SHEAR BOND STRENGTH OF AN ADHESIVE SYSTEM IN HUMAN, BOVINE AND SWINISH TEETH

RESISTÊNCIA AO CISALHAMENTO DE UM SITEMA ADESIVO EM DENTES HUMANOS, BOVINOS E SUINOS

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The purpose of this work was to compare the shear bond strength of an adhesive system in human enamel and dentin, as well as in bovine and swinish, after 24 hours and 7 days storage at 37°C water and 100% of relative humidity. Sixty human upper premolars, sixty bovine upper incisors and thirty swinish molars were used. Rigth after the extractions the tooth were cleaned and stored in 0,09% physiologic solution with 0,05% thymol, at 4° C until they were used. The teeth were divided into 12 groups made by 15 specimens, according to the kind of tooth, the surface to be tested and storage period. The surfaces to be tested were planed by using 180 followed by 400 and 600 wet sandpaper and received Prisma Universal Bond 3 adhesive system according to the manufacturer. A polyethylene cilinder 3 mm in diameter was fixed over these surfaces to limit the area and matrix which was filled with Prisma AP.H/Compules resin. Using an Kratus testing machine the bond strength in MPa were: enamel 24 hours 37.6 ± 7.81(H); 30.77 ± 5.68(B); 25.54 ± 6.72(S); enamel 7 days 36.17 ± 4.83(H); 36.94 ± 6.72(B); 23.33 ± 25.54 ± 6.72(S); enamel 7 days 36.17 ± 4.83(H); 36.94 ± 6.72(B); 23.33 ± 7.72(S); dentin 24 hours 8.49 ± 2.25 (H); 6.04 ± 2.51(B); 7.99 ± 3.03(S); dentin 7 days 9.37 ± 4.21(H); 7.83 ± 3.15(B); 8.45 ± 4.33(S). Analysis of the values by to Tukey-Kramer test ($P<0.05$) revealed: bond strength in enamel were significantly higher when compared to dentin; bond strength in human enamel did not present significant statistical differences relating to bovine enamel, however both registered significant differences relating to swinish enamel; bond strength obtained in human dentine, bovine and swinish did not present any significant difference among themselves; bond strength obtained after periods storage of 24 hours and 7 days did not present significant statistical differences.

Uniterms: Shear bond strength; Bond strength

INTRODUCTION

Many researches have been developed trying to find an adhesive material with a strong and permanent bonding to the tooth structure, preventing microleakage, pulpal injury, secondary caries, increasing this way, the restoration longevity.

Because there are many problems in making adhesion researches "in vivo", they have been conducted much more "in vitro". The literature has a lot of works with human teeth , but in our days, with the development of the Preventive Odontology, it`s too difficult to get human teeth.

There are researches with bovine teeth used to avaliate the adhesive systems, but its use in "in vitro" tests is contradictory.

NAKAMICHI IWAKU FUSAYAMA[3],1983, have studied the possibility in using bovine teeth instead of human ones, in bond strength test in enamel and dentin, and concluded that the bovine specimens have condictions to substitute the human ones.

Saunders[5], 1988, compaired both specimens in dentin bond strength tests and agreed with these authors.

However, Retief et al. (1990) thinks the bovine substrate doesn't work so good for the adhesive systems researches.

The aim of this work was to compair the shear bond strength in enamel and dentin of an adhesive system in human, bovine and swinish teeth to avaliate if it's possible to use the bovine and swinish specimens as a good alternative for bonding laboratory tests.

MATERIAL AND METHODS

Sixty human upper premolars, sixty bovine upper incisors and thirthy swinish molars were used (Figure 1). Rigth after the extractions the tooth were cleaned and stored in physiologic solution at 0,09% with 0,05% of thymol, at 4° C until they were used.

The teeth were distributed in 12 groups made by 15 specimens, according to the kind of tooth, the surface to be tested and storage period (Table 1).

The surfaces to be tested were planed by using 180 followed by 400 and 600 wet sandpaper and received Prisma Universal Bond 3 adhesive system according to the manufacturer. A polyethylene cilinder 3 mm in diameter was fixed over these surfaces to limit the area and matrix RETIEF et al.[4] which was filled with Prisma AP.H/ Compules resin.

The teeth were fixed with stone plaster (Vel-Mix) inside a metal ring.

The samples were stored in physiologic solution for 24 hours and 7 days at 37°C, until the shear bond strength test moment, using a Kratus testing machine.

