

Comparison of Tooth Reduction Among Pediatric Crown Types

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Introduction

Full-coverage restorations are commonly used to manage extensive caries in primary molars. Stainless steel crowns (SSCs) have long been considered the gold standard because of their durability and predictable clinical performance. With increasing esthetic demands, zirconia crowns have become more widely used. More recently, flexible hybrid esthetic crowns such as BioFlx have been introduced as an alternative that may allow for improved adaptability while maintaining esthetics.

Previous studies have shown that zirconia crowns generally require greater tooth reduction compared to stainless steel crowns.^{1,2} However, data comparing newer esthetic crown systems, including flexible hybrid crowns, remain limited.

The amount of tooth structure removed during preparation may be clinically relevant. Remaining dentin thickness has been shown to influence pulpal response, and deeper injury can stimulate biologic repair processes within the pulp.^{3,4} While restorative procedures aim to preserve as much tooth structure as possible, primary molars naturally exhibit thinner dentin and prominent pulp horns,^{5,6} making preparation depth an important consideration.

Although zirconia crowns demonstrate favorable clinical outcomes and parental satisfaction,⁷ stainless steel crowns continue to show excellent longevity and remain widely used.⁸ Despite the growing adoption of esthetic pediatric crown systems, direct quantitative comparison of tooth structure removal among stainless steel, BioFlx, and zirconia crowns remains limited.

Objective

To compare the amount of tooth structure removed during preparation of primary posterior teeth for three pediatric crown materials: stainless steel crown, BioFlx, and zirconia.

Materials and Methods



- Thirty mandibular right primary first molar typodont teeth were used and randomly divided into three groups (n=10 per group). They are assigned to receive zirconia crowns (Sprig Pediatric Dentistry), BioFlx crowns (NuSmile), or stainless-steel crowns (3M ESPE).

- Each tooth underwent standardized crown preparation using the EZ-Prep bur system, following the manufacturer-specific reduction guidelines for each crown type.

- Tooth weight was recorded before and after preparation, and the difference in weight was used as a quantitative measure of tooth structure removed.

- Statistical analysis was performed using the Kruskal–Wallis test, followed by Dunn’s test with the Bonferroni correction.

Conclusion

SSC had the lowest median change in weight, followed by BioFlx, and zirconia had the highest change in weight after preparation.

