

A Supplement to  
**Compendium**  
of Continuing Education in Dentistry®

**Colgate® 360™**  
**Whole Mouth Clean**



***A New High-Performance Manual Toothbrush***

**A Preview Summary** to be published October 2004 / Vol. 25, No. 10 (Suppl 2)

*Supported by The Colgate-Palmolive Company*

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A next-generation high-performance toothbrush designed to go beyond cleaning teeth to cleaning the whole mouth, Colgate® 360°™ is clinically proven to:

- Reduce up to 40% more interproximal plaque<sup>1</sup>
- Reduce up to 72% more gingival bleeding<sup>2</sup>
- Remove up to 96% more odor-causing bacteria<sup>3</sup>
- Desquamate bacteria-harboring epithelial cells from buccal mucosa
- Reduce oral malodor over 3 times better than the leading manual and battery-powered toothbrushes<sup>4</sup>
- Provide up to 10 hours of long-lasting fresher breath.<sup>4</sup>

<sup>1</sup>Versus a leading U.S. manual toothbrush.

<sup>2</sup>Versus a leading U.S. manual toothbrush.

<sup>3</sup>Versus brushing teeth alone with a leading U.S. manual toothbrush.

<sup>4</sup>Versus brushing teeth alone with leading U.S. manual and battery-powered toothbrushes.

\*Colgate and 360° are trademarks of the Colgate-Palmolive Company.

# Driving Toothbrush Innovation Through a Cross-functional Development Team

*Douglas J Hoblbein, BS; Malcolm I Williams, PhD; Thomas E Mintel, BS, ME*

A cross-functional team was assembled to take on the project of developing a toothbrush that could deliver a “whole mouth clean.” As such, this brush needed to not only demonstrate superior plaque removal from teeth, it also needed to provide a means for safe cleaning of soft oral tissues. During use, the brush needed to be comfortable both in hand

and in mouth, and it required contemporary esthetics to help drive consumer acceptance. This article will take the reader through the full development cycle of the new toothbrush, identifying the proposed benefit of each brush feature along the way. Where appropriate, care was taken to identify the specific insights leading to the development of several new features not

previously seen in commercial toothbrushes. This article also will attempt to demonstrate the value of forming new product development teams with representatives of multiple functional areas, including marketing, product development, advanced technology, clinical, engineering, and manufacturing.

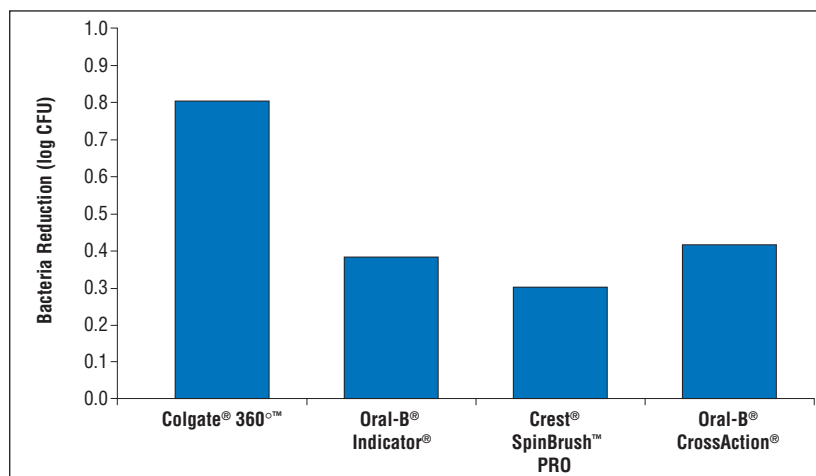
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# Clinical Comparison of a New Manual Toothbrush on the Level of Hydrogen-Sulfide-forming Bacteria on the Tongue

Malcolm I Williams, PhD; Joe Vazquez, BA; Diane Cummins, PhD

The objective of this randomized, crossover study was to compare the effectiveness of a newly designed manual toothbrush (Colgate® 360™) to two commercially available manual toothbrushes (Oral-B® Indicator® and Oral-B® CrossAction®) and a battery-powered toothbrush (Crest® SpinBrush™ PRO) for their ability to reduce hydrogen-sulfide-forming bacteria on the tongue. After a washout period, subjects arrived at the clinical site for baseline sampling without performing dental hygiene, eating, and drinking. Subjects sampled the left side of their tongue with a cotton swab. Subjects brushed for 1 minute with the assigned test toothbrush and regular fluoride toothpaste. Those using the Colgate® 360™ toothbrush also were instructed to brush the tongue with the implement on the back of the brush for 10 seconds. After 2 hours, the subjects returned to the clinical site having refrained from dental hygiene, eating, and drinking for posttreatment sampling, this time sampling the right side of the tongue. After a minimum 2-day washout period, subjects repeated the same regimen using the other toothbrushes. Collected tongue samples were