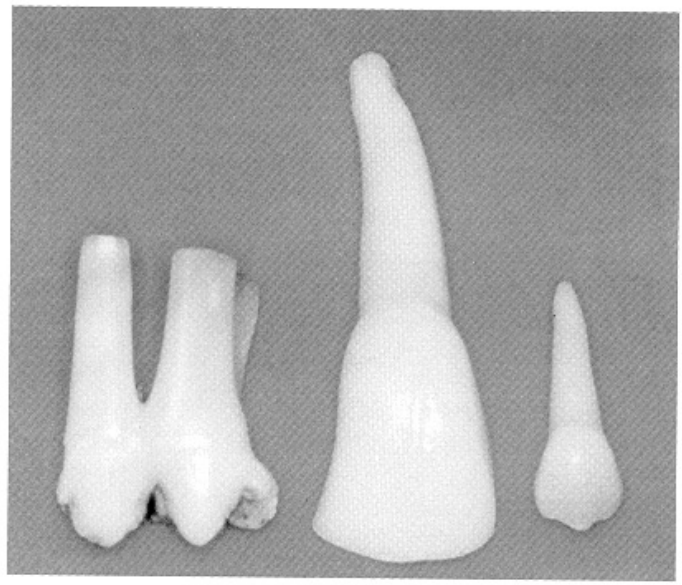

Figure 1- Swinish, bovine and human tooth

TABLE 1- Experimental groups

Groups	Teeth	Surface	Storage period
1	Human (H)	Enamel	24 hours
2		Dentin	
3	Bovine (B)	Enamel	
4		Dentin	
5	Swinish (S)	Enamel	
6		Dentin	
7	Human (H)	Enamel	7 days
8		Dentin	
9	Bovine (B)	Enamel	
10		Dentin	
11	Swinish (S)	Enamel	
12		Dentin	

RESULT

After the statistical analysis of the values by the Tukey-Kramer Test

(P<0.05), the results were:

TABLE 2- Shear bond strength means (Tukey-Kramer test) for surface and storage period, in MPa.

Surface	Enamel	31.72
	Dentin	8.03
Storage period	24 hours	19.41 a
	7 days	20.35 a

a = values were not significantly different

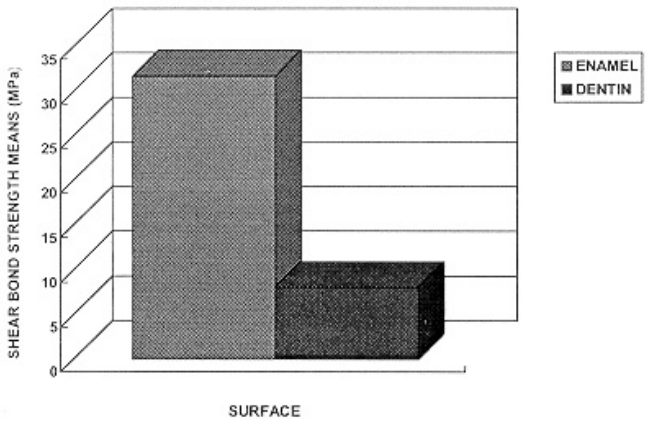

Figure 2- Shear bond means (MPa) of the surface

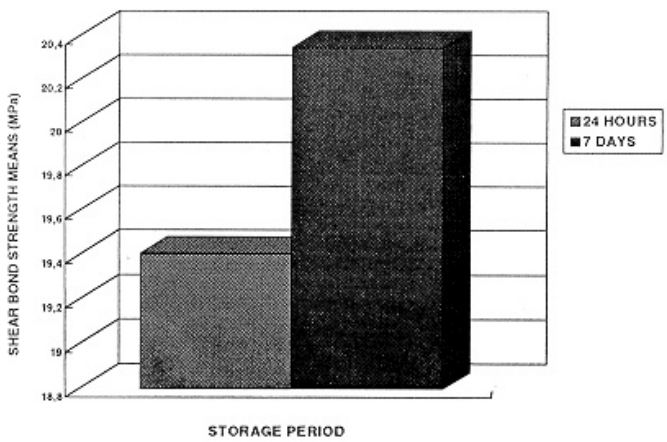

Figure 3- Shear bond strength means (MPa) of the storage period

TABLE 3- Shear bond strength for tooth-surface (MPa)

