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Titanium-Dioxide Nanotubes Reinforced Glass-Ionomers' Fluoride Release and Anti-Bacterial Properties

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Objectives This in vitro study evaluated the addition of titanium-dioxide (TiO_2) nanotubes to a conventional glass-ionomer cement (GIC) on fluoride release and anti-bacterial properties.
Methods A conventional GIC (Ionofil Molar, Voco GmbH) was reinforced with varying amounts of nanotubes (0.1%, 0.5%, 1% ve 2% wt) and functionalized TiO_2 (f-TiO_2). The specimens were assigned to 9 groups: Group IM0: no addition TiO_2 (control), Group IM1: 0.1% TiO_2, Group IM2: 0.5% TiO_2, Group IM3: 1% TiO_2, Group IM4: 2% TiO_2, Group IM1f: 0.1% f-TiO_2, Group IM2f: 0.5% f-TiO_2, Group IM3f: 1% f-TiO_2, Group IM4f: 2% f-TiO_2. Disc-shaped specimens (5x2mm) were fabricated according to the manufacturers' instructions. Fluoride releases were tested with ion chromatography at 1st, 2nd, 7th, 14th and 21st days (n=8). Direct contact tests against *Streptococcus mutans* and *Lactobacillus casei* ATCC strains were conducted at 1st, 7th and 21st days to determine the antibacterial activities (n=5). Repeated measures ANOVA and Bonferroni tests were done for statistical analyses ($p<0.05$).
Results For all tested groups, significantly higher amount of fluoride releases were detected on 1st and 7th days. Besides, on 2nd,7th,14th and 21st days, Group IM4 (2% TiO_2) and Group IM4f (2% f-TiO_2) caused statistically higher amount of fluoride release than control group whereas on 1st day, there were no significant differences in fluoride release between control group and all reinforced groups. At all time intervals, a reduction in the numbers of both bacteria were found for all reinforced groups compared to control group. Particularly, a significant decrease in the number of S.mutans was observed on 21st day; while the number of L.casei statistically fell down on 7th day.
Conclusions The reinforcement of TiO_2 nanotubes might result in differences for antibacterial activities and fluoride release of GIC at some time intervals.