Figure—Log reduction in tongue bacteria 2 hours after using the 4 test toothbrushes.

dispersed in sterile water, serially diluted in sterile phosphate-buffered saline, and triple-plated onto lead acetate agar. When plated on this medium, bacteria that produce hydrogen sulfide appear as dark-pigmented colonies. After 72 hours of incubation, the dark colonies were counted, expressed as log colony-forming units/mL, and reduction from baseline was calculated. Thirty-one adult men and women completed the clinical study. There was no significant difference between baseline hydrogen-sulfide-forming bacteria levels. Posttreatment, the log reduction of bacteria was 0.80, 0.41, 0.33, and 0.44 for the Colgate® 360™ Oral-B® Indicator®, Crest® SpinBrush™

PRO, and Oral-B® CrossAction®, respectively. Statistical analysis indicated that the Colgate® 360™ toothbrush was statistically significantly better ( $P < .05$ ) than the 3 commercial toothbrushes in reducing the levels of hydrogen-sulfide-forming bacteria on the tongue.

Table—Summary of Hydrogen-sulfide Levels (in CFU) After Brushing With the Four Toothbrushes

Toothbrush	n	Baseline Bacterial Levels (CFU) Mean ± SD	Postbrushing Bacteria Levels (CFU) Mean ± SD	Percent Reduction vs Baseline*	Significance Compared to Baseline†
Colgate® 360™	31	5.72 ± 0.43	4.92 ± 0.40	84.2	$P < .05$
Oral-B® Indicator®	31	5.62 ± 0.44	5.21 ± 0.41	54.0	$P < .05$
Crest® SpinBrush™ PRO	31	5.58 ± 0.39	5.25 ± 0.53	53.2	$P < .05$
Oral-B® CrossAction®	31	5.53 ± 0.44	5.09 ± 0.44	63.7	$P < .05$

\* Within-treatment percent reduction between baseline and postbaseline levels, expressed as a percentage of the baseline levels. Percent reduction was calculated using the antilog of the mean values at baseline and postbrushing.

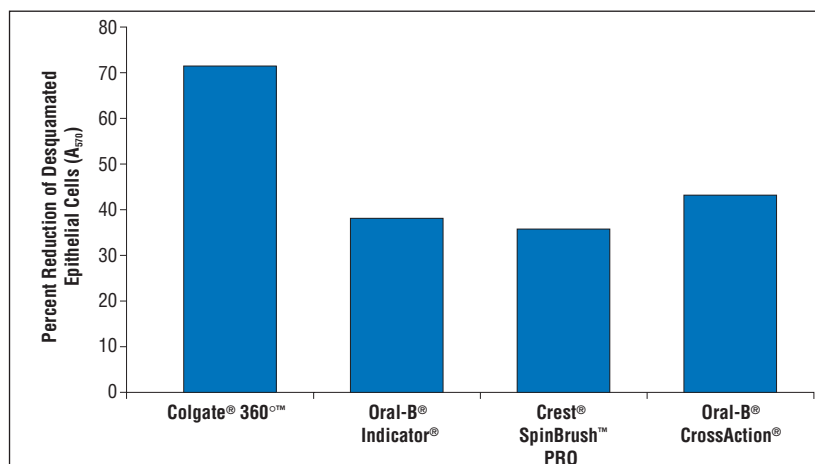
† Significance of analysis of covariance comparison of baseline-adjusted mean level of bacteria.

CFU = colony-forming units; SD = standard deviation.

