OCRR 2003 | N= 40 | Human premolars | water | G1= txp+ txt<br>G2= tmip+ txt<br>G3= txp+ water+ txt<br>G4= tmip+ water+ txt | Orthodontists who suspect moisture contamination should use a hydrophilic primer during bonding procedures to maintain shear/peel bond strength. |
| 23. | Vittorio cacciafesta et al<br>AJODO 2003 | N= 315 | Bovine incisor | Water and saliva | G1= acid etching+ txp+ txt<br>G2= acid etching+ water+ txp+ txt<br>G3= acid etching+ txp+ water+ txt<br>G4= acid etching+ water+ txp+ water+ txt<br>G5= acid etching+ saliva+ txp+ txt<br>G6= acid etching+ txp+ saliva+ txt<br>G7= acid etching+ saliva+ txp+ saliva+ txt<br>G8= acid etching+ tmip+ txt<br>G9= acid etching+ water+ tmip+ txt<br>G10= acid etching+ tmip+ water+ txt<br>G11= acid etching+ water+ tmip+ water+ txt | The self-etching material is the least influenced in terms of bond strength values and type of failure site by water and saliva contamination. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | G12= acid etching+ saliva+ tmip+ txt<br>G13= acid etching+ tmip+ saliva+ txt<br>G14= acid etching+ saliva+ tmip+ saliva+ txt<br>G15= tsep+ txt<br>G16= water+ tsep+ txt<br>G17= tsep+ water+ txt<br>G18= water+ tsep+ water+ txt<br>G19= saliva+ tsep+ txt<br>G20= tsep+ saliva+ txt<br>G21= saliva+ tsep+ saliva+ txt | |
| 24 | Bishara et al<br>AO 2002 | N=52 | HUMAN MOLAR | SALIVA | G1= sep(angel I) + acp II<br>G2= saliva+ sep(angel I) + acp II<br>G3= sep(angel I) + saliva+ acp II<br>G4= saliva+ sep(angel I) + saliva+ acp II | Contamination both before and after the application of the primer significantly reduced the shear bond strength of orthodontic brackets |
| 25 | Shane Schaneveldt et al<br>AJODO 2002 | N=240 | HUMAN PREMOLARS | SALIVA | G1= TXP+TXT<br>G2= Assure primer + Assure resin<br>G3= TMIP +TXT<br>G4= SALIVA + Assure primer + Assure adhesive<br>G5= SALIVA +TMIP +TXT<br>G6= Assure primer+ LC +SALIVA +with Assure adhesive | Comparing saliva contamination after application of Primer had significantly greater shear-peel bond strengths than when contamination occurred before the application of each primer. |
| 26. | Ross s hobson et al<br>AJODO 2001 | N= 90 | Human premolars | Water, blood | G1= acid etching+ tmip+ txt<br>G2= acid etching+ water+ tmip+ txt<br>G3= acid etching+ blood+ tmip+ txt | There was no significant difference in bond strength achieved between moist and blood-contaminated enamel. |
| 27. | I kirivski et al<br>EJO 2000 | N= 40 | Human premolars | Water, saliva, plasma | G1= fuji ortho lc<br>G2= 10% polyacrylic acid+ water+ fuji ortho lc<br>G3= 10% polyacrylic acid+ saliva+ fuji ortho lc<br>G4= 10% polyacrylic acid+ plasma+ fuji ortho lc | Etching of enamel surface produce higher bond strength. |
| 28. | Mark j webster et al<br>AJODO 2001 | N= 144 | Bovine teeth | saliva | G1= acid etching+ txp+ txt<br>G2= acid etching+ tmip+ txt<br>G3= acid etching+ assure primer+ assure composite<br>G4= acid etching+ saliva+ txp+ txt<br>G5= acid etching+ saliva+ tmip+ txt<br>G6= acid etching+ saliva+ assure primer+ assure composite | The hydrophilic primers also showed improved bond strengths with reapplication of primer after saliva contamination |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | G7= acid etching+ txp+ saliva+ txt<br>G8= acid etching+ tmip+ saliva+ txt<br>G9= acid etching+ assure primer+ saliva+ assure composite<br>G10= acid etching+ saliva+ txp+ saliva+ txt<br>G11= acid etching+ saliva+ tmip+ saliva+ txt<br>G12= acid etching+ saliva+ assure primer+ saliva+ assure composite | |
| 29. | Douglas rix et al AJODO 2001 | N= 160 | Human premolars | saliva | G1= acid etching+ txp+ txt<br>G2= 10% polyacrylic acid+ fuji ortho lc<br>G3=10% polyacrylic acid+ assure primer+ assure adhesive<br>G4= 10% polyacrylic acid+ saliva+ assure primer+ assure adhesive | There was no significant difference in mean shear peel bond strengths between Assure-wet and Assure-dry |
| 30 | Takami Itoh et al AO 1999 | N=360 | human premolars | WATER, SALIVA | G1= unetched+ fuji ortho lc<br>G2= etched+ fuji ortho lc<br>G3= unetched+ water+ fuji ortho lc<br>G4= etched+ water+ fuji ortho lc<br>G5= unetched+ saliva+ fuji ortho lc<br>G6= etched+ saliva+ fuji ortho lc<br>G7= unetched+ ex<br>G8= etched+ ex<br>G9= unetched+ water+ ex<br>G10= etched+ water+ ex<br>G11= unetched+ saliva+ ex<br>G12= etched+ saliva+ ex | No significant difference between both etched and unetched surface with Fuji Ortho LC |

