International Poster Journal IPJ of Dentistry and Oral Medicine

Int Poster J Dent Oral Med 2005, Vol 7 No 02, Poster 268

Bond Strength of Dentin Adhesives to Bone After Different Pretreatments

Language: English

Authors:
Stefanie Kluck, Dr. Christian Ralf Gernhardt, Dr. Katrin Bekes,
Department of Operative Dentistry and Periodontology,
Prof. Dr. Dr. Johannes Schubert, Department of Maxillofacial and Plastic Surgery
Prof. Dr. Hans-Günter Schaller, Department of Operative Dentistry and Periodontology
Martin-Luther-University Halle - Wittenberg

Date/Event/Venue:
March 10h-13th, 2004
82nd General Session & Exhibition of the IADR/AADR/CADR
Honolulu, HI, United States

Introduction

Plates and screws are currently the state-of-the-art technique for internal fixation in craniomaxillofacial surgery because of their unmatched ability to provide three-dimensional bone position control. However, there are numerous potential problems using these metallic implants including the damage of associated anatomical structures, inflammatory reactions, infection and palpability. Recently, there have been promising developments in the field of dentin bonding agents. As the composition of dentin and bone are chemically and structurally similar, it is possible that some of the modern dentin adhesive systems may offer a suitable method of attaching rigid fixation devices to bone without the aid of screws.

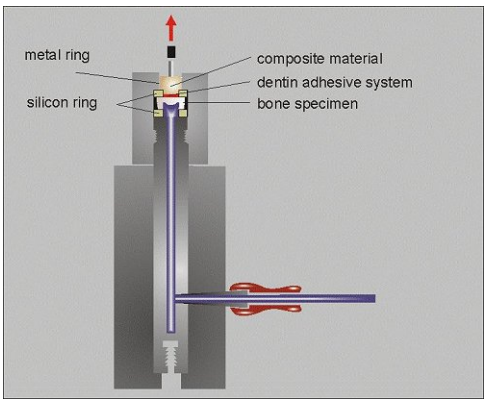

Fig. 1: Special designed apparatus to test tensile bond strength under permanent dentin perfusion.

Fig. 2: Special designed apparatus mounted in a universal testing machine.

Objectives

The study was performed to compare tensile bond strength obtained between composite and bone using a dentin bonding agent (Clearfil New Bond) after different pretreatments concerning surface roughening and etching times in vitro (Fig. 1, 2).

Material and Methods

Four mandibles of freshly sacrificed pigs were used to prepare twelve specimens each using trephane burs under constant water cooling (Fig. 4, 5). After preparation the surface was sanded (Fig. 6). Forty-eight bone specimens with a total thickness of 4.0 mm (± 0.5 mm) and a cortical layer of 1.5 mm (± 0.2 mm) were obtained under standardized conditions. Each twelve specimens were assigned to four experimental groups (Group A1: sandpaper 1000 (fine), etching 30 seconds; group A2: sandpaper 1000, etching 60 seconds; group B1: sandpaper 220 (rough), etching 30 seconds, group B2: sandpaper 220, etching 60 seconds). Tensile bond strength of the dentin adhesive Clearfil New Bond was measured 15 minutes after application and polymerization of the composite material (Clearfil Core) using an universal testing machine (Fig. 7).

	Group A1 *(sandpaper 1000 (fine), etching 30 seconds)*	Group A2 *(sandpaper 1000, etching 60 seconds)*	Group B1 *(sandpaper 220 (rough), etching 30 seconds)*	Group B2 *(sandpaper 220, etching 60 seconds)*
Bond Strength (MPa)	4.54	4.25	2.34	0.67
Standard deviation	+/- 1.93	+/- 1.80	+/- 0.83	+/- 0.34

Tab. 1: Mean value and standard deviation within the different groups.