# Clinical Efficacy of Colgate® 360° and Three Commercially Available Toothbrushes on the Removal of Desquamated Epithelial Cells

Malcolm I Williams, PhD; Joe Vazquez, BA; Diane Cummins, PhD

This randomized, crossover-design clinical study evaluated the desquamating efficacy of a new manual toothbrush (Colgate® 360°™) compared to two commercially available manual toothbrushes (Oral-B® CrossAction® and Oral-B® Indicator®) and a commercially available battery-powered toothbrush (Crest® SpinBrush™ PRO). The subjects—adult men and women—reported to the clinical facility after a 1-week washout period of brushing with a regular fluoride dentifrice and a soft-bristled toothbrush. Participants reported having refrained from oral hygiene procedures, eating, and drinking that morning. After providing a baseline rinse sample, subjects brushed their teeth for 1 minute with their assigned toothbrush and a commercially available fluoride toothpaste. Those using the Colgate® 360°™ toothbrush also were instructed to brush the tongue with the implement on the back of the toothbrush head. Subjects refrained from dental hygiene, eating, and drinking during the 30-minute evaluation period. To provide the samples, subjects rinsed with 10 mL of sterile phosphate-buffered saline solution for 10 sec-



**Figure**—Percent reduction of the levels of desquamated epithelial cells after brushing with the four toothbrushes.

onds. The levels of epithelial cells in the collected rinse samples were determined using a colorimetric test and measured instrumentally at an optical density of 570 nm (OD<sub>570</sub>). Twenty adults completed the study. At baseline, the mean levels of desquamated epithelial cells for the 4 treatments were 0.70 ± 0.27, 0.63 ± 0.20, 0.69 ± 0.30, and 0.62 ± 0.31 for the Colgate® 360°™, Oral-B® Indicator®, Crest® SpinBrush™, and Oral-B® CrossAction®, respectively. Posttreatment, the mean levels of epithelial cells were 0.19, 0.38, 0.42, and 0.34, respectively. All of the treatments provided a statistically significant reduction compared to

their respective baseline. However, the Colgate® 360°™ toothbrush was statistically significantly better than the other three toothbrushes in reducing desquamated epithelial cells. Therefore, the results of this randomized, crossover clinical study indicate that the newly designed Colgate® 360°™ manual toothbrush with a tongue-cleaning implement on the back of the brush head was statistically significantly more effective than the Oral-B® Indicator®, Crest® SpinBrush™, and Oral-B® CrossAction® toothbrushes in removing desquamated epithelial cells.

**Table**—Summary of Desquamated Epithelial Cell Levels After Brushing With the Four Toothbrushes

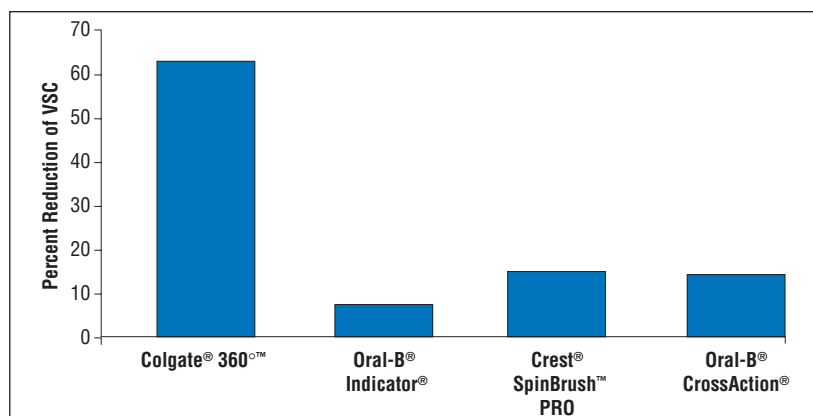
Toothbrush	n	Baseline Levels of Epithelial Cells by OD <sub>570</sub> Mean ± SD	Mean Postbrushing Levels of Epithelial Cells by OD <sub>570</sub> Mean ± SD	Percent Reduction vs Baseline*	Significance vs Baseline†
Colgate® 360°™	20	0.70 ± 0.27	0.19 ± 0.12	74.3	P < .05
Oral-B® Indicator®	20	0.63 ± 0.20	0.38 ± 0.19	39.7	P < .05
Crest® SpinBrush™ PRO	20	0.69 ± 0.30	0.42 ± 0.27	39.1	P < .05
Oral-B® CrossAction®	20	0.62 ± 0.31	0.34 ± 0.17	45.2	P < .05

\* Within-treatment change from baseline and posttreatment levels of epithelial cells, expressed as the change from baseline levels.  
† Significance of within-treatment paired t test comparison of the baseline levels vs postbaseline levels.  
OD<sub>570</sub> = optical density at 570 nm; SD = standard deviation.