## CHARACTERISTICS OF VARIABLE: WATER CONTAMINATION

**TABLE 2: TXP + TXT**

| S. No | Author | Material | No Contamination (MPa) | Before Primer (MPa) | After Primer (MPa) | Inference |
|---|---|---|---|---|---|---|
| 1. | Bianca mota santos et al AO 2010 | TXP+TXT | 153.9 ± 61.4 | 74.8 ± 42.6 | | Bond strength is reduced to 50%. |
| 2. | Ascension vicente et al Med oral path oral circ buccal 2010 | TXP+TXT | 21.83 ± 7.57 | 20.25 ± 7.09 | | No statistically significant difference at p>0.05 |
| 3 | K s kula et al Orthod craniofac res 2003 | TXP+TXT | 8.30 ± 2.29 | | 0.84 ± 0.72 | Statistically significant difference at p<0.01 |
| 4 | Vittorio cacciafesta et al Ajodo 2003 | TXP+TXT | 11.95± 6.20 | 4.54 ± 1.13 | 6.85 ± 2.23 | Statistically significant difference at <0.0001 |

**TABLE 3: TMIP + TXT**

| S. No | Author | Material | No Contamination (MPa) | Before Primer (MPa) | After Primer (MPa) | Inference |
|---|---|---|---|---|---|---|
| 1. | Ascension vicente et al AO 2009 | TMIP + TXT | 8.23 ± 3.77 | | 2.20 ± 1.54 | statistically significant difference at p<0.008 |
| 2 | K s kula et al Orthod craniofac res 2003 | TMIP + TXT | 7.53 ± 1.82 | | 7.94 ± 1.68 | No statistically significant difference at p<0.01 |
| 3 | Vittorio cacciafesta et al Ajodo 2003 | TMIP + TXT | 12.76± 3.27 | 8.01± 1.54 | 7.29 ± 2.26 | Bond strength is reduced under contamination irrespective of before or after primer application |
| 4 | Ross s hobson et al Ajodo 2001 | TMIP + TXT | 15.69 ± 3.8 | 12.89± 3.4 | | There was higher bond strength with dry enamel at p<0.001 |

**TABLE 4: TSEP + TXT**

| S. No | Author | Material | No Contamination (MPa) | Before Primer (MPa) | After Primer (MPa) | Inference |
|---|---|---|---|---|---|---|
| 1. | Ascension vicente et al Med oral path oral circ buccal 2010 | TSEP+ TXT | 16.83 ± 4.93 | | 20.37 ± 5.88 | The bond strength was increased with contamination. No statistically significant difference at p>0.05 |
| 2. | Ascension vicente et al Ao 2009 | TSEP+ TXT | 8.15 ± 4.22 | | 6.80 ± 2.91 | No statistically significant difference at p>0.05 |
| 3 | Vittorio cacciafesta et al Ajodo 2003 | TSEP+ TXT | 12.29± 1.37 | 10.87± 2.24 | 5.67 ± 1.55 | There was significant difference of bond strength when contamination occurred after primer application |

