

Background and Aims

Formation of enamel cracks and fractures is one of the biggest concerns of people wearing fixed orthodontic appliances (Fig. 1). Orthodontic treatment may be performed for adult patients whose enamel has a decrease in the fracture toughness and increase in brittleness.

However, only few investigations analyzed the influence of debonding procedure on enamel of adult patients.

The aim of this study was to evaluate and compare enamel cracks characteristics (location, length and width) of adult patients before and after removal of metal brackets.

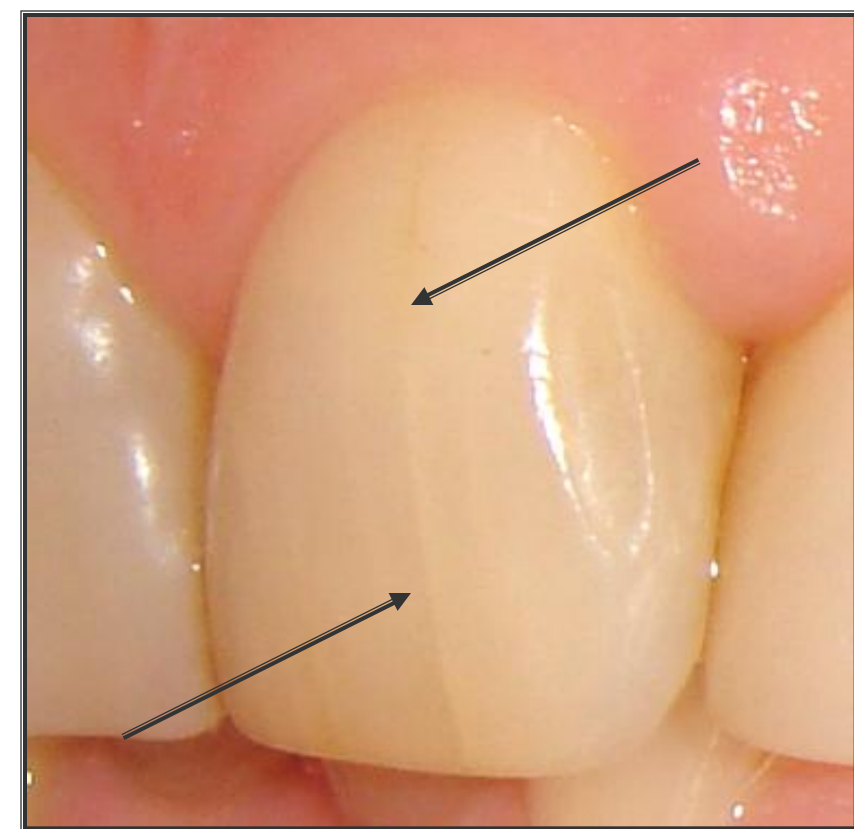


Fig. 1 Clinical view of the enamel crack

Materials and Methods

Sample size consisted of 45 extracted human (35-55 years old) teeth that satisfied the inclusion criteria and demonstrated similar initial enamel characteristics.

After the examination with scanning electron microscopy (SEM, Hitachi TM-1000, Tokyo, Japan), teeth were divided into three groups of equal size: group 1, teeth having enamel cracks, group 2, teeth without initial enamel cracks, and group 3, a control group to study the effect of dehydration on existing cracks or formation of new ones.

