



INTRODUCTION

In pediatric dentistry, parents constantly ask about the best ways to efficiently brush their kids' teeth and inquire about new products. The AutoBrush® is a new children's toothbrush with a U-shaped, whole-mouth mouthpiece. These toothbrushes have recently become popular due to their advertising of 360° cleaning, eliminating user error by brushing all surfaces at once, being dentist-approved, having a kid-friendly design, and being fast and effective. Overall, there is limited research on the efficiency of these whole-mouth brushing systems. This study aimed to evaluate plaque removal using the manual and sonic AutoBrush® and compare it to standard manual and electric pediatric toothbrushes. The results of this study could inform clinicians about the plaque-reducing efficiency of whole-mouth toothbrushes.

OBJECTIVE

The objective of this study was to evaluate plaque removal with a 360° toothbrush by comparing the manual and sonic AutoBrush® to standard manual and electric pediatric toothbrushes.

METHODS

IRB status of exempt (IBC #5004) was granted for this study by the Louisiana State University Health Science Center, New Orleans, Louisiana, USA on February 7, 2023.

Twenty pediatric typodonts were painted with Kilgore International, Inc.® artificial plaque to all smooth surfaces of the teeth. Four different pediatric toothbrushes were tested for the time recommended by the toothbrush manufacturer. The toothbrushes tested include the Oral-B® Pro-Health Stages 2 Manual Toothbrush, the Oral-B® Kids Battery Powered Toothbrush, the AutoBrush® Manual Kids Toothbrush, and the AutoBrush® Sonic Kids Toothbrush. Following brushing, the smooth surfaces of every tooth were blind scored by 3 different calibrated examiners using the Turesky Modified Quigley-Hein Plaque Index (Table 1). Each tooth was visually divided into six sections and given a 0-5 score based on the amount of remaining artificial plaque. Each toothbrush was tested on five different typodonts. For statistical analysis, random effects multivariable linear regression was performed to determine if the toothbrush type impacted scores. Fixed effects were assumed for toothbrush type, while random effects were assumed for examiner number, tooth number, model number, and tooth surface. Estimated fixed effects and the variance - covariance matrices from these models were used to obtain 95% Wald-based confidence intervals for the mean outcome level of each toothbrush after adjustment (Figure 2).

Plaque Index Scoring

Score	Description
0	No visible plaque
1	Separate flecks of plaque at the cervical margin of the tooth
2	A thin, continuous band of plaque (up to 1 mm wide) at the cervical margin
3	A band of plaque wider than 1 mm but covering less than one-third of crown
4	Plaque covering at least one-third but less than two-third of crown
5	Plaque covering two-thirds or more of crown

