



Silver and Fluoride Release from SDF Treated Carious Lesions

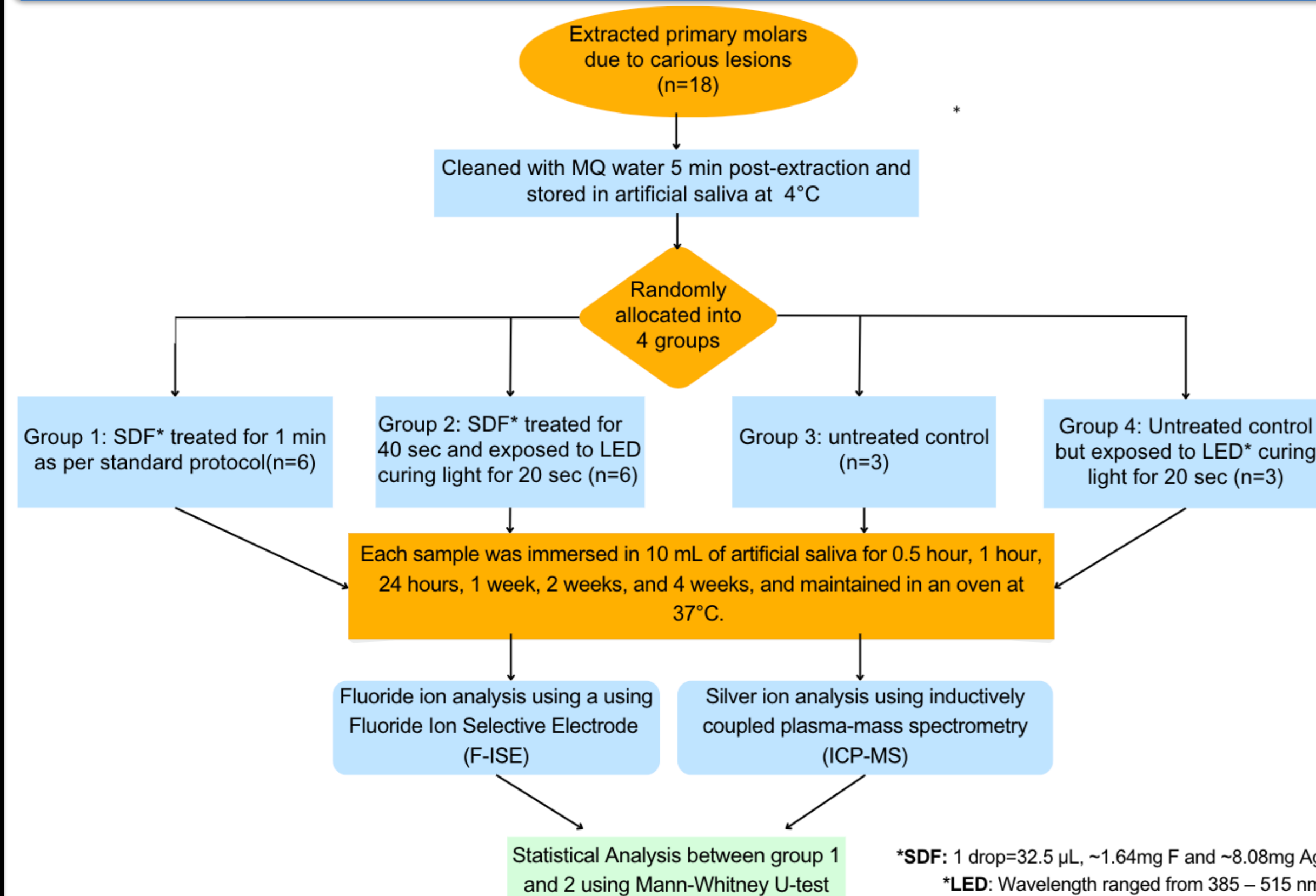
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Background/Aim

Silver diamine fluoride (SDF) is a liquid solution, that combines the antibacterial properties of silver with the remineralizing effects of fluoride. It offers a minimally invasive alternative (MIA) for caries management in patients unable to undergo conventional restorative procedures. SDF 38%, which is the typical concentration available in the U.S. (Advantage Arrest, Elevate Oral Care), has a pH of 10 and 24-27% silver content (approx. 250,000 ppm), 11% ammonia, and 5-6% fluoride (approx. 50,000 ppm). The recommended application times for SDF pose a significant challenge for young children, typically requiring a 1-min exposure. Recent research has demonstrated that using a curing light not only enhances silver precipitation in infected dentin but also increases hardness while reducing SDF penetration into sound dentin. There is still the question of how much of the silver and fluoride remain bound to the tooth structures, and how much of it is still free enough to diffuse outwards into the surrounding media, especially in the initial hours after application. **The aim** of this study was to investigate the amount of silver and fluoride ions released from natural caries lesions treated with SDF into artificial saliva, both with and without using LED curing light.