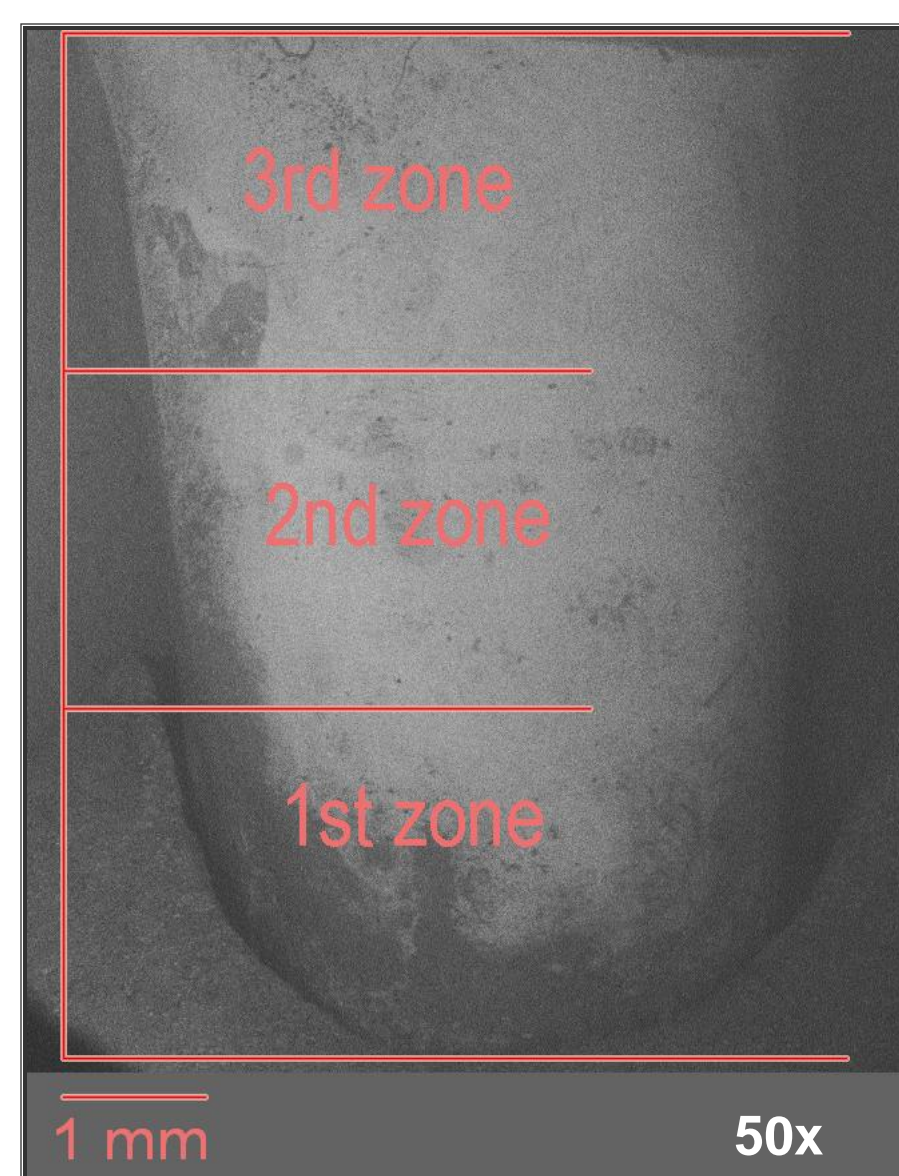


Fig. 2

From digital SEM micrographs vertical height of the tooth's crown was measured. The buccal enamel surface was divided in 3 zones of equal height (1st zone – cervical third, 2nd zone – middle third, 3rd zone – occlusal third) for detailed mapping of enamel cracks (Fig. 2).

Every zone was divided in 10 measurement areas using a ruler constructed for this purpose; a total of 30 measurement areas were obtained (Fig. 3).

