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(Organizadores)

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APRESENTAÇÃO

A obra "*As Ciências da Saúde*" aborda uma série de livros de publicação da Atena Editora, em seus 17 capítulos do volume IV, apresenta a importância da higiene e o cuidado com a saúde bucal frente à instalação de doenças orais e a qualidade do perfil nutricional de pacientes.

A saúde bucal transcende a dimensão técnica da prática odontológica, sendo a saúde bucal integrada às demais práticas de saúde coletiva. As ações de promoção e proteção à saúde visam à redução de fatores de risco, que constituem uma ameaça à saúde das pessoas, podendo provocar-lhes incapacidade e doenças, desta maneira, a nutrição apropriada reflete na manutenção de uma dieta bem balanceada para que o corpo possa obter os nutrientes necessários para uma boa saúde e bem-estar. Se sua dieta é pobre em relação aos nutrientes de que seu corpo necessita, sua boca dificilmente resistirá a uma infecção. Isso pode contribuir para doenças periodontais, uma das causas principais da perda de dentes em adultos. Embora uma má nutrição não cause doenças periodontais diretamente, muitos pesquisadores acreditam que a doença avança com maior rapidez e pode ser mais grave em pessoas com dietas carentes de nutrientes.

Colaborando com essa transformação nutricional e de cuidados orais, este volume IV é dedicado ao público de profissionais odontólogos e nutricionistas, bem como estudantes e pessoas que se preocupam e manter uma nutrição adequada e a saúde bucal.

Desta forma, este volume apresenta artigos que abordam a avaliação da condição de saúde bucal das famílias indígenas; função mastigatória, movimentos mandibulares e atividade elétrica do músculo masseter em crianças e adolescentes respiradores oronasais; cárie precoce da infância em uma criança desnutrida; análise salivar dos pacientes transplantados renais e com doença periodontal; fatores que interferem na decisão da mudança alimentar em pacientes com diabetes.

Portanto, esperamos que este livro possa fortalecer e incentivar mudanças de hábitos alimentares, incentivando, assim, uma maior atenção à cavidade oral, desenvolvendo um plano de cuidado e caracterizar o consumo alimentar de pacientes hemofílicos, além de determinar os conhecimentos de profissionais envolvidos na área.

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SUMÁRIO

CAPÍTULO 6

EVALUATION OF THE INFLUENCE OF ENAMEL INFILTRANT ON THE SHEAR BOND STRENGTH OF ORTHODONTIC BRACKETS

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ABSTRACT: The aim of this study was to evaluate the effects of a caries infiltrant on the shear bond strength of metallic brackets fixed to healthy bovine enamel. Forty permanent incisors were randomized into two groups: 1- was not treated and 2- was treated with the ICON®. Metallic brackets (Roth Kirium, slot .022"× 030", Abzil, 3M Unitek, Brazil) were glued on to the buccal surface of the teeth using an adhesive system and composite resin. Each group was divided into two subgroups: in subgroup a, the enamel was not subjected to pHcycling; in subgroup b,the enamel was subjected to pHcycling. The specimens were aged, and the pH-cycling process was performed. Shear strength tests were performed with a universal testing machine and the specimens were classified according to the adhesive remnant index (ARI). The shear bond strength was significantly lower in group G1a compared with group G1b. Groups G2a and G2b did not show statistically significant differences in shear bond strength ($p > 0.05$). In addition, the shear bond strength in group G2b was not significantly different compared with the control group (G1a). There was no statistically significant difference in the ARI values between groups. Application of the Icon®resin infiltrant on the enamel surface subjected to demineralization did not significantly affect shear bond strength compared with the control group. The pH-cycling process did not affect shear bond strength or the ARI in the experimental groups treated with the Icon® resin infiltrant. ARI analysis demonstrated the prevalence of adhesive failures in all experimental groups.

KEYWORDS: Dental caries, Orthodontic

brackets, Shear bond strength.

