Distribution of nanofillers from a simplified-step adhesive in acid-conditioned dentin.

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Abstract

PURPOSE: This in vitro study examined the interfacial ultrastructure of a nanofilled, simplified-step adhesive (Prime & Bond NT, Dentsply), to determine the distribution of nanofillers within the collagen network of the hybrid layer.

MATERIALS AND METHODS: Twenty-four dentin discs were divided into two groups and bonded using two recommended conditioning techniques: Group I, NRC (Non-Rinse Conditioner), and Group II, Conditioner 36 (colloidal silica thickened 36% phosphoric acid). Following conditioning, a single coat of adhesive was applied and light-cured. Dentin discs were then bonded to form disc-pairs and processed for TEM examination. Demineralized, ultrathin sections were examined stained or unstained. Non-demineralized sections were used for STEM/EDX analysis of elemental distribution across the resin-dentin interface. In addition, four dentin discs were bonded with a generic adhesive (HEMA/TBBO) for TEM examination of stained collagen and proteoglycans.

RESULTS: In unstained sections of both groups, nanofillers from the adhesive layer were congested around patent tubular orifices, but were not found within the interfibrillar spaces of the hybrid layer. EDX analysis of silicon (Si) showed predominant distribution within the adhesive layer and tubular orifices. Phosphorus (P) was present within the hybrid layer and adhesive layer in Group II.

CONCLUSION: It is hypothesized that a) aggregation of the nanofillers within the adhesive resulted in filler clusters that are too large to infiltrate the interfibrillar spaces of the hybrid layer; and b) retention of ground substance within the demineralized intertubular collagen matrix may also have prevented the
infiltration of the nanofillers.

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