



# Zinc compromises chemical interaction of acidic functional monomers with dentine



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## INTRODUCTION

The role of matrix-metalloproteinases (MMPs) enzymes is well-established regarding the degradation of resin-dentin bonds by accelerating the breakdown of collagen fibres (Mazzoni et al. 2012). Their activity may be inhibited by some substances showed inhibition such as chlorhexidine and zinc (Carrilho et al. 2007, Toledano et al. 2012). The latter was successfully incorporated in the adhesive blends and reduced the MMPs' activity. However, the incorporation of zinc into a self-etch adhesive jeopardized the initial bond strength in a previous investigation (Osorio et al. 2011). We hypothesised that zinc

may prejudice the chemical interaction of functional acidic monomers with calcium and dentine and it is important to verify this interaction to avoid future mistakes in doping self-etch adhesives.

This study aimed at evaluating if the presence of Zn ions affects the chemical interaction of 10-methacryloyloxydecyl-phosphate (MDP) with calcium/dentine and the bond strength/nanoleakage of MDP-based adhesives with dentine.

## MATERIALS AND METHODS

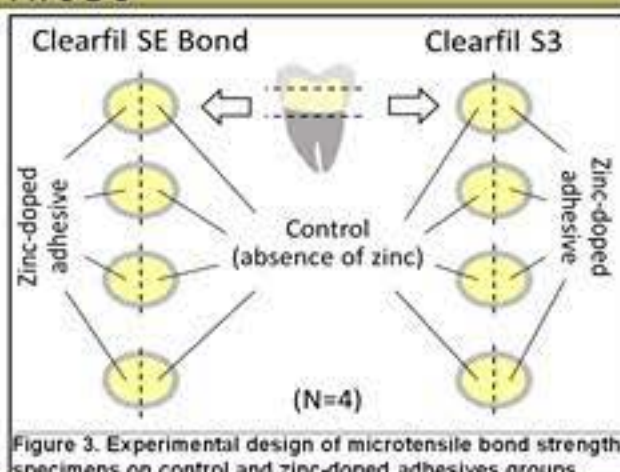
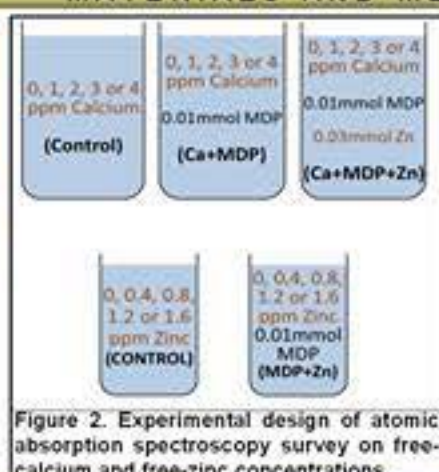


Figure 2. Experimental design of atomic absorption spectroscopy survey on free-calcium and free-zinc concentrations.

Figure 3. Experimental design of microtensile bond strength specimens on control and zinc-doped adhesives groups.

## RESULTS

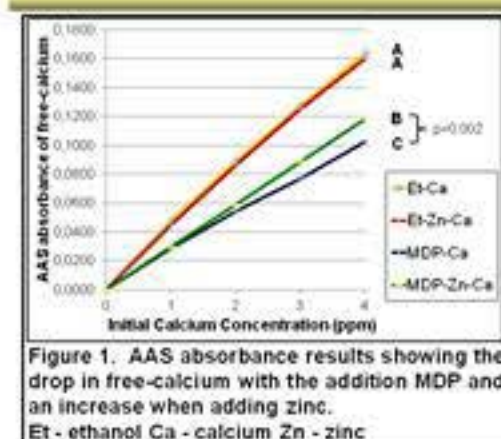


Figure 1. AAS absorbance results showing the drop in free-calcium with the addition MDP and an increase when adding zinc. Et - ethanol Ca - calcium Zn - zinc

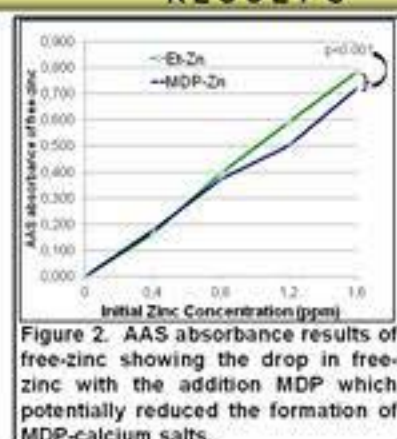


Figure 2. AAS absorbance results of free-zinc showing the drop in free-zinc with the addition MDP which potentially reduced the formation of MDP-calcium salts.