Table 1. The Turesky Modification of the Quigley-Hein Plaque Index

Photo of the AutoBrush® 306° Mouthpiece

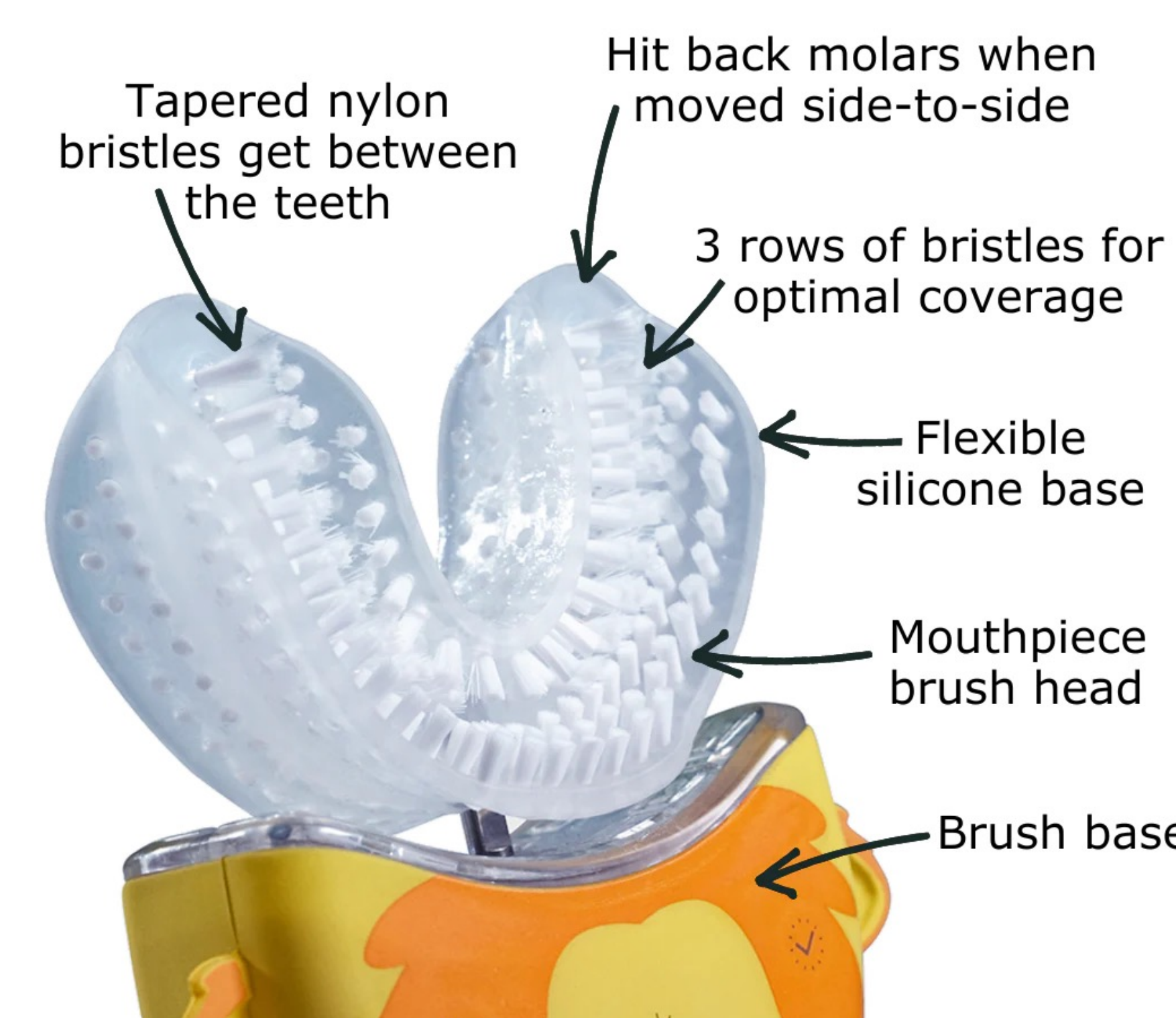


Figure 1. Representative picture showing the design of the AutoBrush®

Average Plaque Index Score Total and Per Tooth

Tooth	M Auto	Manual	Electric	Sonic Auto	Tooth	M Auto	Manual	Electric	Sonic Auto
All	2	0.7	0.5	1.7	19	4.8	0.7	0.7	4.9
3	4.9	1	0.6	4.3	K	3.1	0.5	0.5	3.6
A	1.7	0.6	0.4	1.9	L	0.5	0.7	0.5	0.6
B	1.1	1	0.5	1	M	1	0.7	0.5	0.6
C	1.3	0.8	0.5	1	N	0.9	0.7	0.7	0.4
D	2.3	0.3	0.5	0.6	O	1.3	0.8	0.7	1.1
E	1.3	0.5	0.3	0.3	P	1.4	1	0.7	1.1
F	0.9	0.6	0.3	0.1	Q	1.2	0.8	0.6	1.1
G	1.4	0.5	0.5	0.4	R	2	0.5	0.8	1.8
H	0.8	0.7	0.5	0.7	S	1	0.3	0.2	0.6
I	1.3	1.1	0.6	1	T	1.2	0.4	0.6	1.7
J	3.2	0.6	0.4	3.5	30	4.2	0.8	0.7	4.2
14	4.9	0.8	0.2	4.9					