BACKGROUND

Orthodontic therapy provides functional and aesthetic reestablishment of mouth occlusion; however, this often requires using fixed braces for a long period of time. The presence of the orthodontic appliance can impair oral hygiene, compromising the success of orthodontic therapy.[1]

Moreover, studies[2,3] have shown that orthodontically treated persons have an increased risk of developing white stain lesions on the enamel during orthodontic treatment compared with untreated persons. The research conducted by Olympio et al. (2006) concluded that orthodontic appliancesact as dental plaque retainers, which can lead to demineralization of the adjacent dental enamel.[4]

White stains are one of the most frequent dental problems, and a new technique for treating these incipient caries lesions has been proposed, i.e.,the application of low viscosity infiltrants tothe affected area. One of the infiltrants currently available is the Icon® (Icon, DMG, Hamburg, Germany) resin infiltrant.[5,6,7] This resin infiltrant, when photoactivated by blue light, has the capacity to seal the lesion, inhibiting its progression by soaking into the pores.[6,7] Therefore, the diffusion path of cariogenic acids is blocked and the lesion is sealed.[8]

The use of resin infiltrants reduces enamel demineralization in incipient caries lesions.[5,9,10] However, a study by Schmidlin et al. (2012)[11] demonstrated that the Icon®resin infiltrant can be used as a preventive agent in order to reduce enamel dissolution, thereby limiting the appearance of white stains. Given that the bond strength of orthodontic appliances can vary and that this technique can interfere with the strength of orthodontic bonding to an unknown degree, the consequences on shear bond strength and the adhesive remnant index should be considered.[12] Thus, the objective of the present study was to evaluate the influence of an enamel infiltrant on the shear bond strength of orthodontic brackets. Additionally, we aimed to evaluate the influence of enamel pHcycling on both the shear bond strength of the metallic brackets bonded to healthy bovine teeth and to classify specimens with and without prior use of the Icon®infiltrant system according to the adhesive remnant index (ARI).

METHODS

The study sample consisted of 40 healthy bovine permanent incisors[13] stored in 0.5% chloramine solution for disinfectionfor 48 hours according to the ISO/TS 11405 guidelines (2003). The study was carried out at the Biomaterials Laboratory of the Dentistry Post-Graduate Programatthe Federal University of Santa Maria (Santa Maria, RS).

The teeth were sectioned at the neck level using a double-sided diamond disk. The crowns had their buccal faces worndownto obtain a flat enamel surface in the bonding area, using a rotating electric polishing machine (Ecomet 250, Buehler Ltd., Lake Bluff, IL, USA). Abrasive strips of 400, 600, and 1200 grit were then usedfor 80 seconds of polishing time with each granulation under water cooling.

Later, the crowns were individually placedin polyvinyl chloride cylinders (internal area of 20 × 25 mm) and embedded in self-polymerized acrylic resin (JET/Classic, São Paulo, SP, Brazil), leaving the buccal surface exposed. After resin polymerization, the specimens were manually polished with abrasive strips of 400, 600, and 1200 gritunder water cooling and stored in distilled water.

The specimens were randomized into two groups: Group 1 was not treated and Group 2 was treated with the Icon® enamel protective agent. Each group was then divided into two subgroups: in subgroup a, the enamel was not subjected to pHcycling; in subgroup b, the enamel was subjected to pH cycling, as described in Table 1.

G1	**G1a** - not treated with Icon®resin infiltrant; not subjected to pHcycling (control group)
	G1b - not treated with Icon®resin infiltrant; subjected to pHcycling
G2	**G2a** - treated with Icon®resin infiltrant; not subjectedto pHcycling
	G2b - treated with Icon®resin infiltrant; subjected to pHcycling

Table 1 - Description of the experimental groups and subgroups.

Prophylaxis was performed on the specimens with a rubber cup (Preven, Guapirama, PR, Brazil) at low rotation, pumice (SS White / Duflex, Rio de Janeiro, RJ, Brazil), and water for 10 seconds. Subsequently, we washed the specimens with water for 10 seconds and dried them with air jets for 15 seconds. The cups were changed after five cleaning procedures. For Group 1 specimens, the enamel surface was conditioned with 37% phosphoric acid according to the manufacturer's recommendations.

For Group 2 specimens, the Icon® resin infiltrating agent was applied according to the manufacturer's recommendations. In this group, Icon-Etch was used inlieu of the 37% phosphoric acid during the application of the Icon® Infiltrant according to manufacturer's recommendations.