Results

In every group tensile bond strength could be measured. Following bond strengths were evaluated (mean values and standard deviations, printed in MPa): Group A1: 4.54 (± 1.93); group A2: 4.25 (± 1.80); group B1: 2.34 (± 0.83); group B2: 0.67 (± 0.34) (Tab. 1, Fig. 3). Statistical analysis showed a significant influence of the used pretreatment technique on tensile bond strength ($p < 0.001$, ANOVA). Roughening the bone surface (Group B1, B2) decreased tensile bond strength significantly ($p < 0.05$, Tukey's test). The values in group B2 were significantly reduced compared to all other groups ($p < 0.05$, Tukey's test). No significant differences could be observed between group A1 and A2 ($p < 0.05$, Tukey's test).

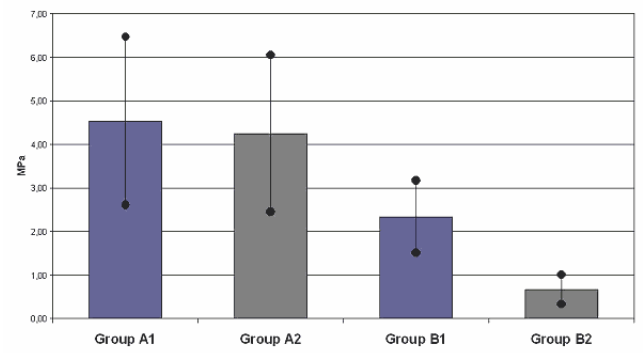

Fig. 3: Mean value and standard deviation within the different groups.

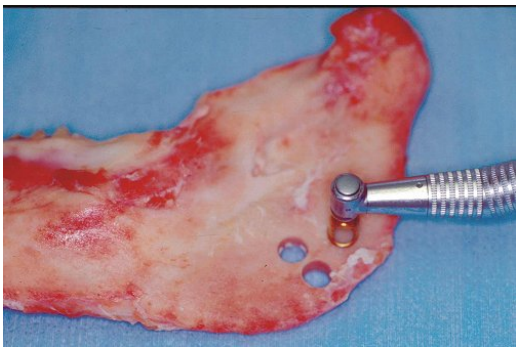

Fig. 4: Specimen preparation from a pig mandible using a trephane bur.

Fig. 5: Preparated specimen (diameter: 8 mm): thickness of 4.0 mm (± 0.5 mm) and a cortical layer of 1.5 mm (± 0.2 mm).

Fig. 6: Pretreatment of the specimens with sandpaper.

Fig. 7: Dentin bonding agent and composite material used in this study.

Conclusions

Regarding the pretreatments tested in this study, differences in tensile bond strength could be observed. The specimens treated with fine sandpaper (1000) showed higher bond strength than those pretreated with rough sandpaper (220). Within the limitations of an in vitro investigation it can be concluded that different pretreatment techniques might have an important impact on adhesive systems in bone bonding.
Further investigations will have to focus on biocompatible and toxicological aspects.

Literature

1. Meechan JG, McCabe JF, Beynon AD (1994): Adhesion of composite resin to bone - A pilot study. Br J Oral Maxillofac Surg 32: 91-93.

2. Meechan JG, McCabe JF (1995): A Comparison of the Bond Strengths of Two Different Dentine-Bonding Agents to Bone. J Oral Maxillofac Surg 53: 284-287.
3. Amarante MTJ, Constantinescu MA, O'Connor D, Yaremchuk MJ (1995): Cyanoacrylate Fixation of the Craniofacial Sceleton: An Experimental Study. Plast Reconstr Surg 4: 639-646.
4. Shermak MA, Wong L, Inoue N, Chao EYS, Manson PN (1998): Butyl-2-Cyanoacrylate Fixation of Mandibular Osteotomies. Plast Reconstr Surg 8: 319-324.

Abbreviations

MPa = Megapascals
Fig. = Figure
Tab. = Table

This Poster was submitted by Dr. Christian Ralf Gernhardt.

Correspondence address:
Dr. Christian Ralf Gernhardt.
Stefanie Kluck
Department of Operative Dentistry and Periodontology
Martin-Luther-University Halle - Wittenberg
Große Steinstrasse 19
D-06108 Halle (Saale)
Germany

Poster Faksimile: