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Push-out bond strength of CPP-ACP-modified calcium silicate-based cements

Abstract:

Calcium silicate-based cements (CSCs), such as mineral trioxide aggregate (MTA), are widely used for pulp capping, perforation repair, apexification procedures, and root-end filling1). CSCs are active biomaterials with an ability to produce calcium phosphate and apatitelike precipitates at the cement-dentine interface and within the dentinal tubules, triggering the formation of an interfacial hybrid layer with tag-like structures at the interface; this hybrid layer could be responsible for chemical and mechanical bonds2-4). Calcium ions (Ca^{2+}) released from these cements react with phosphate ions (P*i*) available in the tissue fluid forming calcium phosphate and apatite-like crystals on the cement surface5). The apatite forming ability of CSCs is proportional to their ability to release Ca^{2+} and the presence of P*i* in the tissue fluids6,7). CSCs must interact with P*i* to produce their biomineralization ability, so it may be possible to improve the retention of MTA apical plugs to dentine by using a phosphate containing solution as an intra-canal dressing or as a final rinse in prepared root canals, as suggested by Martin *et al.*8). Casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) is a biocompatible milk-derived protein that has been used in dentistry as a source of Ca^{2+} and P*i* for caries control9). It has been reported that the addition of CPP-ACP to CSCs improved Ca^{2+} and P*i* release10). The addition of CPP-ACP to CSCs may induce the precipitation of calcium phosphate salts and apatitelike precipitates at the cement-dentin interface and thus improve the dentinal bond strength. The aims of the present study were to determine whether the addition of CPP-ACP to CSCs would improve the dentinal push-out bond strength of the modified cement and to compare the push-out bond strength of a new trial MTA with commercially available CSCs.