Effect of a Polymerizable Cationic Monomer on Dentin MMPs

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Objectives: This study examined the use of methacryloxyethyl cetyl dimethyl ammonium chloride (DMAE-CB) as a potential matrix metalloproteinases (MMPs) inhibitor on both soluble recombinant MMPs and dentine matrix-bound endogenous MMPs. It also examined the effective anti-MMP group of quaternary ammonium methacrylates (QAMs).

Materials and Methods: The possible inhibitory effects of DMAE-CB (concentrations of 0.1%, 0.5%, 1%, 3% and 5%) on soluble rhMMP-9 were measured using a colorimetric assay kit. Methyl methacrylate (MMA) and [2-(Methacryloyloxy)ethyl] trimethylammonium chloride (METMAC) were also screened against rhMMP-9 to compare the inhibitory effect with DMAE-CB. Matrix-bound endogenous MMP-activity was evaluated in completely demineralized dentin beams. Thirty beams were randomly divided into three groups and placed into 500 µL of calcium- and zinc-containing media (CM, control), 0.2% chlorhexidine or 3% DMAE-CB in CM aged for 30 days. The changes in modulus of elasticity, loss of dry mass and solubilization of collagen peptides were measured via three-point bending, precision weighing and hydroxyproline assay, respectively.

Results: 0.5%-5% mass concentrations of DMAE-CB were highly effective (P<0.05) in inhibiting rhMMP-9 (range 76.6%-97.1%). The inhibitory effect of MMA was lower than that of METMAC and DMAE-CB at the same concentration (P<0.05). Dentin beams incubated in 3% DMAE-CB showed a 26.3% decrease in the modulus of elasticity (75.7% decrease in control), a 1.7% loss of dry mass (29.7% loss in control), and less solubilized hydroxyproline when compared with the control (P<0.05). Conclusions: DMAE-CB is effective at inhibiting both soluble recombinant MMPs and matrix-bound dentine MMPs. Quaternary ammonium group is the effective anti-MMP group of QAMs. Clinical Significance: The incorporation of DMAE-CB into dental adhesives has the potential to enhance the durability of dentin bonding. This study was financially supported by grants from the Natural Science Foundation of China (No. 81100772, No. 81130078) and Natural Science Foundation of Shanxi Province, China (No. 2011JQ4020).