**TABLE 5: FUJI ORTHO LC**

| S. No | Author | Material | No Contamination (MPa) | With Contamination (MPa) | Inference |
|---|---|---|---|---|---|
| 1. | Hsiang Yu Cheng et al<br>EJO 2011 | FUJI ORTHO LC (etched)<br><br>(unetched) | 17.3±2.73<br><br>14.4±5.93 | 13.2± 5.95<br><br>11.4±4.35 | Bond strength is reduced with contamination and without etching. But no statistically significant difference among them at p<0.01 |
| 2. | Ascension vicente et al<br>Med oral path oral circ buccal 2010 | FUJI ORTHO LC Etched | 22.75 ± 6.64 | 17.06 ± 5.29 | No statistically significant difference at p>0.05. |
| 3. | Vittorio cacciafesta et al<br>Ajodo 2003 | FUJI ORTHO LC Etched | 18.98± 3.23 | 15.47 ± 2.87 | There was significantly higher bond strength in uncontaminated group |
| 4 | Takami Itoh et al<br>AO 1999 | FUJI ORTHO LC Etched<br><br>unetched | 12.4±2.8<br><br>8.4±1.7 | 12.6±2.2<br><br>6.9±1.4 | No statistically significant difference at p<0.05 |

**TABLE 6: OTHERS**

| S. No | Author | Material | No Contamination (MPa) | After Primer (MPa) | Inference |
|---|---|---|---|---|---|
| 1. | Bianca mota santos et al<br>AO 2010 | TSEP+TPCC | 125.8 ± 52.7 | 111.1 ± 71.4 | No statistically significant difference |
| 2. | Ascension vicente et al<br>AO 2009 | TSEP+TPCC<br><br>TMIP+TPCC | 6.93± 3.34<br><br>7.89 ± 2.71 | 6.14 ±2.40<br><br>7.83± 2.54 | No difference in bond strength between dry and wet condition |

## CHARACTERISTICS OF VARIABLE- SALIVA CONTAMINATION

**TABLE 7: TXP + TXT**

| S. No | Author<br>Journal<br>Year | Material | No Contamination (MPa) | Before Primer (MPa) | After Primer (MPa) | Inference |
|---|---|---|---|---|---|---|
| 1 | Lorenz Brauchli et al<br>Ajodo 2010 | TXP + TXT | 25.06 ± 10.81 | | 4.75± 5.88 | There was significant difference in the bond strength |
| 2 | Bianca mota santos et al<br>Ao 2010 | TXP + TXT | 153.9 ± 61.4 (N) | 80.9 ± 47.7 (N) | | Significantly higher bond strength under dry condition |
| 3. | Luciana borges retamoso et al<br>J app oral sci 2009 | TXP + TXT | 17.03 ±4.91 | 12.80 ±8.27 | | No statistically significant difference at p<0.05 |
| 4. | Andreas faltermeier et al Ejo 2007 | TXP + TXT | 8.71 ± 1.37 | | 3.42 ± 0.78 | It revealed distinctive and significant decrease in bond strength after contamination |
| 5. | Mehmet oguz oztoprak et al<br>Ajodo 2007 | TXP + TXT | 15.28 ± 1.96 | 3.79 ± 2.20 | | Bond strength is significantly dropped with contamination |
| 6 | RangaswamyRajagopal et al. AO | TXP + TXT | 9.54±3.86 | 4.69±3.10 | | There was a statistically significant difference at |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 2004 | | | | | p<0.01 |
| 7 | Vittorio cacciafesta et al Ajodo 2003 | TXP + TXT | 11.95± 6.20 | 7.12 ± 1.86 | 4.65 ± 1.34 | There was significant difference between uncontamination and contamination after primer at p<0.0001 |
| 8 | Mark j webster et al Ajodo 2001 | TXP + TXT | 26.88± 6.89 | 14.18 ± 5.27 | 19.63± 4.15 | Bond strength of saliva contaminated surface was weaker than uncontaminated surface |