Methods



Results

Table 1. Median Fluoride Concentrations (ppm) Over Time in Groups 1 and 2

	0.5 hr	1 hr	24 hr	1 wk
Group 1	4.92	.15	.33	.01
Group 2	2.46	.06	.05	.02
Test Statistic (w)	32	23	25	14
p-value	.026*	.485	.310	.589

*p < .05

Table 2. Median Silver Concentrations (ppb) Over Time in Groups 1 and 2

	0.5 hr	1 hr	24 hr	1 wk
Group 1	5628	132	209	485
Group 2	409	73	160	315
Test Statistic (w)	33	25	24	21
p-value	.015*	.310	.394	.699

*p < .05

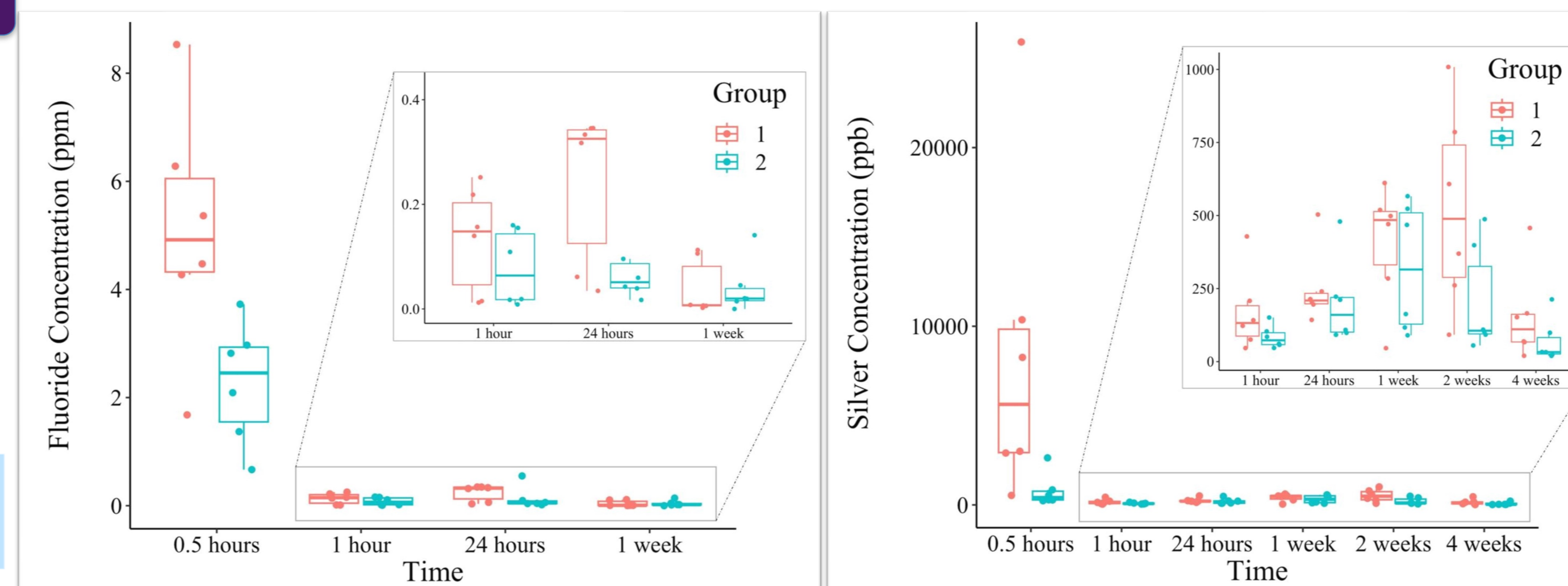


Figure 1. Boxplots for fluoride concentrations in artificial saliva for SDF treated Groups 1 (1-min SDF treatment) and 2 (40-sec SDF treatment followed by 20-sec LED curing light) at four time points.