Table 2: Average PI score totals and per tooth by toothbrush

Adjusted Toothbrush Mean Outcome

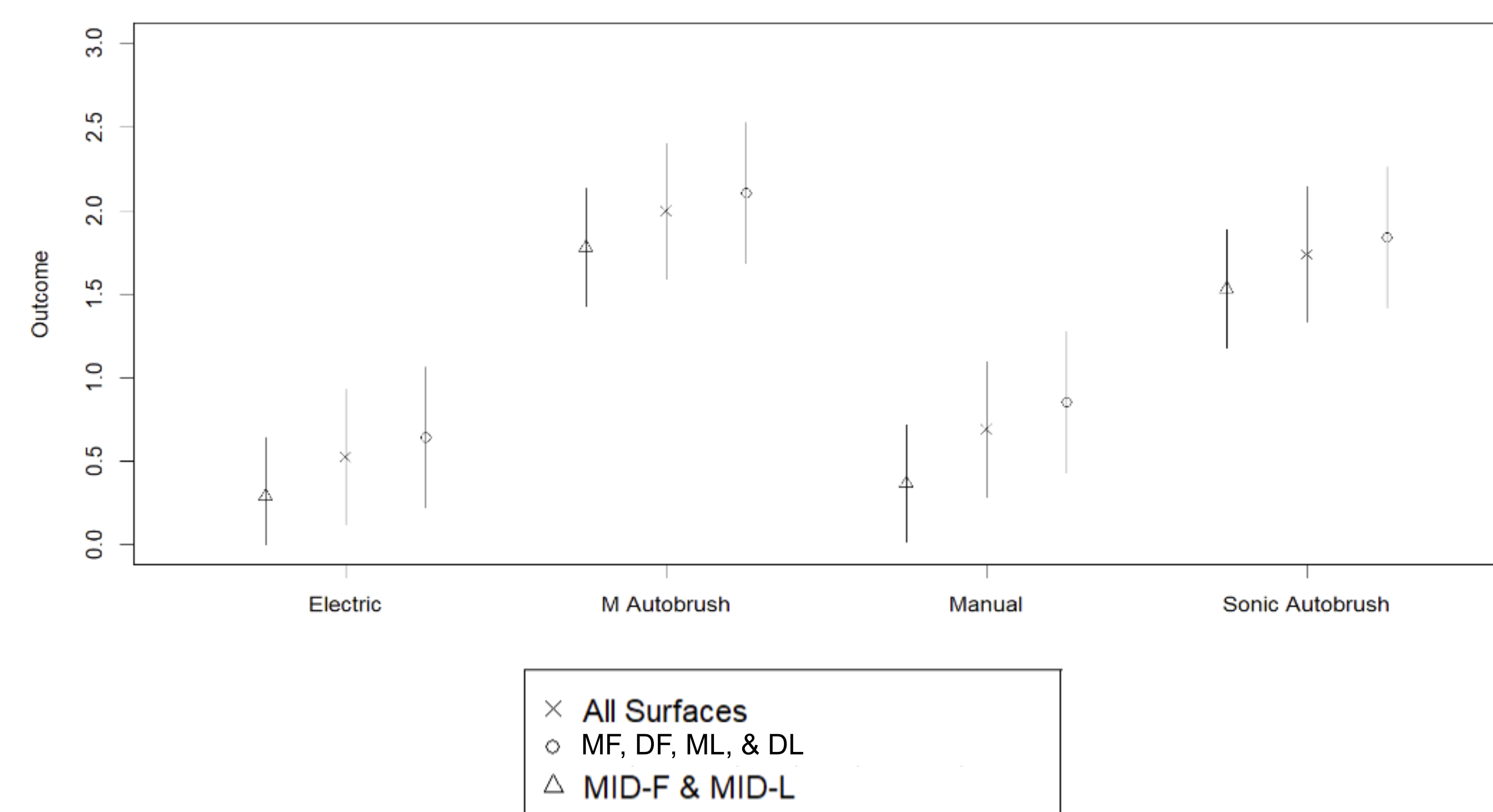


Figure 2: Estimated mean outcomes for each toothbrush along with the Wald-based 95% confidence intervals after adjustment for tooth ID, examiner ID, model ID and surface type

RESULTS

- For both the AutoBrush® Manual Kids and the AutoBrush® Sonic Kids toothbrush, the plaque index was significantly higher on the posterior teeth than the anterior teeth.
- For all surfaces, the plaque index with the AutoBrush® Manual Kids was statistically higher than the manual and electric ($p < .001$) but not the AutoBrush® Sonic Kids ($p = .052$).
- For all surfaces, the plaque index with the AutoBrush® Sonic Kids was statistically higher than the manual and electric ($p < .001$).
- The manual and electric toothbrush plaque indexes were not statistically different.
- For all toothbrushes, the plaque score means were lower on the mid-facial and mid-lingual surfaces compared to the interproximal surfaces.

CONCLUSIONS

- The AutoBrush® Manual Kids and AutoBrush® Sonic Kids toothbrushes were significantly less efficient at plaque removal on all teeth compared to the manual and electric toothbrushes.
- Both AutoBrush® toothbrushes had significant plaque remaining on all posterior teeth compared to the anterior teeth.

REFERENCES

- Artificial Plaque. Kilgore International Inc. Accessed March 11, 2024. <https://kilgoreinternational.com/product/artificial-plaque/>
- Ghassemi A, Vorwerk LM, Hooper WJ, Putt MS, Milleman KR. A four-week clinical study to evaluate and compare the effectiveness of a baking soda dentifrice and an antimicrobial dentifrice in reducing plaque. *J Clin Dent.* 2008;19(4):120-126.
- Milleman J. *FINAL REPORT Study Title: Plaque Removal Efficacy of AutoBrush®, a 360 Degree Sonic Power Toothbrush, in Children.* https://cdn.shopify.com/s/files/1/0063/0213/8415/files/AutoBrush_-_Final_Report_Executed_4e11dcb2-656b-4c85-8b1f-c0378e515d5f.pdf?v=1646674987
- Nieri M, Giuntini V, Pagliaro U, Giani M, Franchi L, Franceschi D. Efficacy of a U-Shaped Automatic Electric Toothbrush in Dental Plaque Removal: A Cross-Over Randomized Controlled Trial. *Int J Environ Res Public Health.* 2020;17(13):4649. Published 2020 Jun 28. doi:10.3390/ijerph17134649

ACKNOWLEDGEMENTS

Special thanks to Drs. Wen, Chapple, and Johnson for their assistance in organizing and conducting this experiment.