**TABLE 8: TMIP + TXT**

| S. No | Author Journal Year | Material | No Contamination (MPa) | Before Primer (MPa) | After Primer (MPa) | Inference |
|---|---|---|---|---|---|---|
| 1 | Lorenz Brauchli et al Ajodo 2010 | TMIP+ TXT | 20.53 ± 10.79 | | 1.54 ± 3.33 | There was statistically significant difference between dry and wet condition. |
| 2. | Ascension vicente et al Ao 2009 | TMIP+ TXT | 8.23 ± 3.77 | | 1.81 ± 1.29 | There was statistically significant difference |
| 3. | Andreas faltermeier et al Ejo 2007 | TMIP+ TXT | 9.29 ± 1.16 | | 8.82 ± 1.21 | No significant difference |
| 4 | Korkmaz sayinsu et al Ao 2006 | TMIP+ TXT | *14.45 ± 2.35* | | *7.08 ± 1.29* | There was statistically significant difference at p<0.001 |
| 5 | Rangaswamy Rajagopal et al AO 2004 | TMIP+ TXT | 9.27±1.71 | 9.07±1.99 | | There was no statistically significant difference |
| 6 | Arndt Klocke ET AL AO 2003 | TMIP+ TXT | 15.07±4.14 | 14.91±3.99 | 9.85±3.77 | There was statistically significant difference in bond strength after primer application |
| 7 | Vittorio cacciafesta et al Ajodo 2003 | TMIP+ TXT | 12.76± 3.27 | 7.56 ± 1.92 | 7.14 ± 1.54 | There was statistically significant difference between dry and wet condition |
| 8 | Shane Schaneveld et al Ajodo 2002 | TMIP+ TXT | 14.02±2.94 | 12.23±2.53 | | No significant difference |
| 9 | Mark j webster et al Ajodo 2001 | TMIP+ TXT | 28.12± 5.06 | 20.72± 4.61 | 15.28± 9.03 | There was statistically significant difference in bond strength after primer application |

**TABLE 9: TSEP + TXT**

| S. No | Author Journal Year | Material | No Contamination (MPa) | Before Primer (MPa) | After Primer (MPa) | Inference |
|---|---|---|---|---|---|---|
| 1 | Lorenz Brauchli et al Ajodo 2010 | TSEP+ TXT | 19.94 ± 10.53 | | 23.19 ± 11.13 | High bond strength with saliva contamination |
| 2 | Sergio ricardo campos maia et al Ajodo 2010 | TSEP+ TXT | 4.02 ± (1.82) | | 2.87 ± (0.97) | There was statistically significant difference in bond strength after primer application at p<0.05 |
| 3 | Bianca mota santos et al Ao 2010 | TSEP+ TXT | 125.8 ± 52.7 (N) | | 121.6± 40.7(N) | No statistically significant difference |
| 4 | Ascension vicente et al Ao 2009 | TSEP+ TXT | 8.15 ± 4.22 | | 7.50± 3.21 | No statistically significant difference |
| 5 | Tamer turk et al Ao 2007 | TSEP+ TXT | 17.61 ± 4.04 | 10.05 ± 1.96 | 10.94± 2.05 | No statistically significant difference |
| 6 | Mehmet oguz oztoprak et al Ajodo 2007 | TSEP+ TXT | 13.76 ± 2.76 | | 13.80± 3.96 | No statistically significant difference |
| 7 | Ma Dolores Campoya et al AO 2005 | TSEP+ TXT | 12.42±3.27 | 11.61±2.74 | 9.93±4.50 | No statistically significant difference |
| 8 | Rangaswamy Rajagopal ET AL AO 2004 | TSEP+ TXT | 11.04±2.56 | | 10.79±2.43 | No statistically significant difference |
| 9 | Vittorio cacciafesta et al Ajodo 2003 | TSEP+ TXT | 12.29± 1.37 | 10.31 ± 2.53 | 7.25± 1.88 | There was statistically significant difference in bond strength after primer application at p<0.0002 |

**TABLE 10: FUJI ORTHO LC**

| S.No | Author Journal Year | Material | No Contamination (MPa) | With Contamination (MPa) | Inference |
|---|---|---|---|---|---|
| 1 | Lorenz Brauchli et al Ajodo 2010 | Etched (10% polyacrylic acid) | 2.56± 2.81 | 4.78 ± 4.19 | It showed lower bond strength with control group |
| 2 | Vittorio cacciafesta et al Ajodo 2003 | Etched (10% polyacrylic acid) | 12.47± 2.22 | 11.77± 1.75 | No statistically significant difference |
| 3 | I kirivski et al Ejo 2000 | Etched (10% polyacrylic acid) | 9.97± 3.20 | 11.35 ± 4.12 | No statistically significant difference |
| 4 | Takami Itoh et al AO 1999 | Etched (10% polyacrylic acid) | 12.4±2.8 | 8.2±1.8 | There was reduction in bond strength after contamination |