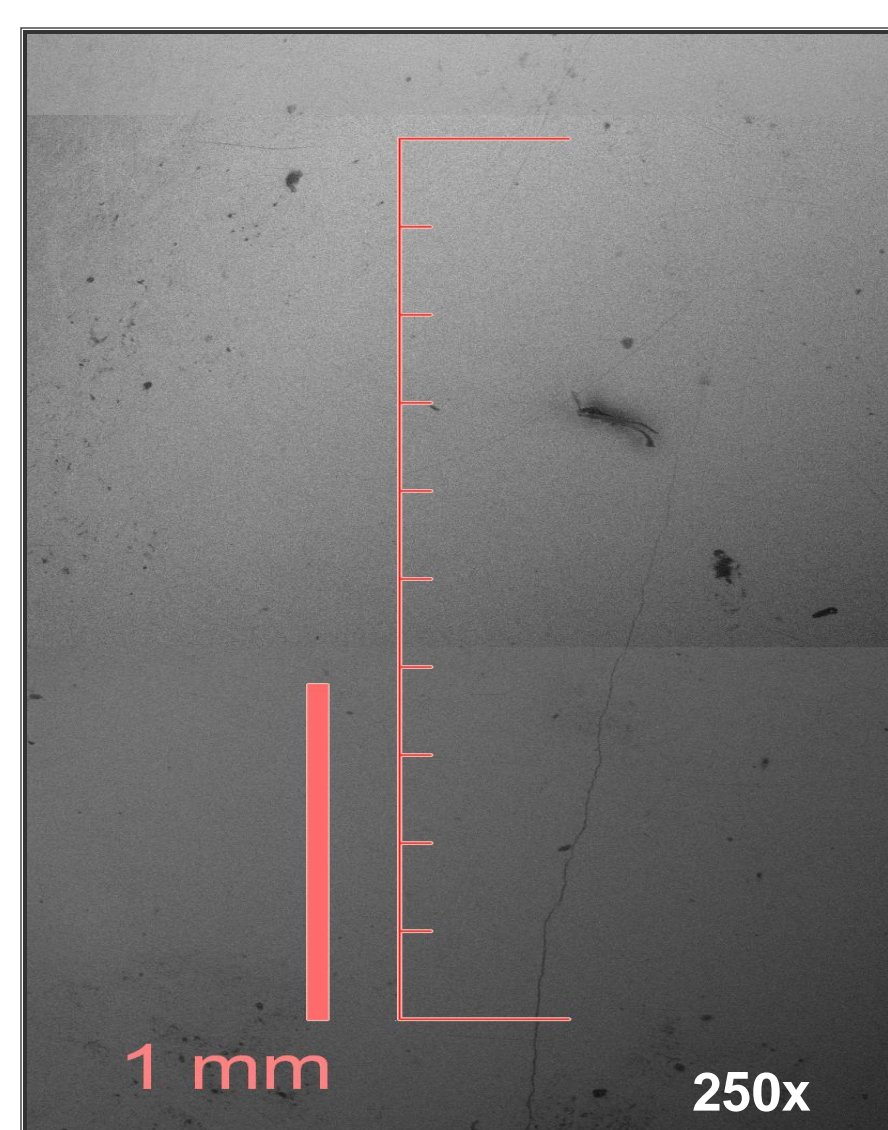


Fig. 3

For all the teeth in group 1 and group 2, the same bonding and debonding procedures of metal brackets were conducted. The length and width of the longest enamel crack were measured for all the teeth before and after removal of metal brackets. Changes of the location of the cracks were also evaluated. In group 3, teeth were subjected to the same analysis, but not bonded. Statistical analyses were carried out using the Statistical Package SSPS 17.0.

Results

Fig. 4 presents the changes in width of enamel cracks before and after removal of metal brackets. The differences in width of enamel cracks in separate zones could be seen in Fig. 5. The mean length of enamel cracks was non-significantly smaller after debonding than before bonding procedure.

New enamel cracks were recorded in 6 of 15 (40%) examined teeth.