Human/ Enamel	36.89 a
Bovine/ Enamel	33.85 a
Swinish/ Enamel	24.44
Human/ Dentin	8.93 a
Bovine/ Dentin	6.94 a
Swinish/ Dentin	8.22 a

a = values were not significantly different

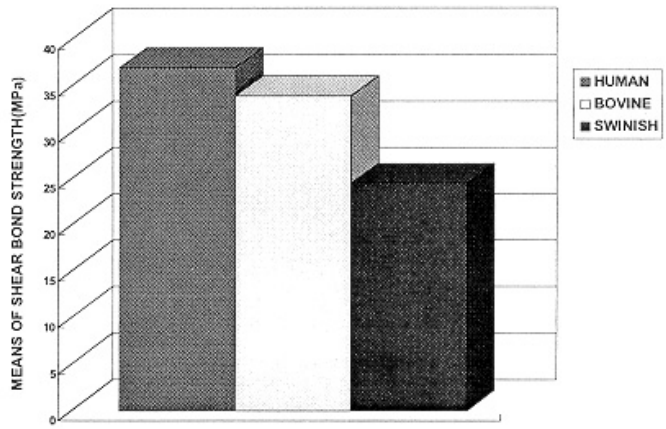

Figure 4- Shear bond strength means (MPa) of the tooth-enamel

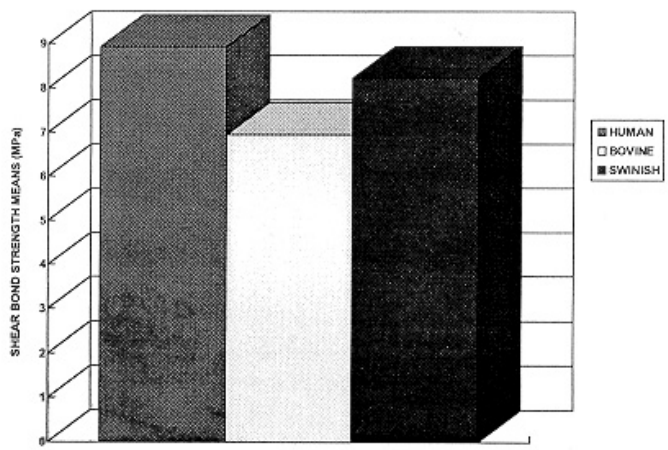

Figure 5- Shear bond strength means (MPa) of the tooth- dentin

TABLE 4- Means and standard deviations of the shear bond strength (MPa) for 12 groups tested

Groups	Means (MPa)	SD
1	37.6	7.81
2	8.49	2.25
3	30.77	5.68
4	6.04	2.51
5	25.54	6.72
6	7.99	3.03
7	36.17	4.83
8	9.37	4.21
9	36.94	6.72
10	7.83	3.15
11	23.33	7.72
12	8.45	4.33

DISCUSSION

The shear bond strength in enamel were significantly higher when compared to the values obtained in dentin (Table 2 and Figure 2) , according to some authors[1, 3, 4, 6].

The adhesive Prisma Universal Bond 3 system showed high bond strength values when used in enamel , with means of 31.72 MPa to the shear bond strength (Table 2 and Figure 2). In dentin the means values obtained were 8.03 MPa (Table 2 and Figure 3) showing no efficiency to resist to the theoretic values of the polymerization shrinkage (17 MPa)[2].

The literature has a lot of different results because of the lack of standardization.

The shear bond strength values after 7 days showed slightly higher results when compared to those found after 24 hours, but there weren't significant statistical difference between them (Table 2 and Figure 3).

There wasn't significant statistically difference between human and bovine enamel results, although the mean values were slightly lower in bovine enamel (Table 3 and Figure 5), showing that the bovine enamel can be used in the shear bond strength tests, agree with the NAKAMICHI, IWAKU; FUZAYAMA[3] results.

The shear bond strength in human and bovine enamel, showed significant statistical difference when compaired to swinish enamel (Table 3 and Figure 4), showing the impossibility in its use in the bond strength tests, in vitro.

It was known how many young animals were present in the research, but not the ages of them. If not so young swinish enamel were used, maybe the results were different from this one.

The mean values of the bond strength of the bovine dentin were slightly lower than the human dentin (Table 3 and Figure 5), that agree with the NAKAMICHI, IWAKU; FUZAYAMA[3] results. However, Retief et al. found significant statistical difference in the shear bond strength between bovine dentin, with the adhesive Scotchbond 2/Silux system, disagreeing with the results of this work.

