

Bond Strength of Orthodontic Brackets to Temporary Crowns: In Vitro Effects of Surface Treatment

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INTRODUCTION

A substantial number of patients seek orthodontic treatment for various reasons, which in turn has caused many clinical challenges during orthodontic therapy. For example, in many cases, orthodontic treatment is delivered in conjunction with other specialties to facilitate restorative therapy of other dental professions, such as prosthodontics.

In cases of tooth fracture or gross carious lesions extending subgingivally, a provisional crown is needed prior to orthodontic root extrusion to avoid biological width violation in the permanent crown. A provisional crown serves to provide temporary protection, stabilization, and function of the tooth, as it also determines the esthetic outcome of the final restoration.

In such a clinical situation, an orthodontic bracket is bonded to the provisional crown material (PCM). A weak bond of the brackets to provisional materials will lead to a high failure rate, with adverse consequences on the cost and efficiency of orthodontic therapy and on patient comfort.

OBJECTIVES

This study aimed to evaluate the effect of different grit sizes of diamond burs and sandblasting surface treatment on the shear bond strength of orthodontic brackets to provisional crowns.

MATERIALS AND METHODS

A total of 75 discs were fabricated from a bisacrylic composite and divided into 5 groups (n=15) according to surface treatment as in Table 1. Metal orthodontic brackets were bonded to discs in a standardized conventional manner. All specimens were subjected to thermocycling with 5000 cycles of alternating 5°C and 55°C water bath. The shear bond strength test was performed using a universal testing machine (Figure1). A scanning electron microscope (SEM) was used to analyze the surface treatment effect and features of debonded surfaces. The amount of composite resin left on the specimen surfaces was analyzed and classified with the adhesive remnant index. One-way ANOVA was performed at $\alpha=0.05$.