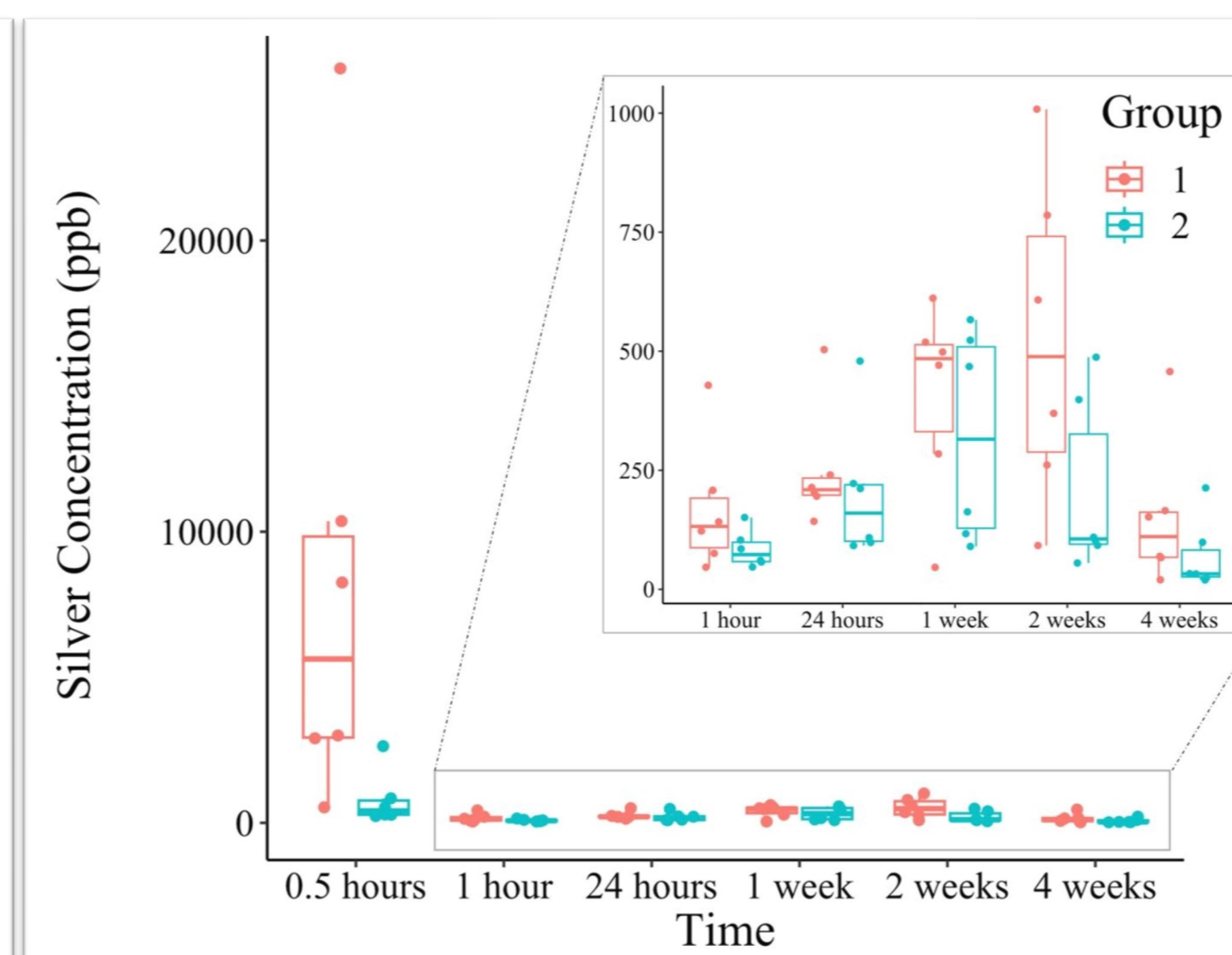


Figure 2. Boxplots for silver concentrations in artificial saliva for SDF treated Groups 1 (1-min SDF treatment) and 2 (40-sec SDF treatment followed by 20-sec LED curing light) at each of the six time points.

Discussion

The results of this study support the hypothesis that using a curing light after SDF application results in a reduction in the outward diffusion of silver and fluoride ions into the artificial saliva medium, as compared to the 1-min standard SDF treatment protocol without the use of any curing light. The observed 93% reduction in the release of silver ions from the treated lesions during the first 30 minutes after SDF application coupled with LED curing light application (Group 2) is of clinical importance because of the high concentrations of silver in the product. Silver ions that remain freely in the oral cavity after application can be responsible for staining of lesions in adjacent teeth that were not intentionally treated with SDF. Such staining has been reported in many social media postings. Further, silver ions that leach out from the lesion can be ingested by the patient. Knowledge of the amount and timing of outward diffusion of silver and fluoride can help establish adequate protocols that would improve the safety of the product.

Conclusion

The use of an LED curing light after SDF application results in a significant 93% reduction in silver and a 50% reduction in fluoride being released into the surrounding medium, 30 min after application compared to SDF alone. Silver and fluoride release from treated lesions diminishes over time.

Clinical implications: If the goal is to minimize systemic exposure to silver and fluoride, spitting out during the first 30 minutes after application could be a feasible recommendation.

Future research: Our results offer important points to develop a protocol for clinical trials to measure the amounts of fluoride and silver that are released from lesions after treatment in the mouth.

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References upon request.