Evaluation of antimicrobial and physical properties of orthodontic composite resin modified by addition of antimicrobial agents—an in-vitro study

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Introduction: This study was designed to investigate the antimicrobial and physical properties of orthodontic composite resin modified by the addition of antimicrobial agents. Methods: Unitek bonding adhesive (3M Unitek, Monrovia, Calif), a chemically cured composite resin, modified by the addition of benzalkonium chloride (BAC), chlorhexidine, and triclosan in concentrations of 0.1 wt%, 0.2 wt%, and 0.3 wt%, respectively, was formed into tablets for testing. The tablets of each group and a control group were subjected to the agar plate diffusion test to measure the zone of bacterial inhibition. In addition, they were incubated for 24 hours in tryptic soy broth inoculated with Streptococcus mutans and examined for bacterial growth. A total of 80 extracted premolars were collected and divided into 2 sets of 40 teeth each. Stainless steel Begg brackets were bonded by using control and experimental composites. A universal testing machine was used to determine shear bond strength. The first set of teeth was tested after 24 hours and the second set after 25 days of storage in distilled water. Time-dependent release of antimicrobial agents from the modified composites was monitored spectrophotometrically. Results and Conclusions: The findings indicated that (1) addition of BAC to the orthodontic composite resin enhanced its antimicrobial properties, (2) there was no significant difference in the bond strengths of the control and the experimental resin tested after 24 hours and 25 days, and (3) maximum release of BAC from the modified resin was higher than that of chlorhexidine or triclosan, and was much higher than the minimum inhibitory concentration level. (Am J Orthod Dentofacial Orthop 2007;131:525-9)

The use of fixed appliances is a significant challenge to the patient for maintaining good oral hygiene to avoid or minimize decalcification of enamel during treatment. 1,2 A higher incidence of white spot lesions was reported in orthodontic patients than in control populations; this was attributed to prolonged accumulation and retention of bacterial plaque on the enamel surfaces adjacent to the appliances. 3-6 Colonization and infection with Streptococcus mutans has been strongly associated with development of dental caries. 7

Resin composites tend to accumulate more bacteria of plaque than other restorative materials in vitro 8,9 and in vivo. 9,10 Plaque accumulation on resin is related to its surface roughness and free energy, which is related to resin type, filler size, and percentage of filler. 11 No components of the composite resin have bacteriostatic activity, but they are metabolized or eaten away by microorganisms; this indicates that orthodontic adhesives are prone to microbial attack. The addition of antimicrobial agents to the adhesive makes it resistant to microbial attack. 12

Attempts were made by several researchers to prevent plaque accumulation on the surfaces of restorative materials by the incorporation of chlorhexidine 13,12 and triclosan. 15 These authors suggested that these agents, added in minute amounts, could impart antibacterial traits to dental materials without signifi-