Metallic orthodontic brackets for the upper central incisors (Roth, Kirium, slot .022"× .030", Abzil, 3M/Unitek, Brazil) were fixed in all groups with an adhesive system and resin (Transbond™ XT, 3M Unitek, Monrovia, USA) as recommended by the manufacturer. During the bonding procedure, a Gillmore needle was placed in the center of the bracket, applying a 600-g load for 10 seconds, to standardize the resin thickness at the bracket-tooth interface. The extra resin was removed with an exploratory probe. The adhesive system and composite resin were polymerized according to the manufacturer's recommendations withthe Radii-Cal photopolymerization device (SDI, Victoria, Bayswater, Australia).

After the bonding of the brackets, the specimens were subjected to an aging process (500 cycles of thermocycling from5to 55°Cand storage in distilled water at 37°C for 24 hours), as recommended by the ISO/TS 11405 guidelines (2003). The thermocycling was performed with an Ethik Technology machine (São Paulo, SP, Brazil).

Subsequently, the subgroup b specimens (G1-b /G2-b) were individually immersed for eight hours in a pH 4.5 demineralizing solution (2.2 mM $CaCl_2$, 2.2 mM NaH_2PO_4, 0.05 M acetic acid, and 1 M KOH) and sixteen hours in a pH 7.0 remineralizing solution (1.5 mM$CaCl_2$, 0.9 mMNaH_2PO_4, and 0.15 mMKCl) every day for 14 days.[14]

After a 24-hour period in deionized water, the specimens were subjected to the shear bond strength test in a universal mechanical test machine (EMIC DL-1000, São José dos Pinhais, Brazil). Force was applied through a chisel positioned atthe bracket's body[15] at a speed of 0.5 mm/min as recommended by the ISO/TS 11405 guidelines (2003). The rupture force was obtained in newtons (N) and converted to megapascals (MPa). This conversion was performed using the following formula: R=F/A, where R = shear bond strength in megapascals, F = rupture load or take-off force in newtons, and A = the bracket's base area in square millimeters. The total bracket base area was 12.89 mm² per the manufacturer.

The enamel surface was immediately analyzed using a Discovery v20 (Zeiss) stereomicroscope with 7.5× magnification and classified according to the ARI. For the ARI evaluation, we used the 4-point scale initially proposed by Artun and Berglan (1984),[16] which suggests the following failure types: 0 = no adhesive on the tooth surface; 1 = less than half of the adhesive on the tooth surface; 2 = more than half of the adhesive on the tooth surface; 3 = all of the adhesive on the tooth surface.

Because the Shapiro-Wilk test showed that the dependent variable was a continuous variable with a non-normal distribution, we used the non-parametric Kruskal-Wallis test to compare the shear bond strength means. Subsequently, the Mann-Whitney test was used to determine differences between experimental groups. The Chi-square test was used to compare categorical variables in order to determinethe frequency of ARI scores in the tested groups. The significance level was 5%. All statistical analyses were performed using the SPSS software, ver. 22.0 (IBM Co., Armonk, NY, USA).

RESULTS

The shear bond strength means and standard deviations of the different experimental groups are presented in Table 2. The highest mean was recorded in the group that was not treated with the Icon®resin infiltrant butthat went through the pH-cycling process (22.21 MPa). The group with the lowest mean was the one treated with the Icon®resin infiltrant that did not go through the pH-cycling process (8.6 MPa). The shear bond strength was significantly higher in group G1b compared with the groups G2a ($p \leq 0.05$) and G2b ($p = 0.03$). The shear bond strengths in groups G2a and G2b

were not statistically different ($p > 0.05$).

Group	n	Mean (MPa)	Standard Deviation	Min (MPa)	Max (MPa)
G1a [a]	10	14.23	6.94	5.4	27.57
G1b [b]	10	22.21	7.19	8.83	29.93
G2a [c]	10	8.6	3.33	3.75	12.89
G2b [ac]	10	13.16	8.43	2.97	27.07

Table 2 - Descriptive analysis of *in vitro* shear bond strength in MPa.

Mean values in each row with the same letter are not statistically different ($p > 0.05$). G1a:not treated with Icon®resin infiltrant and not subjected to pHcycling (control group). G1b:not treated with Icon®resin infiltrant but subjected to pHcycling. G2a:treated with Icon®resin infiltrant but not subjected to pHcycling. G2b:treated with Icon®resin infiltrant and subjected to pHcycling.

The frequency of ARI scores for the tested groups arepresentedin Table 3. Two specimens received a score of 2 (cohesive failure), one of them being in group G1b and the other ingroup G2a. Only one specimen, which belonged to group G2a, received a score of 3. All other specimens received a score of 0, demonstrating the prevalence of adhesive failure at the bracket-tooth interface.