**TABLE 11: ASSURE SYSTEM**

| S.No | Author Journal Year | Material | No contamination (MPa) | Before primer (MPa) | After primer (MPa) | Inference |
|---|---|---|---|---|---|---|
| 1 | Mehmet oguz oztoprak et al Ajodo 2007 | AP+ AA | 16.40± 3.50 | | 10.66 ± 1.67 | Bond strength is reduced with contamination |
| 2 | Korkmaz sayinsu et al Ao 2006 | AP+ AA | *14.7±2.11* | | *6.85±1.25* | Statistically significant difference at p<0.0001 |
| 3 | Shane Schaneveldt et al Ajodo 2002 | AP+ AA | | 9±2.10 | 9.28±1.93 | No significant difference bond strength between contamination before and after primer application |
| 4 | Mark j webster et al Ajodo 2001 | AP+ AA | 20.42 ± 5.06 | 16.53 ± 3.71 | 13.72 ± 4.48 | There was statistically significant difference in bond strength after primer |

**TABLE 12: OTHERS**

| S.No | Author Journal Year | Material | No Contamination (MPa) | Before Primer (MPa) | After Primer (MPa) | Inference |
|---|---|---|---|---|---|---|
| 1 | Sergio ricardo campos maia et al Ajodo 2010 | Adhese system | 3.58 ± (0.92) | | 4.23 ± (1.17) | High bond strength with contamination after primer application |
| | | Self etch bond system | 1.57 ± (0.85 | | 0.96 ± (0.37) | low bond strength with contamination after primer application |
| 2 | Bianca mota santos et al Ao 2010 | Tsep+ tpcc | 125.8 ± 52.7(N) | | 121.6± 40.7(N) | bond strength is reduced with contamination after primer application |
| 3 | Luciana borges retamoso et al J app oral sci 2009 | Adhere system | 13.53 ±2.37 | | 8.58 ±1.73 | No significant difference |
| | | Xeno III system | 11.92 ±3.04 | | 10.39 ±4.06 | No significant difference |
| 4 | Ascension vicente et al Ao 2009 | Tsep+ tcpp | 6.93± 3.34 | | 7.78± 4.45 | No significant difference |
| | | Tmip+ tcpp | 7.89 ± 2.71 | | 7.51 ± 3.18 | No significant difference |
| 5 | Ekaterini paschos et al Ao 2008 | Txp+ acp II | 10.6± 1.6 | 11.8 ± 1.3 | | No significant difference |
| | | Tsep+ acp II | 13.2 ± 1.6 | | 11.1± 2.3 | low bond strength with contamination after primer application |
| | | ibond+ acp II | 11.3± 2.7 | | 11.1± 3 | No significant difference |
| 6 | Irene l zeppieri et al Ajodo 2003 | Tmip+ ortholux | 20.7 ± 5.0 | 13.1 ± 3.6 | 15.0 ± 3.0 | There was significant difference between contamination before primer and uncontamination |
| | | Tsep+ | 13.7 ± 5.1 | 13.8 ± 3.9 | 12.7 ± 3.5 | No significant difference |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | ortholux | | | | |
| 7 | Bishara et al AO 2002 | Sep(angel I)+ acp II | 6.0±3.5 | 4.8±3.3 | 4.8±3.3 | No significant difference |

