

# Enamel shear bond strength of different bracket systems on differently pre-treated bovine enamel surfaces

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## Background

The bond strength of orthodontic brackets can be influenced by numerous factors, including pre-treatment of the tooth surface, type of the bonding system, mastication forces during treatment, the type, size and design of the bracket, and especially the bracket retention mechanism<sup>1</sup>.

**The aim of the study was to compare the shear bond strength (SBS) and adhesive remnant index (ARI) at the enamel-bonding interface between brackets of different base sizes, including a new very small self-ligating-bracket (MiniQuick), using two different methods of enamel surface pre-treatment.**

## Material and Methods

Freshly extracted bovine permanent incisors (n=360) were used in this study, which were embedded in Technovit®4004 (Kulzer GmbH, Hanau, Germany) and divided into six groups (n=60) dependent on enamel surface pre-treatment (Airflow, Rocatec) and bracket type (Sprint II, Micro Sprint, MiniQuick; FORESTADENT® Bernhard Förster GmbH, Pforzheim Germany). Pre-treatment included Airflow technique (Clinpro™ Prophy Powder, 3M Espe, Neuss, Germany; core size 45µm) and Rocatec technique (Aluminium oxid powder, core size 50µm), respectively, thereafter all teeth were etched with 35% phosphoric acid, followed by water spray and compressed air. Transbond™ XT light cure primer and adhesive (3M™ Unitek, Landsberg am Lech, Germany) and Valo® Cordless curing light (Ultradent Products Inc., South Jordan, UT, USA), 5s each, were used for bonding. Thus, 720 brackets were fixed with two on each tooth surface, respectively. After de-bonding (universal testing machine TIRAtest-2720, Schalkau, Germany; pressure force of 1kN maximum, speed of 0.5mm/min), SBS and ARI was evaluated in all groups (Fig. 1). Statistics were conducted using two-way ANOVA, significance level p≤ 0.05.

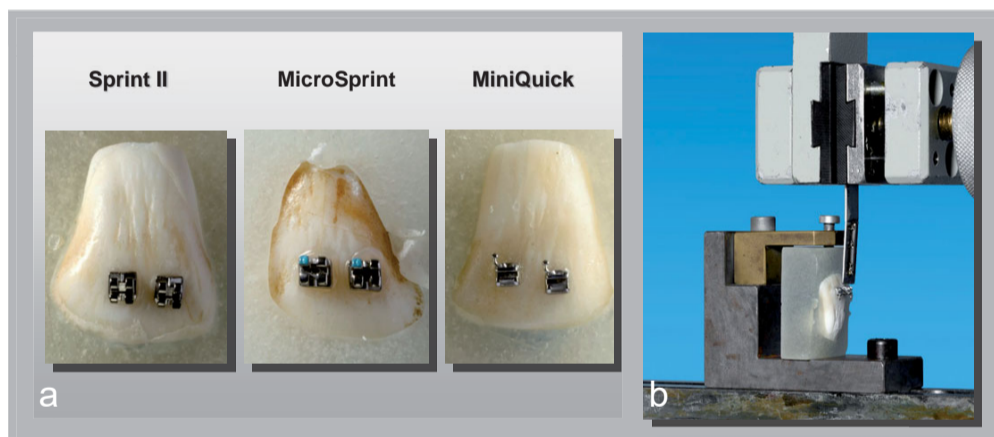


Figure 1: a) Illustration of test brackets bonded on bovine enamel, b) during shear test in the TIRAtest-2720 universal testing machine.

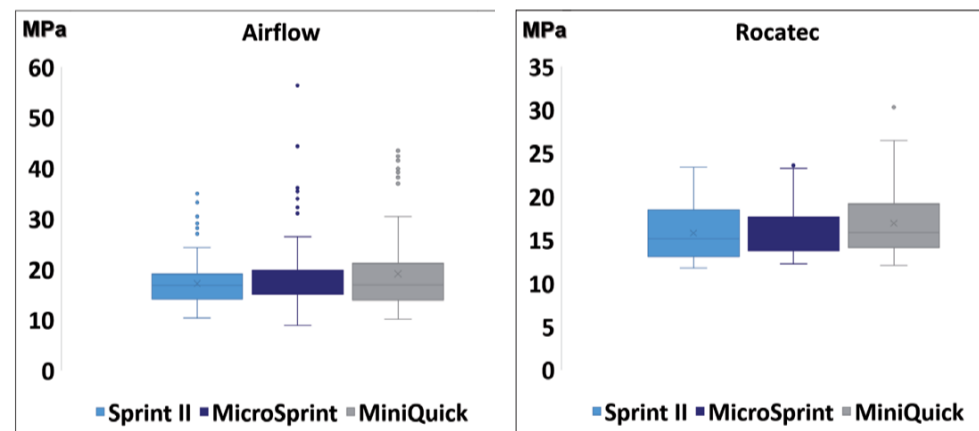


Figure 2: Box plot diagrams of shear test results in the different pre-treatment groups (n=120 brackets each).

## Results

All groups showed high SBS with similarly comparable high mean values. Statistically significant differences could only be detected between Sprint II and MiniQuick brackets and between Airflow and Rocatec pre-treatment (Fig. 2). ARI 2 and 1 revealed a high percentage in all groups (Tab. 1).

## Conclusion

MiniQuick brackets showed not only similar but also statistically significant higher mean SBS values compared to the other two bracket types, which indicates that despite their reduced size, they are suitable for clinical use. In this context, pre-treatment with Airflow showed a positive influence on the bonding process.

Group	ARI in %				
	0	1	2	3	4
Sprint II + Airflow	15	32	48	5	0
Micro Sprint + Airflow	20	37	41	2	0
MiniQuick + Airflow	22	35	40	3	0
Sprint II + Rocatec	14	28	52	4	2
Micro Sprint + Rocatec	9	30	58	2	1
MiniQuick + Rocatec	12	30	57	1	0

Table 1: ARI Scores (in %) after debonding of the different brackets types in the two pre-treatment groups (n=120 brackets each).

## Literature

<sup>1</sup>Bakhadher W, Halawany H, Talic N, Abraham N, Jacob V. Factors Affecting the Shear Bond Strength of Orthodontic Brackets - a Review of In Vitro Studies. Acta Medica (Hradec Kralove). 2015;58(2):43-8.