Group	n	ARI score			
		0	1	2	3
G1a [a]	10	10	0	0	0
G1b[a]	10	9	0	1	0
G2a [a]	10	8	0	1	1
G2b [a]	10	10	0	0	0

Table 3 –Frequency of ARI scores for the tested groups.

Chi-square test: $p = 0.51$. The same letters in each row indicate that there is no statistical difference. ARI scores: 0 = no adhesive on tooth surface; 1 = less than half of the adhesive on tooth surface; 2 = more than half of the adhesive on tooth surface; 3 = all ofthe adhesive on tooth surface. G1a: not treated with Icon®resin infiltrant and not subjected to pHcycling (control group). G1b: not treated with Icon®resin infiltrant butsubjected to pHcycling. G2a: treated with Icon®resin infiltrant but not subjected to pHcycling. G2b: treated with Icon®resin infiltrant and subjected to pHcycling.

DISCUSSION

The presence of orthodontic brackets on the crown of teeth increases plaque retention, which favors enamel demineralization and the development of initial caries lesions around these appliances.[4,17] Even with daily use of a fluoridated dentifrice and conventional hygiene measures, the appearance of white stainsis still frequent in

orthodontic patients.[17-19]

The Icon® resin infiltrant is a low-viscosity resin, with optical refraction properties similar to healthy enamel, specifically indicated for aesthetic improvement and interrupting incipient caries.[20] Furthermore, the efficacy of the Icon® resin can persist for three years after application.[10] The treatment of carious lesions with this infiltrating agent can effectively control the lesion progression[5,9,10]; however, preventing enamel demineralization is one of the major challenges faced by dentists and orthodontists.[18]

An *in vitro* study conducted by Oliveira (2013)[21] found that use of the Icon®resin infiltrant in healthy enamel or enamel with initial erosion injuries was effective in preventing and inhibiting erosive progression. Another *in vitro* study conducted in bovine teeth by Schmidlinet al.(2012)[11] compared the potential protection of a conventional adhesive, the Icon® resin infiltrant, and the combination of both agents against enamel demineralization. The results showed that each of these treatments reducedenamel dissolution, but the adhesive alone and the combination of the adhesive and infiltrantwere more effective than the infiltrant alone.

However, there have only been a few studies[13,22] evaluating the shear bond strength and ARI with and without the use of a resinous infiltrant prior to the bonding of orthodontic brackets. The adhesion strength in the bonding of orthodontic appliances can vary depending on several factors, including the intensity of the resin's polymerization light, type of tooth enamel, design of the bracket's base, the bracket's material composition, time of conditioning, concentration and composition of the acid, and composition of the adhesive system.[12] Therefore, the expected adhesive strength may decrease, leading to early bracket detachment; or the adhesive strength may increase, causing enamel fracture during the removal process. Thus, the adhesive system used must generate enough bond strength to resist the orthodontic forces employed during treatment and be able to resist the shearing forces generated by the impact of food while chewing without damaging the dental enamel.

Considering these factors and the recent introduction of the Icon®resin infiltrant for preventing caries lesions, the present study tested the use of the Icon®resin infiltrant prior to bonding orthodontic brackets to evaluate its effect on shear bond strength. We also tried to simulate clinical conditions after bracket bonding, such as the aging process, following the ISO/TS 11405 (2003) guidelines, and the pH-cycling protocol, as suggested by ten Cate and Duijsters (1982)[14], to simulate enamel demineralization.

The bond strength values in the groups treated with the Icon® resin infiltrant were significantly lower than those in the untreated group that under went pHcycling. All groups had mean strengths greater than what was needed to resist the mechanics employed during orthodontic treatment, which Reynolds (1975)[23] has indicatedis 5.88 to 7.84 MPa. The minimum and maximum mean values found in the present study were 8.6 and 22.21 MPa, respectively. In the present study, the highest shear bond strength values were found in the groups that were not treated with the Icon®resin infiltrant (G1a-14,23 and G1b-22,21). Unlike the results of the present study, Naidu

et al. (2013)[22] tested the Icon® resin infiltrantin bovine enamel and found higher bond strength values in the group that was treated with the Icon® resin infiltrant compared with the untreated group.

