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Anti bacterial Effectiveness of Electro- Chemically Activated (ECA) Water as a Root Canal Irrigant- An In-vitro Comparative Study

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How ECA Water Kills Microorganisms: The ORP of ECAa (ano-lyte) is +800 mV to +1,200 mV, which creates an environment outside the working range of important microbial metabolic processes [7]. When immersed in these solutions, the microorganisms are exposed to powerful oxidants causing the rupturing of biochemical bonds and hence leading to loss of cell function. Moreover, the high ORP environment creates an unbalanced osmolarity between the ion concentrations in the solution and that within unicellular organisms, further damaging membrane structures [8]. This leads to increased membrane porosity, enabling oxidizing moieties present in ECAa (anolyte) to penetrate into the cell cytoplasm, ultimately leading to the inactivation of intracellular protein, lipids and nucleic acid, rendering the cell non-functional [9–12].

Antimicrobial Components of ECA Water: According to many studies, it was concluded that HOCl is the primary active agent present in acidic ECAa (anolyte) [13–15] which disrupts many microbial structure [16,17]. In addition, OH- hydroxyl radicals, which is the strongest oxidizing agent also have shown antimicrobial activity [16,17].

Statistical Analysis

The results were submitted to one way ANOVA, performed as parametric test to compare different variables, taken before or after irrigation, as well as to Dunkan's Multiple Range Test as post hoc analysis to elucidate the difference between each group for all statistical

analysis evaluations, a two tailed probability of value, $p < 0.05$ was considered significant. The data were expressed as means and standard deviation.

Under the conditions of the present study, the irrigating solutions failed to destroy all the bacteria within the root canals. But all the three experimental groups considerably reduce the bacterial count (CFU). Comparable results were obtained with ECAs, 1% sodium hypochlorite and 3% sodium hypochlorite groups. Though 3% sodium hypochlorite showed slightly better results, there was no statistical difference between the three groups.

Spectrophotometric analysis of all the samples had also been done to obtain a qualitative value of bacterial concentration. The optical density values before and after irrigations were compared for all the groups. The results showed a statistically significant difference in all three experimental groups, compared before and after irrigation. The results were also compared between individual Groups, and the results showed that the difference between group B (1% sodium hypochlorite) and C (3% sodium hypochlorite) were not significant. But there was a statistically significant difference between the optical density values among Groups A and Group B and also between Group A and Group C. Hence, the results obtained in ECA showed a significant difference from both 1% and 3% group. Though the numerical values appeared quite similar, but the difference between the ECA and sodium hypochlorite in spectrophotometric analysis was significant.

Under clean conditions freshly prepared ECA water was found to be highly active against all microorganisms giving 99.999% or greater reductions in less than two minutes, thus many investigators concluded ECA water as potent anti-microbial agent and its clinical application were reported to be effective which is in accordance with our study [25,26]. In another comparative study by Helme AJ et al., in 2010, the bactericidal activity of ECA water was found four times more effective than commercially available 2.5% sodium hypochlorite solutions [27].

Conclusion

ECA water being non-toxic, more biocompatible, inexpensive, easily available and a potent antibacterial agent, it can be very well used as a root canal irrigating solutions. The antibacterial efficacy of ECA water was found to be comparable with sodium hypochlorite solution against E. faecalis.ubules in apical as well as coronal third [28].