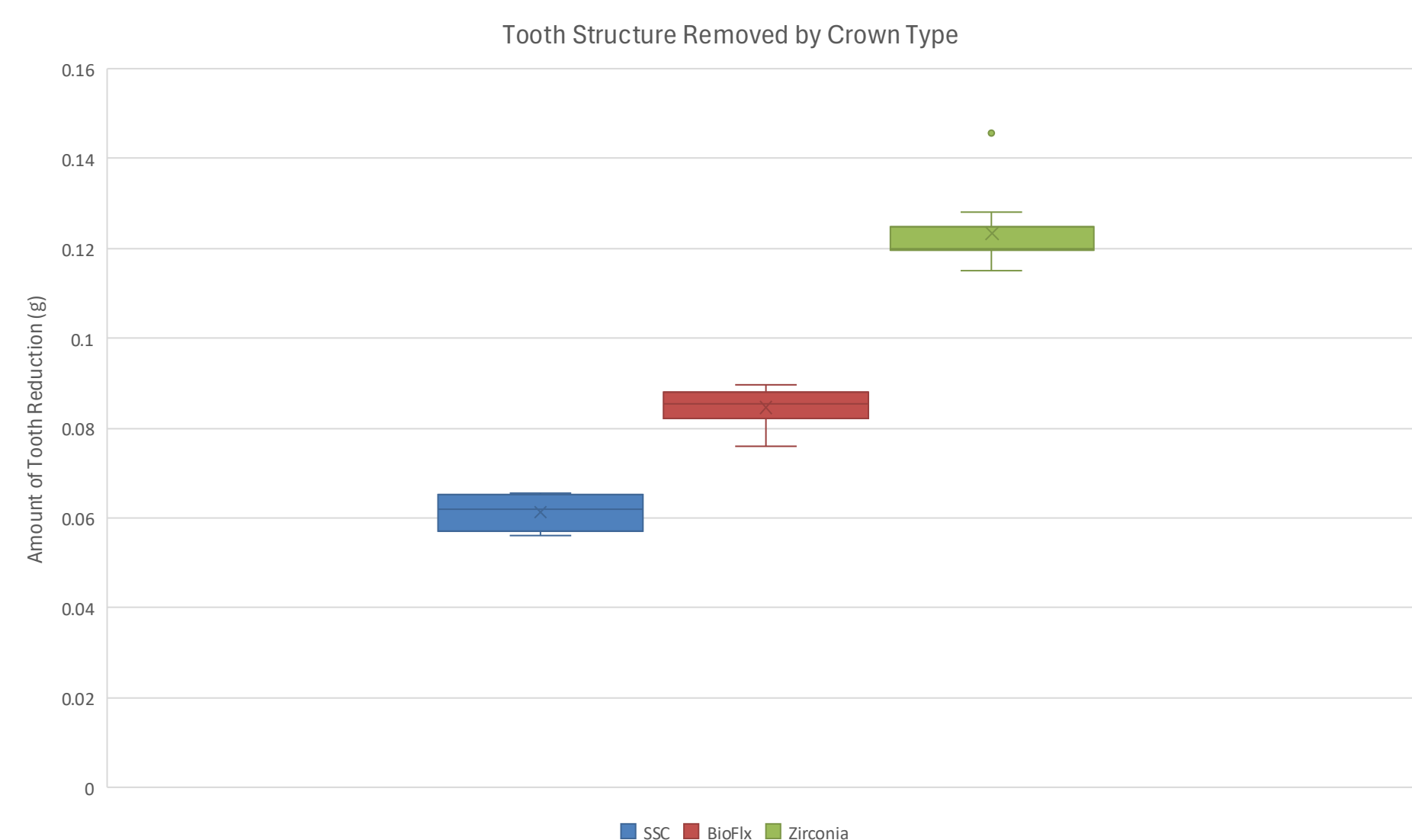


Figure 1. Amount of Tooth Reduction by Crown Type

Table 1. Median tooth structure reduction by crown type. Kruskal-Wallis test showed a significant difference among groups ($P < .001$).

Crown Type	Median weight tooth reduction (g)	IQR
Stainless Steel	0.0618	0.0081
BioFLx	0.0855	0.0061
Zirconia	0.1201	0.0054

Table 2. Pairwise comparisons using Dunn’s test with Bonferroni correction demonstrating statistically significant differences in tooth structure removal among all three crown groups. Their significance level is 0.050.

Pairwise comparisons (Dunn’s test)

Crown Type Comparisons	P value
SSC vs BioFlx	$P = .030$
SSC vs Zirconia	$P < .001$
BioFlx vs Zirconia	$P = .030$

Table 3. Typodont tooth weight before and after treatment for different crown groups. *Median value.

Group	Pretreatment typodont tooth weight* (g)	Posttreatment typodont tooth weight* (g)	% Weight reduction
SSC	0.7294	0.6639	9
BioFlx	0.7289	0.6403	12
Zirconia	0.7295	0.6092	16

This corresponds to approximately 1.3 times greater reduction for BioFlx and 1.8 times greater reduction for zirconia compared to stainless steel crowns. This is consistent with prior in vitro research Clark et al. (2016), who reported that zirconia crowns require approximately 1.7-2.3 times more tooth reduction than stainless steel crowns.

Conclusion

Preparation requirements vary significantly among pediatric crown types. Stainless steel crowns required the least tooth reduction, followed by BioFlx, while zirconia required the largest reduction. These differences are clinically relevant when considering pulpal proximity and preservation of tooth structure in primary molars.

References

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