The present study demonstrated that the use of the Icon® resin infiltrant, when subjected to the pH-cycling process, did not show a statistically significant difference with the conventional bonding process of orthodontic brackets (Transbond™ XT adhesive system) that did not undergo pHcycling.This demonstrates that use of the Icon® resin infiltrant, when subjected to pHcycling,was not able to significantly alter the adhesion in the brackets' bonding compared with thecontrol group.Similar results were found by Montasser and Taha (2014), who evaluated the effect of two enamel protective agents on the shear bond strength of brackets bonded with different adhesive systems[13]; they concluded that use of the Icon® resin infiltrant prior to bonding the brackets did not significantly alter the bond strength compared with untreated groups.

In this study, the pH-cycling process influenced the shear bond strength values in the groups not treated witha resinous infiltrant, similar to the results ofthe study by Tedesco (2011)[24] that evaluated cariogenic challenge simulation on the bond strength of adhesive systems with healthy and demineralized enamel; that studyconcluded that cariogenic challenge simulation negatively influencedthe bond strength in deciduous and permanent teeth, regardless of the type of adhesive system used.

An excessively high bond strength may, however, make it difficult to remove the bracket at the end of treatment, leading to fracture of the enamel or bracket.[25] Although the *in vitro* shearing test does not perfectly replicate *in vivo* behavior, as demonstrated in the study by Murray and Hobson (2003),[26] it does reveal that the bond strength in samples exposed to the oral environment for 4 and 8 weeks are significantly lower than that when exposed to a sterile water environment at 37°C for the same period. A similar result was found in the study by Penido et al. (2008),[27] in which the authors also observed that the *in vivo* mean bond strength was significantly lower in relation to *in vitro* mechanical assays.

Astudy by Naidu et al. (2013)[22] concluded that preconditioning with the Icon®resin infiltrant in the bonding of orthodontic brackets did not alter the ARI scores. The same result was found in the present study, since there was no statistically significant difference in the ARI with and without the use of the Icon® resin infiltrant. Further, no significant differences were observed in ARI values between the specimens subjected or not subjected to pHcycling.

The most common ARI scorein the present study was zero.[16] This type of failure is considered the most dangerous because there is a greater chance of enamel fracture occurring during bracket removal.[28] The ARI scores found in the present study do not corroborate the results found by Montasser and Taha (2014),[13] who evaluated, among other factors, the ARI of teeth treated with the Icon®resin infiltrant prior to the bonding of orthodontic brackets. In this study, the most frequent score in the group treated with the infiltrant was 3, revealing that many adhesive failures occur at the bracket-resin

interface.

The present study used bovine incisors as a substitute for human teeth, as they are easier to acquire and manipulate. According to Romano et al. (2004)[29], recent advances in dentistry and improved oral health have considerably reduced the number of extracted teeth. This makes it difficult to collect and use human teeth for laboratory research. The previously cited authors compared the shear bond strength and the ARI of brackets bonded to bovine and human incisors. The results of that study demonstrated that bovine teeth can be substituted for human teeth in laboratory experiments without compromising the fidelity of the test.

Matos et al. (2008)[30] also evaluated the use of bovine teeth as substitutes for human teeth for their *in vitro* tests, concluding that bovine enamel is an adequate substitute for human enamel. Although bovine teeth are suitable alternatives for shear bond strength tests, bond strength values may differ slightly compared withhuman enamel[31]; however, this difference becomes negligible since all groups use the same substrate.

Laboratory studies are necessary to elucidate the behavior of different types of materials, but the actual performance of these materials can only be assessed in the environment for which they are intended.[32] According to Montasser and Taha (2014),[13] *in vitro* studies are an important preliminary guide for clinicians, while *in vivo* studies are required for evidence-based practice.

According to the results of the present study, the Icon® resin infiltrant can be used on the enamel surface prior to the bonding of orthodontic brackets and before being subjected to the pH-cycling process, since it does not affect the shear bond strength or the ARI compared with the control group.

CONCLUSIONS

After evaluating the effect of the Icon®resin infiltrant and pHcycling on the shear bond strength of metallic brackets bonded to the surface of healthy bovine enamel, we concluded the following:

- Application of the Icon®resin infiltrant on the enamel surface subjected to demineralization did not significantly affect shear bond strength compared with the control group.
- The pH-cycling process did not affects hear bond strength or the ARI in the experimental groups treated with the Icon®resin infiltrant.
- ARI analysis demonstrated the prevalence of adhesive failures in all experimental groups.