**CHARATERISTICS OF VARIABLE - BLOOD CONTAMINATION:**

**TABLE 13: TXP + TXT:**

| S. No | Author | Material | No Contamination (MPa) | Before Primer (MPa) | After Primer (MPa) | Inference |
|---|---|---|---|---|---|---|
| 1. | Lorenz Brauchli et al AJODO 2012 | TXP+TXT | 25.06 ± 10.81 | | 4.88± 4.82 | There was significant difference on bond strength under contamination after primer application |
| 2. | Maria Francesca Sfondrini et al Briti.Journal of Oral & Maxillo Facial Surgery 2011 | TXP+TXT | 12.65 ± 3.96 | 1.29± 1.05 | 2.28± 1.69 | Bond strength is reduced under contamination |
| 3. | Bianca mota santos et al AO 2010 | TXP+TXT | 153.9 ± 61.4(N) | 8.4± 4.5(N) | | Bond strength is reduced much more under blood contamination |
| 4. | Andreas faltermeier et al Ejo 2007 | TXP+TXT | 8.71 ± 1.37 | | 2.37 ± 1.13 | significant difference at p=0.005 |
| 5. | Mehmet oguz oztoprak et al Ajodo 2007 | TXP+TXT | 15.28 ± 1.96 | 3.08± 1.81 | | significant difference at p<0.001 |

**TABLE 14: TMIP + TXT**

| S. No | Author | Material | No Contamination (MPa) | Before Primer (MPa) | After Primer (MPa) | Inference |
|---|---|---|---|---|---|---|
| 1. | Lorenz Brauchli et al AJODO 2012 | TMIP+ TXT | 20.53 ± 10.79 | | 0.73 ± 1.51 | There was significant difference at p<0.05 |
| 2. | Andreas faltermeier et al Ejo 2007 | TMIP+ TXT | 9.29 ± 1.16 | | 7.08 ± 0.78 | No significant difference |
| 3. | Korkmaz sayinsu et al Ao 2006 | TMIP+ TXT | *14.45 ± 2.35* | | *5.04 ±1.31* | There was significant difference |
| 4. | Ross s hobson et al Ajodo 2001 | TMIP+ TXT | 15.69 ± 3.8 | 11.16± 2.6 | | No significant difference at p<0.001 |

**TABLE 15: TSEP + TXT**

| S. No | Author | Material | No Contamination (MPa) | After Primer (MPa) | Inference |
|---|---|---|---|---|---|
| 1. | Lorenz Brauchli et al AJODO 2012 | TSEP+ TXT | 19.94 ± 10.53 | 2.51 ± 3.29 | Bond strength was reduced by blood contamination after primer application |
| 2. | Mehmet oguz oztoprak et al Ajodo 2007 | TSEP+ TXT | 13.76 ± 2.76 | 5.28 ± 1.47 | There was significant difference at p<0.01 |

**TABLE 16: FUJI ORTHO LC**

| S. No | Author | Material | No Contamination (MPa) | With Contamination (MPa) | Inference |
|---|---|---|---|---|---|
| 1. | Lorenz Brauchli et al AJODO 2012 | FUJI ORTHO LC | 2.56± 2.81 | 0.45 ± 1.40 | No significant difference |
| 2. | Vittorio cacciafesta et al Ajodo 2004 | FUJI ORTHO LC | 4.21± 3.00 | 4.08 ± 1.91 | No significant difference |

**TABLE 17: OTHERS**

| S. No | Author | Material | No Contamination (MPa) | Before Primer (MPa) | After Primer (MPa) | Inference |
|---|---|---|---|---|---|---|
| 1. | Bianca mota santos et al AO 2010 | TSEP+TPCC | 125.8 ± 52.7 | | 97.4 ± 61.2 | bond strength is reduced with contamination after primer application |
| 2. | Mehmet oguz oztoprak et al Ajodo 2007 | AP+ AA | 16.40± 3.50 | | 6.83 ± 2.88 | Significant difference is evident at p<0.001 |
| 3. | Korkmaz sayinsu et al AO 2006 | AP+ AA | *14.17±2.11* | *4.12±1.5* | | There was statistically significant difference at p<0.001 |
| 4. | Vittorio cacciafesta et al Ajodo 2004 | TXP +ACP II | 8.27 ± 1.65 | 3.76± 1.37 | 3.64± 1.28 | Bond strength is significantly differs from dry to wet condition |
| | | TMIP+ACPII | 8.36 ± 2.60 | 4.86 ± 1.15 | 4.69± 1.03 | There was statistically significant difference at p<0.02 |
| 5. | Maria francesca sfondrini et al Ajodo 2004 | TXP +ACP II | 8.27 ± 1.65 | 3.76 ± 1.37 | 3.64± 1.28 | No significant difference |
| | | TSEP+ACP II | 8.57 ± 2.09 | 5.98± 1.48 | 5.61± 1.02 | There was statistically significant difference at p<0.02 |