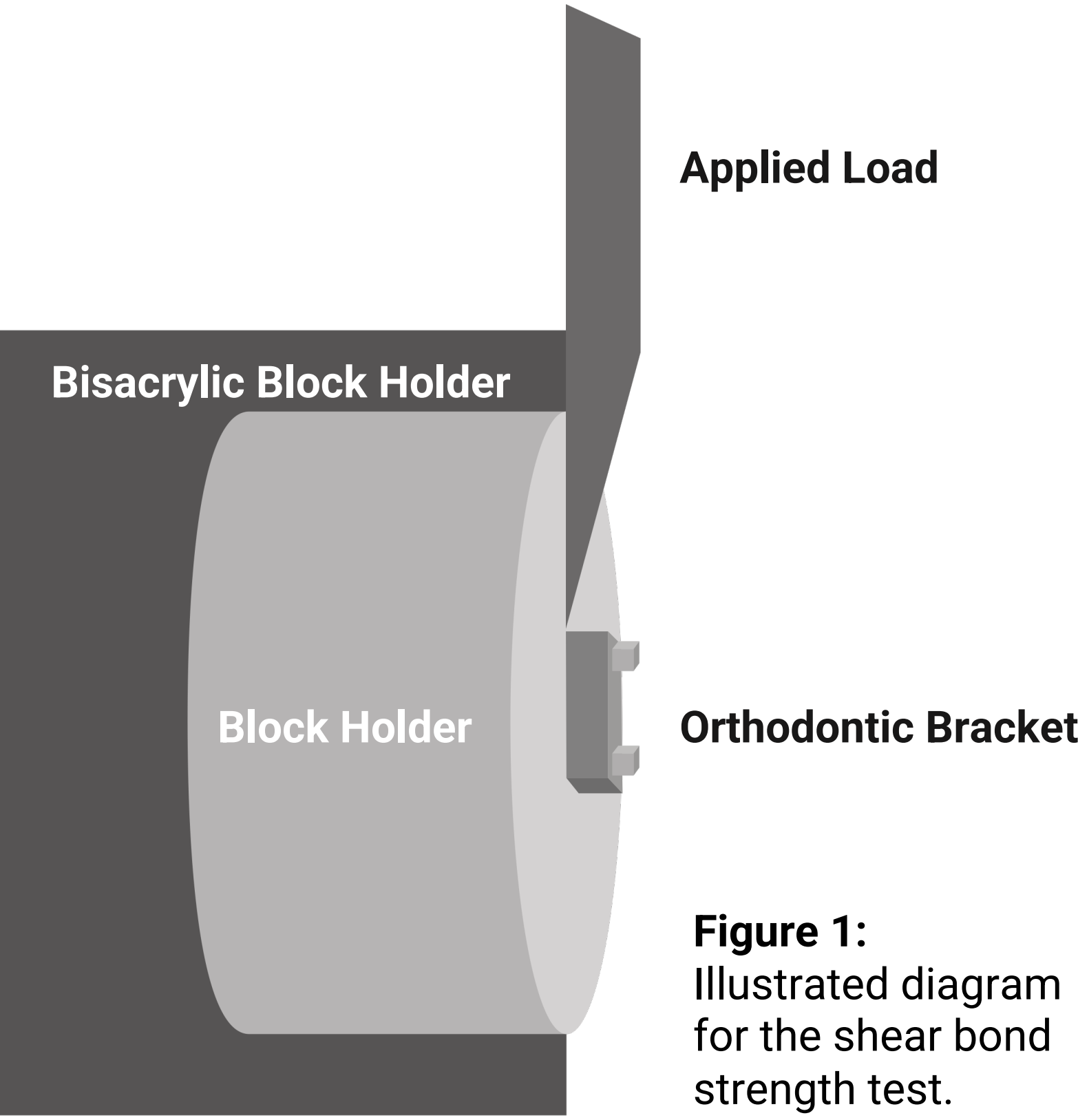


Figure 1:
Illustrated diagram
for the shear bond
strength test.

Group (n)		Surface Treatment
Control	No treatment	
G1 (15)	Blue, medium grit grinding	Each specimen was subjected to 5 strokes in the same direction at the center of the surface by one well-trained investigator using diamond burs (Jota diamond bur, Switzerland) with three different grit sizes: medium, coarse, and supercoarse.
G2 (15)	Green, coarse grit grinding	
G3 (15)	Black, supercoarse grinding	
G4 (15)	Sandblasting	Specimens were sandblasted (50 mg alumina particles) for 10 seconds from a distance of 10 mm by the application of 0.55 MPa of propulsion pressure using Wassermann Dental-Machine, CEMAT- NT3, GMBH, Hamburg, Germany. Specimens were rinsed with a steady stream of water for 30 seconds and then dried with compressed air.

Table 1: Specimens grouping according surface treatment and treatment procedures.

RESULTS

The shear bond strength of specimens treated with sandblasting was significantly higher than that of the control group under thermal aging conditions ($p=0.022$). Additionally, sandblasting group showed higher value of bond strength compared to the group treated by medium grit diamond burs ($p= 0.001$). No significant differences were found between different grit diamond burs and the controls ($p > 0.05$).

RESULTS (CONT.)

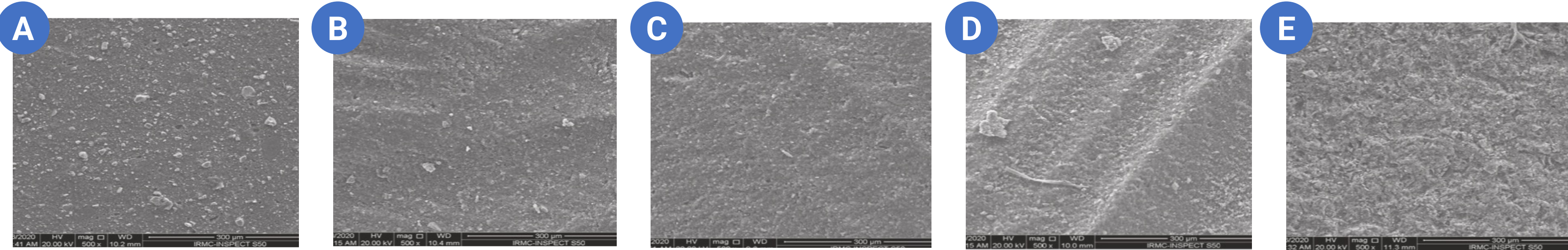


Figure 2: (a), (b), (c), (d), (e) SEM representative images for surface treatment effects.