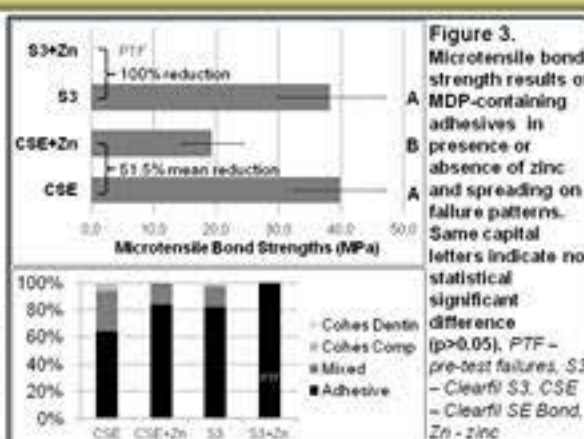


Figure 3. Microtensile bond strength results of MDP-containing adhesives in presence or absence of zinc and spreading on failure patterns. Same capital letters indicate no statistical significant difference ( $p > 0.05$ ). PTF - pre-test failures, S3 - Clearfil S3, CSE - Clearfil SE Bond, Zn - zinc

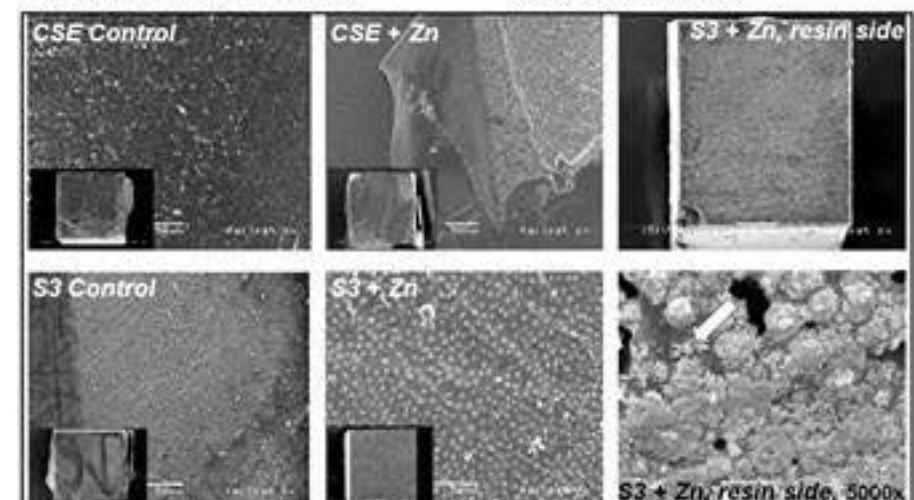


Figure 4. SEM micrographs showing the fracture patterns of debonded specimens from microtensile bond strength survey. The fractures occurred at the bottom of hybrid layer when doping both adhesives with zinc. With S3, a complex structure (arrow) was observed attached to adhesive layer. This structure may jeopardize the chemical interaction of MDP with dentine.



Figure 5. SEM micrographs showing the nanoleakage (arrows) in the resin-dentin interfaces. In control groups, S3 presented more silver uptake than CSE. The nanoleakage of CSE was notably increased when adding 5w% of zinc nitrate in the primer. The nanoleakage of sticks bonded with S3+Zn were not evaluated due to all sticks failed prematurely.

## CONCLUSION

Addition of zinc in MDP-containing adhesives and MDP aqueous solutions jeopardizes the bond strength and the formation of MDP-calcium salts. The formation of MDP-zinc salts compromises the optimal bonding with dentine and calcium. Doping MDP-based self-

etch adhesives with zinc should be avoided in order to achieve adequate chemical interaction of such acidic monomer with dentine/calcium.

## REFERENCES

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