DECLARATIONS

List of abbreviations

ARI: adhesive remnant index
A – bracket base area in mm^2
C – celsius
F – shear bond strenght in N
g – grams
M – molar
min – minutes
mm – millimeters
mM – millimolar
mm^2 – square millimeters
N – Newtons
Mpa – megapascals
pH – hydrogen potential
R - shear bond strenght in megapascals

REFERENCES

1 SOUZA FM, SENES AM, HENRIQUESJFC, BASTOS JRM. **Prevenção de cáries e doençasperiodontaisemortodontiacorretiva. Métodos simples para seremutilizados no consultório.** Ortodontia, v.27, n.3, p.87-94, 1994.

2 HADLER-OLSEN S, SANDVIK K, EL-AGROUDI MA, ØGAARD B. **The incidence of caries and white spot lesions in orthodontically treated adolescents with a comprehensive caries prophylactic regimen- a prospective study.** Eur J Orthod, v.34, n.5, p.633-39, 2012.

3 MASARWA NA, AL-NSOUR HF, AL-ZOUBIZH, AL-AWABDEH HF, AL-KHRAISAT AS. **Prevalence of new carious lesions among patients undergoing orthodontic treatment with fixed appliances.** Pakistan Oral and Dental Journal, v.33, n.3, p.539-43, 2013.

4 OLYMPIO KPK, BARDAL PAP, HENRIQUESJFC, BASTOS JRM. **Prevenção de cárie dentária e doença periodontal em Ortodontia: uma necessidade imprescindível.** R Dental Press Ortodontia e Ortopedia Facial, v.11, n.2, p.110-9, 2006.

5 MEYER-LUECKEL H, BITTER K, PARIS S. **Resin infiltration of caries lesions: an efficacy randomized trial.** J Dent Res, v.89, n.8, p.823-6, 2010.

6 PARIS S, MEYER-LUECKEL H, CÖLFEN H, KIELBASSA AM. **Resin infiltration of artificial enamel caries lesions with experimental light curing resins.** Dent Mater J, v.26, n.4, p.582-8, 2007.

7 MEYER-LUECKEL H, PARIS S. **Progression of artificial enamel caries lesions after infiltration with experimental light curing resins.** Caries Res, v.42, n.2, p.117-24, 2008.

8 SPLIETH CH, EKSTRAND KR, ALKILZY M, et al. **Sealants in dentistry: outcomes of the ORCA Saturday afternoon symposium.** Caries Res, v.44, n.1, p.3-13, 2010.

9 DOMÉJEAN S, DUCAMP R, LÉGER S, HOLMGREN C. **Resin infiltration of non-cavitated caries lesions: a systematic review.** MedPrincPract, v.24, n.3, p.216-21, 2015.

10 MEYER-LUECKEL H, BITTER K, PARIS S. **Randomized controlled clinical trial on proximal caries infiltration: three-year follow-up.** Caries Res, v.46, n.6, p.544-8, 2012.

11 SCHMIDLIN PR, SENER B, ATTIN T, WIEGAND A. **Protection of sound enamel and artificial enamel lesions against demineralization: caries infiltrant versus adhesive.** J Dent, v.40, n.10, p.851-6, 2012.

12 REICHENEDER CA, GEDRANGE T, LANGE A, BAUMERT U, PROFF P. **Shear and tensile bond strength comparison of various contemporary orthodontic adhesive systems: an in-vitro study.** Am J Orthod Dentofacial Orthop, v.135, n.4, p.422-6, 2009.

13 MONTASSER MA, TAHA M. **Effect of enamel protective agents on shear bond strength of orthodontic brackets.** Progress Orthod, p.15:34, 2014.

14 TEN CATE JM, DUIJSTERS PP. **Alternating demineralization and remineralization of artificial enamel lesions.** Caries Res, v.16, n.3, p.201-10, 1982.

15 CAMPOS, MIC, CAMPOS CN, AARESTRUP FM, FRAGA MR, VITRAL RWF. **Estudo Microscópico da Prevenção da Desmineralização do Esmalte Dentário Durante Tratamento Ortodôntico Utilizando Selante de Fóssulas e Fissuras.** Pesquisa Brasileira em Odontopediatria e Clínica Integrada, v.11, n.3, p.399-405, 2011.