Table 2. Scores for the adhesive remnant index of all groups (n = 15) according to optical microscope (16x) analysis.

Groups	Score 0	Score 1	Score 2	Score 3
Control	8	2	4	1
Blue	7	3	4	1
Green	0	2	5	8
Black	0	4	2	9
Sandblasting	0	1	5	9

Score 0, no adhesiv4 left on the crown surface. Score 1, less than half of the adhesive left. Score 2, more than half of the adhesive left. Score 3, all adhesive left on the crown surface, with a distinct impression of the bracket mesh.

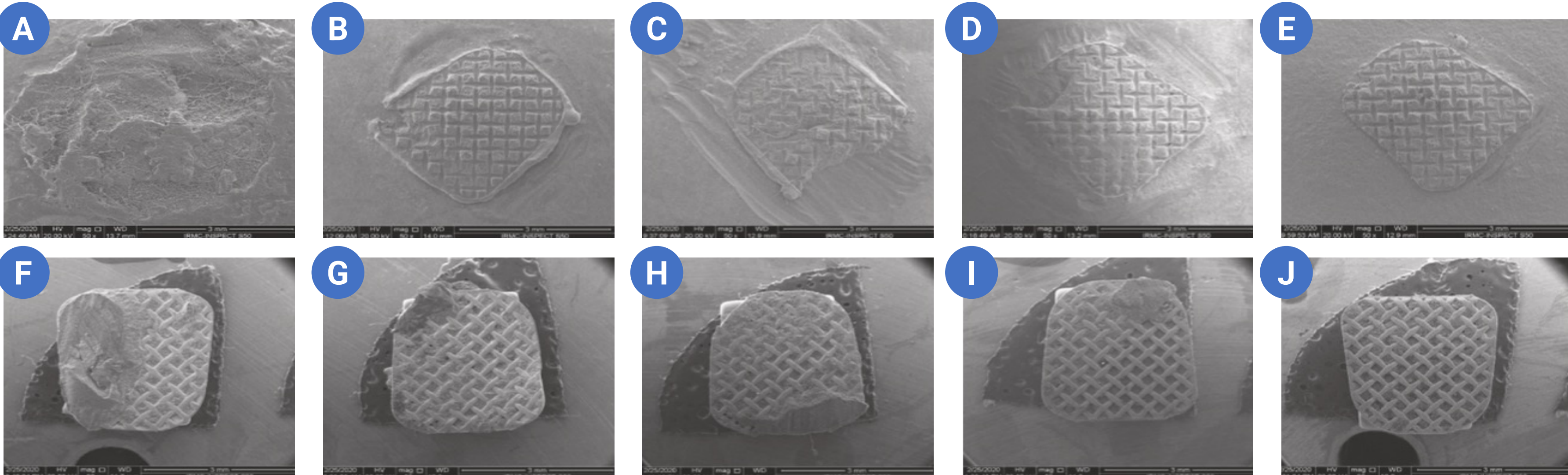


Figure 3: Representative SEM images for deboned surface after the SBS test. (a-c) Crown surfaces: (f-j) bracket surfaces. (a) Control, (b) blue bur, (c) green bur, (d) black bur, and (e) sandblasting bur.

CONCLUSION

The shear bond strength of specimens treated with sandblasting was significantly higher than that of the control group under thermal aging conditions ($p=0.022$). Additionally, sandblasting group showed higher value of bond strength compared to the group treated by medium grit diamond burs ($p= 0.001$). No significant differences were found between different grit diamond burs and the controls ($p > 0.05$).