This study aimed to compare the efficacy of low-temperature atmospheric pressure plasma (LTAPP) with the current materials (MTAD, NaOCl, EDTA) used with or without passive ultrasonic irrigation (PUI) on smear and debris removal. Mandibular premolars (n = 55) were prepared to an apical size of 40/.06 and randomly divided into 5 different test groups (n = 10 per group) and 1 control group (n = 5) with the following final irrigation protocols: NaOCl + EDTA; NaOCl with PUI; MTAD; MTAD with PUI; LTAPP; and saline (control). Presence of smear layer and debris was evaluated at ×2000 (for each third) using a fourlevel scoring system. The data were analyzed statistically by Kruskal–Wallis and Bonferroni–Dunn tests (P = 0.05). The results showed that NaOCl + EDTA and MTAD with PUI irrigation were the most effective methods for smear layer removal, whereas MTAD irrigation with or without PUI, for debris removal (P < 0.05). Smear and dentin scores showed significant differences among the groups in all thirds (P < 0.05). It could be concluded that LTAPP did not appear effective on smear layer and debris removal as expected. PUI improved only the efficacy of MTAD.

Keywords: electron microscopy, in vitro, low-temperature, atmospheric pressure plasma, smear layer, surface analysis