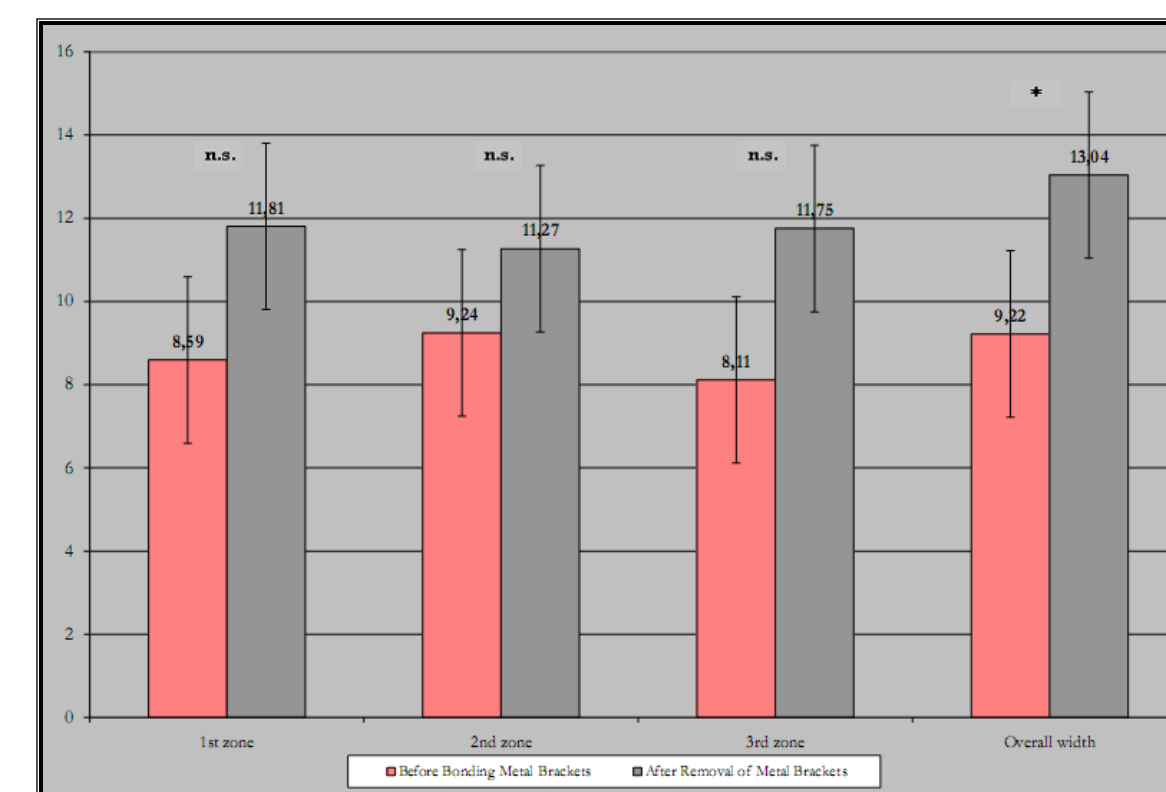


Fig. 4 The changes in width (µm) of enamel cracks before bonding procedure and after removal of metal brackets (* P<.05; n.s. indicates non-significant)

