

Original Article

Influence of Various Chelating Irrigating Solutions and Protocols on the Micro-hardness and Surface Roughness of Root Dentin

Abstract

Aim: Effective irrigants and chemo-mechanical debridement are critical for successful endodontic therapy. However, use of irrigating solutions can significantly alter the physical properties of root canal dentin, particularly its micro-hardness (MH) and surface roughness (SR). This study evaluated and compared the effects of three final chelating irrigants—0.5% chitosan nanoparticle solution (CNPs), 17% ethylenediaminetetraacetic acid (EDTA), and 10% citric acid (CA)—with and without ultrasonic (US) activation on the MH and SR of radicular dentin, aiming for informed clinical endodontic practices. **Materials and Methods:** Forty-nine extracted mandibular premolars were decoronated, instrumented, longitudinally sectioned, and divided into 98 root halves. These were randomly assigned to two main groups for MH and SR testing and further subdivided ($n = 7$ per subgroup) based on the irrigant type and protocol: CNPs, CNPs + US, EDTA, EDTA + US, CA, CA + US, and distilled water (control). After 180-s immersion at 37°C, the MH was measured using a Vickers MH tester, while the SR was assessed using an SR tester. Statistical analyses were conducted using one-way analysis of variance with Tukey's *post hoc* test ($\alpha = 0.05$). **Results:** EDTA and EDTA + US groups showed the most significant MH reduction across all root regions (coronal, middle, and apical), followed by CA and CA + US groups ($P < 0.05$). In contrast, CNPs and CNPs + US groups showed a significant increase in the MH compared to the control group ($P < 0.05$). Regarding SR, EDTA and EDTA + US produced the highest roughness values, while CNPs and CNPs + US treatment induced minimal SR changes relative to the control group. **Conclusion:** CNPs demonstrated superior performance by increasing dentin MH and minimizing SR alterations, suggesting it is a promising, bio-compatible alternative to conventional chelating agents like EDTA for endodontic irrigation.