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# Can we stop dentist drilling too much on our caries tooth?

Dental caries is one of the most prevalent diseases worldwide. It is a result of hard tissue demineralization largely caused by acid produced by bacteria on the tooth surfaces as a by-product of metabolism of fermentable carbohydrate. Some dentists want to fill all caries tooth with just little pits and flaws, sometimes warning of cavities to come, perhaps leading to a dreaded root canal, or losing the tooth. Some dentists would convince their low-risk patients to do the filling and may honestly believe they're doing a patient a favor by treating early.

The traditional treatment of dental caries, especially in dentine, involves removal of all infected tissue of the original tooth structure, and then replacing the missing/removed tissues with various restorative materials. Generally speaking, the traditional restoration is preferred as it is a more mature procedure. However, over extension of the cavity often weakens tooth structure and increases the risk of premature restoration failure. In order to enhance longevity of restorations, minimal intervention dentistry (MID) (called treat tooth with microcavities) has been advocated so as to only remove the severely decayed portion of enamel, followed by conserving and sealing the carious dentine with various restoratives. It is argued that this technique arrests bacteria activity by preventing fermentable sugars and acid transport to the carious dentine. Such a conservative restoration not only provides the potential of remineralization of the inner layer of demineralized and softened dentinal tissues, but also partially restores the tooth structure.

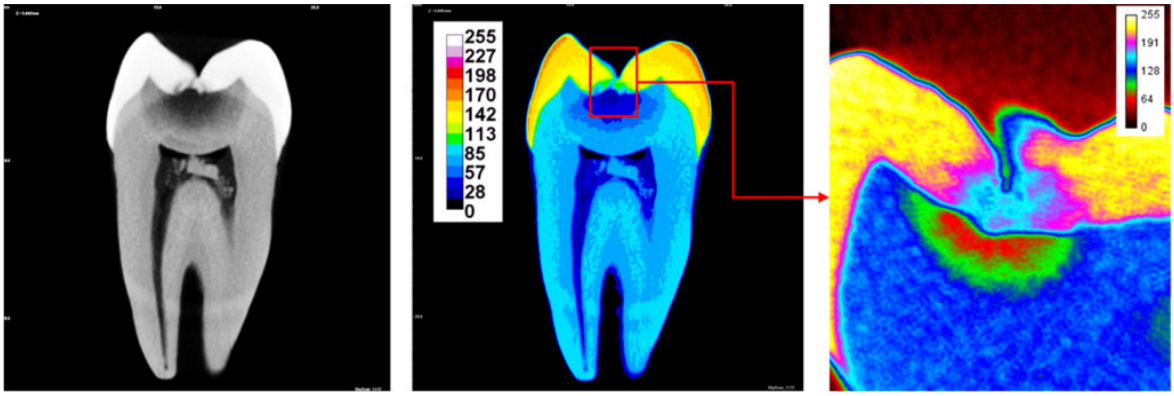


Fig. 1.

We conducted a numerical modelling study to test whether there is any advantage of conservative treatment strategy from a biomechanical perspective. We scanned a human molar with fissure initiated caries, the finite element models and associated typical clinical restorations were developed and analyzed using extended finite element method (XFEM), aiming to compare the fracture behavior of the differently restored tooth structures under the same occlusal loading. Three different restorative approaches were considered, i.e. traditionally restored tooth that has been one of the most commonly used treatment strategies currently; conservatively restored teeth that preserve more portion of enamel upon the dentinal caries region than traditional restoration and retains potentially remineralizable dentine infected caries region. Fracture patterns and retained strengths between traditionally restored and conservatively treated tooth models were explored and compared with the original carious tooth. It was found that the

conservatively restored methods significantly enhanced the fracture resistance. Such an additional benefit underpins the advantages of biomechanics and endorses, that not only does the minimally invasive restorative clinical technique provide a higher remineralization potential for restoring dentine tissue and its functionality, but also better integrity and load bearing capacity of restored tooth structure.

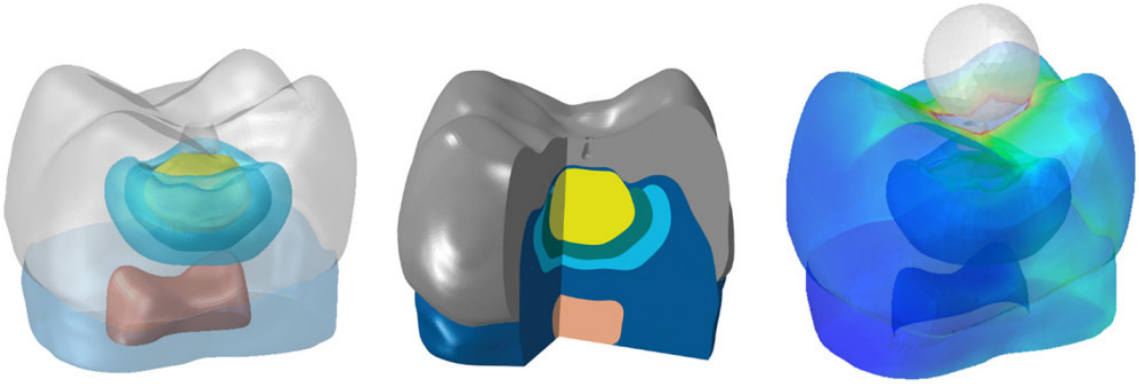

Fig. 2.

From a biomechanical perspective, the results support the concept of minimal intervention dentistry. More importantly, the XFEM modeling procedure as introduced appears potentially advantageous in further exploiting clinical CT diagnosis data for surgical planning, which enables an effective link between a specific patient, virtual simulation, analysis, selection of suitable restorative materials and clinical guidance.

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## Publication

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