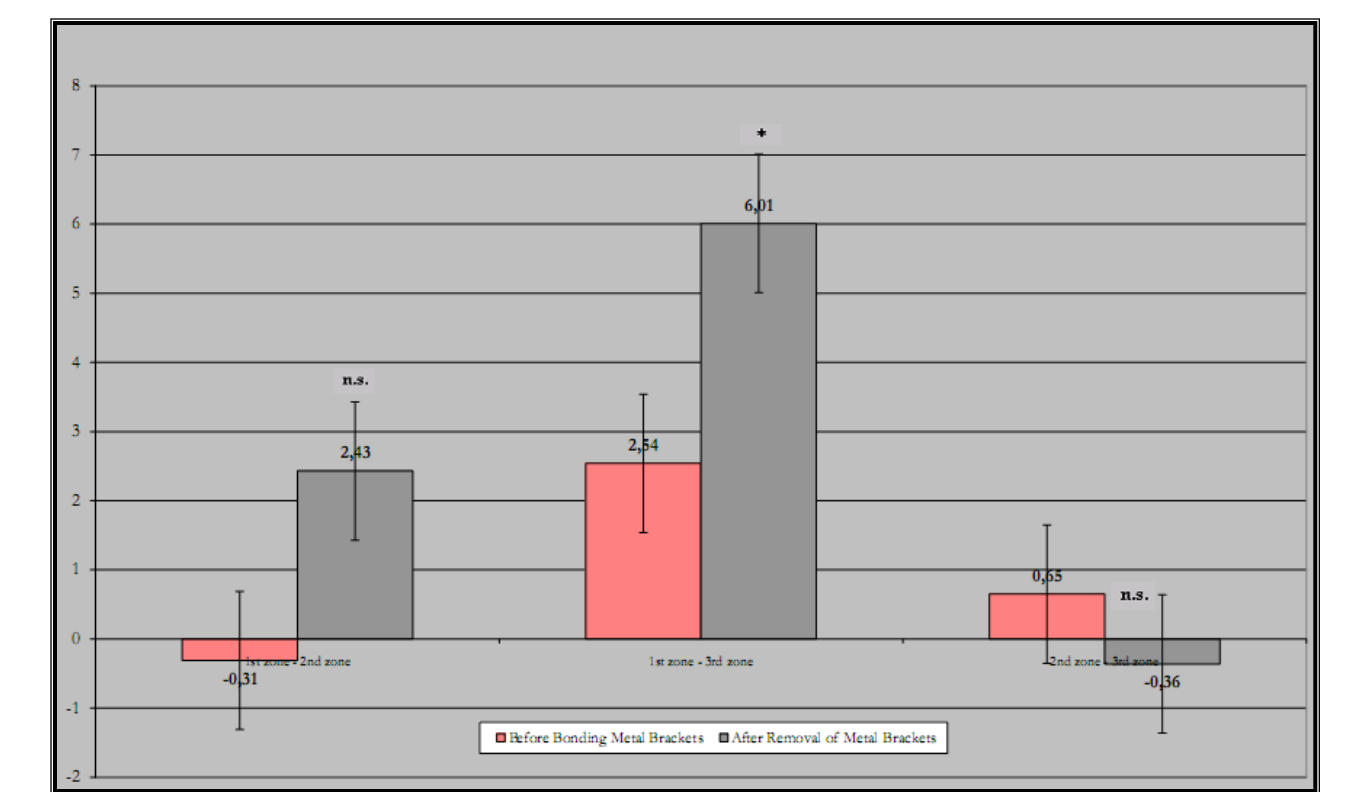


Fig. 5 The changes in width (µm) of enamel cracks in separate zones before bonding procedure and after removal of metal brackets (* P<.05; n.s. indicates non-significant)

Discussion

Findings from the present study indicate that removal of metal brackets leads to an increase in the mean overall width of enamel cracks (Fig. 6, 7).

The difference in width was greatest between 1st zone (cervical third) and 3rd zone (occlusal third).

This suggests that forces during debonding procedure are more concentrated in the cervical rather than middle or occlusal third of the tooth. These findings can be supported by previous studies. Tufekci et al found that any damage on the enamel surface was usually located in the cervical third of the teeth. Schuler et al stated that the middle of the labial surface was not the area most affected, but rather the proximal and cervical borders.

