ABSTRACT

Aim: To assess the effectiveness of nanoparticle based acidulated phosphate fluoride (APF) gel on surface enamel fluoride uptake.

Objectives:

1. To assess the surface enamel fluoride uptake in the tooth pre-operatively using acid etch biopsy method given by Brunn et al 1975.

2. To assess the change in the surface enamel fluoride uptake after the application of nanoparticle based APF gel after a period of 24hrs and 30 days using acid etch biopsy method given by Brunn et al 1975.

3. To assess the change in the surface enamel fluoride uptake after the application of   conventional APF gel after a period of 24hrs and 30 days using acid etch biopsy method given by Brunn et al 1975.

4. To compare the difference in surface enamel fluoride uptake between nanoparticles based APF and conventional APF.

5. To determine the depth of penetration of nanoparticles based APF and conventional APF from the extracted teeth surface and compare the same with the help of scanning electron microscope (SEM).

Methodology:

The intervention split mouth study was conducted over a period of six months from May to November 2018, on patients undergoing orthodontic treatment and indicated for bilateral extraction of premolars on at least one of the arch. Each participant received one application of 4 minutes duration of both the

intervention: Right half of the mouth received nanoparticle based APF gel, and left half of the mouth received conventional APF gel (16 Oz Pascal Corp.; Strawberry Flavour). A total of 30 participants were included in the study. Oral examination and prophylaxis prior to the commencement of the study as all the subjects were patients undergoing orthodontic treatment. Acid etch enamel biopsy was taken for all the study subjects preoperatively and post-operatively, bilaterally on the buccal and palatal/lingual surface of maxillary or mandibular premolars indicated for extraction, using 1μl of 0.5M perchloric acid according to the method suggested by Brunn et al in 1975. The surface enamel fluoride uptake and biopsy depth were estimated at 3 intervals of time namely baseline, 24hrs and 30 days. After the premolars were extracted, scanning electron microscope (SEM) analysis was done to determine the surface characteristics of enamel in both the nanoparticles based APF and conventional APF gel group. The data was collected and analyzed using SPSS software and results were generated.

Results:

The mean levels of surface enamel fluoride at the baseline were found to be 1487.69 ± 826.8 ppm , 1509.39 ± 844.83 ppm in the nanoparticle based gel group and conventional APF group respectively. The biopsy depths were found to be $71.15 \pm 3.18\mu$ and $70.92 \pm 2.95\mu$ respectively in both groups at the baseline.

Overall comparison of the two groups using Generalized Estimating Equations (GEE) showed, both fluoride uptake and depth of biopsy remained significant even after controlling for the covariates (time, group) individually and simultaneously with p value < 0.001. Further analysis between the groups at

individual time points showed that fluoride uptake was significantly increased in the nanoparticle based APF gel group at 24 hour evaluation with a mean value of 5495.25±2171.12 ppm and biopsy depth significantly decreased in the nanoparticle based APF group, with a mean value of 69.33 ± 2.11 μ at the 30 day evaluation.

Conclusion:

The overall study results showed a marked increase in the surface enamel fluoride uptake and decrease in the mean depth of biopsy on using nanoparticle APF gel. Further clinical evaluation should be done to alter the duration of application time and frequency of application with respect to conventional APF gel in order to establish the efficacy of this new formulation.

Key words: Acidulated phosphate fluoride, Biopsy, Enamel fluoride, Nanoparticles