16 ARTUN J, BERGLAND S. **Clinical trials with Crystal growth conditioning as an alternative to acid-etch enamel pretreatment.** Am J Orthod, v.85, n.4, p.333-40, 1984.

17 O'REILLY MM, FEATHERSTONE DB. **Deminetalization and remineralization around orthodontic appliances: an in vivo study.** Am J Orthod Dentofacial Orthop, v.92, n.1, p.33-40, 1987.

18 TUFEKCI E, DIXON JS, GUNSOLLEY JC, LINDAUERSJ. **Prevalence of white spot lesions during orthodontic treatment with fixed appliances.** Angle Orthod, v.81, n.2, p.206-10, 2011.

19 ENAIA M, BOCK N, RUF S. **White-spot lesions during multibracket appliance treatment: A challenge for clinical excellence.** Am J Orthod Dentofacial Orthop, v.140, n.1, p.17-24, 2011.

20 VIANNA, JS. **A influência dos infiltrantes de baixaviscosidade para tratamento de manchas brancas na colagem ortodôntica.** [unpublished dissertation].Rio de Janeiro (RJ):Faculdade de Odontologia da Universidade Federal do Rio de Janeiro; 2013.

21 OLIVEIRA, GC. **Uso de infiltrante sobre o esmalte hígido e com lesão inicial de erosão submetido a desafio erosive *in vitro***. [unpublished dissertation].Baurú (SP): Faculdade de Odontologia de Bauru;2013.

22 NAIDU E, STAWARCZYK B, TAWAKOLI PN, ATTIN R, ATTIN T, WIEGAND A. **Shear bond strength of orthodontic resins after caries infiltrant preconditioning.** Angle Orthodontist, v.83, n.2, p.306-12, 2013.

23 REYNOLDS, IA. **Review of direct orthodontic bonding.** Br J Orthod, v.2, p.171-8, 1975.

24 TEDESCO, TK. **Influência da simulação do desafio cariogênico na resistência de união de sistemas adesivos ao esmalte de dentes decíduos e permamentes.** [unpublished dissertation]. Santa Maria (RS): Faculdade de Odontologia da Universidade Federal de Santa Maria; 2011.

25 BISHARA SE, OLSEN ME, VONWALD L, JAKOBSEN JR. **Comparison of the debonding characteristics of two innovative bracket designs.** Am J Orthod Dentofacial Orthop, v.116, n.1, p.86-92, 1999.

26 MURRAY SD, HOBSON RS. **Comparison of in vivo and in vitro shear bond strength**. Am J Orthod Dentofacial Orthop, v.123, n.1, p.2-9, 2003.

27 PENIDO SMMO, PENIDO CVSR, SANTOS-PINTO A, SAKIMA T, FONTANA CR. **Estudo in vivo e in vitro com e sem termociclagem, da resistência ao cisalhamento de bráquetes colados com fonte de luz halógena.** Revista Dental Press de Ortodontia e Ortopedia Facial, v.13, n.3, p.66-76, 2008.

28 FLEISCHMANN, LA, SOBRALMC, HABIB F. **Resistência de união de sistema adesivo com agentes antimicrobianos utilizado em ortodontia.** Revista odontociência, v.23, n.4, p.346-50, 2008.

29 ROMANO FL, TAVARES SW, RAMALLI EL, MAGNANIMBBA, NOUER DF. **Análise *in vitro* da resistência ao cisalhamento de bráquetes metálicos colados em incisivos bovinos e humanos.** Revista Dental Press de Ortodontia e Ortopedia Facial, v.9, n.6, p.63-9, 2004.

30 MATOS IC, SABTBB, JULIBONIRFG, MIRANDA, MS. **Utilização de dentes bovinos como possíveis substituto aos dentes humanos nos testes in vitro: revisão de literatura.** Revista odontologia UFES, v.10, n.2, p.58-63, 2008.

31 YASSEN GH, PLATT JA, HARA AT. **Bovine teeth as substitute for human teeth in dental research: a review of literature.** J Oral Sci, v.53, n.3, p.273-82, 2011.

32 ELIADES T, BRANTLEY WA. **The inappropriateness of conventional orthodontic bond strength assessment protocols.** Eur J Orthod, v.22, n.1, p.13-23, 2000.

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