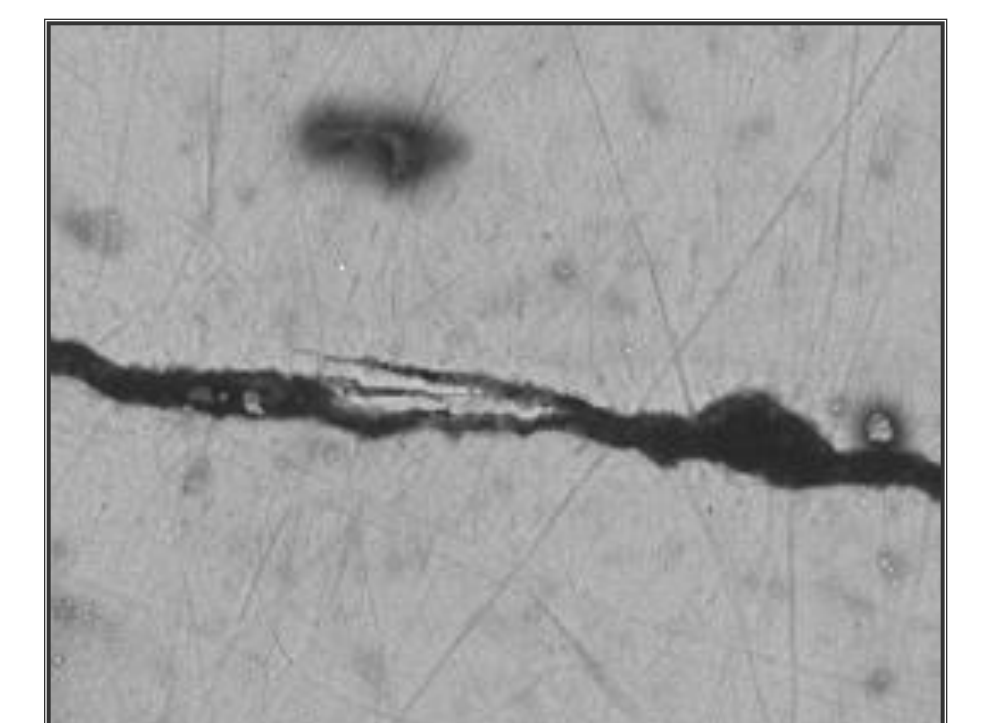


Fig. 6 The width of enamel crack before bonding procedure

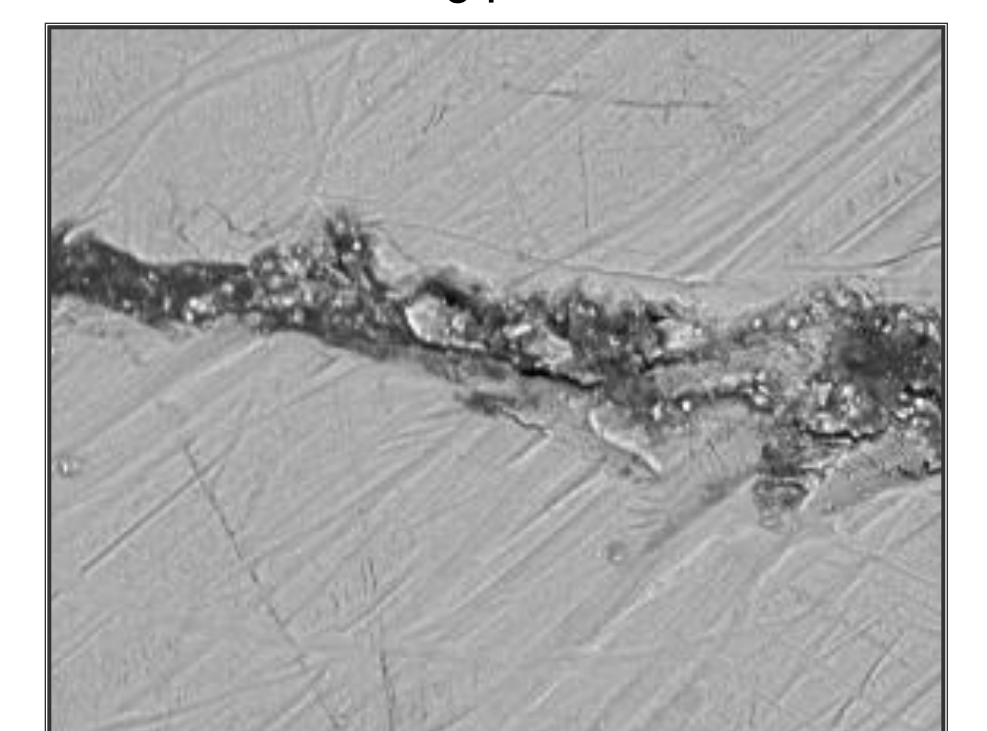


Fig. 7 The width of enamel crack after debonding procedure

Conclusions

1. A significant increase in the mean overall width of the enamel cracks was found after removal of metal brackets.
2. Greatest changes in the width of enamel cracks after debonding procedure appear in cervical third of the tooth. On the basis of this result, the dentist must pay extra care and attention to this specific area of enamel during removal of metal brackets.
3. Majority of examined teeth did not show new cracks after removal of metal brackets.

References

1. Tufekci E, Merrill TE, Pintado MR et al. Enamel loss associated with orthodontic adhesive removal on teeth with white spot lesions: an in vitro study. Am J Orthod Dentofacial Orthop. 2004; 125:773-9.