This work shows good results with the bovine enamel and bovine/swinsh dentin in their use as an alternative to the human substrate in the shear bond strength of the adhesive Prisma Universal Bond 3/Prisma A.P.H. Compules system, however it's necessary the development of new researches to compair the adhesive systems with a bond mechanism different of that used in this work, the histollogical/chemical composition and structural morphology of the bovine and swinish teeth.

CONCLUSION

1- The shear bond strength in enamel were significantly higher when compared to the values obtained in dentin.

2- The shear bond strength in human enamel did not present significant statistically difference relating to bovine enamel, however both registered significant differences relating to swinish enamel.

3- The shear bond strength obtained in human, bovine and swinish dentin did not present any significant difference among themselves.

4- The shear bond strength obtained after storage periods of 24 hours and 7 days did not present significant statistically differences.

RESUMO

O propósito deste trabalho foi comparar a resistência ao cisalhamento de um sistema adesivo em esmalte e dentina de dentes humanos, bovinos e suínos, após estocagem por 24 horas e 7 dias em água a uma temperatura de 37°c e umidade relativa de 100%. Foram usados sessenta premolares superiores humanos, sessenta

incisivos superiores bovinos e trinta molares suínos. Logo após as exodontias, os dentes foram limpos e conservados em solução fisiológica a 0,09% com 0,05% de timol, a uma temperatura de 4°C, até o momento deles serem utilizados. Os dentes foram divididos em 12 grupos de 15 espécimes cada, de acordo com a qualidade do dente, a superfície a ser testada e período de observação. As superfícies a serem testadas foram planificadas com discos de lixa molhados com granulações 180, 400 e 600. Em seguida foi aplicado o sistema adesivo Prisma Universal Bond 3, de acordo com as recomendações do fabricante. Um cilindro de propolietileno de 3mm. De diâmetro foi fixado sobre essas superfícies para limitar a área e a matriz foi preenchida com a resina Prisma APH-Compuler. Foi usada a máquina de ensaios Kratus que determinou as seguintes médias de resistência ao cisalhamento dadas em Mpa: esmalte 24hs. 37.67.81(H); 30.775.68(B); 25.546.72(S); esmalte 7 dias 36.174.83(H); 36.946.72(B); 23.337.72(S); dentina 24hs. 8.492.25(H); 6.042.51(B); 7.993.03(S); dentina 7 dias 9.374.21(H); 7.833.15(B); 8.454.33(S). O teste de Tukey-Kramer ($p<0.05$) revelou: a resistência adesiva do esmalte foi significantemente maior quando comparada à da dentina; a resistência adesiva no esmalte humano não apresentou diferença estatisticamente significante em relação ao esmalte bovino; entretanto ambos apresentaram diferenças significantes em relação ao esmalte suíno; a resistência adesiva na dentina humana, bovina e suína não apresentou diferenças estatisticamente significantes entre si, nos dois períodos testados.

UNITERMOS: Resistência ao cisalhamento; Resistência adesiva

REFERENCE

1- FASBINDER, D.J. et al. Tensile bond strength of adhesives to dentin and enamel. **Dent. Mat.**, v.5, p.272-6, July 1989.

2- MUNKSGAARD, E.C.; IRIE, M.; ASMUSSEN, E. Dentin-polymer bond promoted by Gluma and various resins. J. **dent.Res.**, v.64, p.1409-11, 1985.

3- NAKAMICHI, I.; IWAKU, M.; FUZAYAMA, T. Bovine teeth as possible substitutes in the adhesion test. **J. dent. Res.**, v.62, n.10, p.1076-81, Oct. 1983.

4- RETIEF, D. H. et al. Extracted human versus bovine teeth in laboratory studies. **Amer. J. Dent.**, v.3, n.6, p.253-8, Dec. 1990.

5- SAUNDERS, W.P. The shear impact retentive strengths of four dentine bonding agents to human and bovine dentine. **J. Dent.**, v.16, n.5, p.233-8, 1988.

6- SORENSEN, J.A.; DIXIT, N.V. In vitro shear bond strength of dentin adhesives. **Int. J. Prosthodont.**, v.4, n.2, p.117-25, 1991.

7- ZIDAN, O.; ALJABAB, A. Evaluation of the bond mediated by eight DBA's to enamel and dentin. **Dent. Mat.**, v.6, p.158-61, July 1990.