# Clinical Comparison of a New Manual Toothbrush and Various Toothbrushes on Breath Volatile Sulfur Compounds

Malcolm I Williams, PhD; Joe Vazquez, BA; Diane Cummins, PhD

The objective of this randomized, crossover study was to compare the effectiveness of a newly designed manual toothbrush (Colgate® 360™) to two commercially available manual toothbrushes (Oral-B® Indicator® and Oral-B® CrossAction®) and a battery-powered toothbrush (Crest® SpinBrush™ PRO) for their ability to reduce overnight volatile sulfur compounds (VSC) associated with oral malodor. The study followed a four-period crossover design. Following a wash-out period, prospective subjects arrived at the testing facility without eating, drinking, or performing oral hygiene for baseline evaluation of breath VSC level. For each phase of the study, subjects were given one of the test toothbrushes and a tube of regular toothpaste to take home and were instructed to brush their teeth in their customary manner for 1 minute. When using the Colgate® 360™ toothbrush, subjects also were instructed to brush the tongue with the implement on the back of the brush for 10 seconds. The following morning, subjects reported to the testing facility, again without performing oral hygiene, eating, or drinking, for the overnight evaluation. After a minimum 2-day washout period, subjects repeated the same regimen using the other toothbrushes. The levels of breath



Figure—Percent reduction of morning breath volatile sulfur compounds (VSC) after using the four test toothbrushes.

VSC were evaluated instrumentally using a gas chromatograph equipped with a flame photometric detector. Measurements were taken in duplicate, and then averaged. The levels of VSC were expressed as parts per billion (ppb) in mouth air. Sixteen adult men and women subjects completed the study. At baseline, the mean levels of VSC in mouth air for the 4 toothbrushes were 719.8 ppb ± 318.4 ppb, 592.8 ppb ± 264.6 ppb, 673.8 ppb ± 405.9 ppb, and 656.2 ppb ± 310.2 ppb for the Colgate® 360™, Oral-B® Indicator®, Crest® SpinBrush™, and Oral-B® CrossAction®, respectively. Overnight, the mean breath VSC levels after using the four toothbrushes were lower than those observed at baseline. The respective mean levels of breath VSC were

266.5 ppb ± 269.9 ppb, 545.2 ppb ± 346.1 ppb, 567.0 ppb ± 335.7 ppb, and 554.6 ppb ± 398.4 ppb. Only the Colgate® 360™ toothbrush provided a statistically significant reduction ( $P < .05$ ) in breath VSC vs baseline. Additionally, the Colgate® 360™ toothbrush was statistically significantly better ( $P < .05$ ) than the three commercial toothbrushes in reducing breath VSC. Therefore, the results of this randomized, crossover clinical study indicate that a newly designed manual toothbrush with a tongue-cleaning implement on the back of the brush head was significantly more effective than three commercially available toothbrushes in reducing morning breath VSC associated with oral malodor.

Table—Summary of Breath VSC Levels After Brushing With the Four Toothbrushes

Toothbrush	n	Baseline VSC Levels (ppb) Mean ± SD	Overnight VSC Levels (ppb) Mean ± SD	Percent Reduction from Baseline*	Significance Compared to Baseline†
Colgate® 360™	16	719.8 ± 318.4	266.5 ± 269.9	63.0	$P < .001$
Oral-B® Indicator®	16	592.8 ± 264.6	545.2 ± 346.1	8.1	$P < .1489$
Crest® SpinBrush™ PRO	16	673.8 ± 405.9	567.0 ± 335.7	15.8	$P < .2341$
Oral-B® CrossAction®	16	656.2 ± 310.2	554.6 ± 398.4	15.5	$P < .1786$

\*Within-treatment percent reduction between baseline and postbaseline levels, expressed as a percentage of the baseline levels.

†Significance of analysis of covariance comparison of baseline-adjusted mean breath VSC levels.

VSC = volatile sulfur compounds; ppb = parts per billion; SD = standard deviation.

# Comparison of the Clinical Efficacy of a New Manual Toothbrush on Gingivitis Reduction and Plaque Removal

Suru Mankodi, DDS, MSD; Gerald N Wachs, MD; Dolores M Petrone, BA; Patricia Cbaknis, BS; Margaret Petrone, JD; William DeVizio, DMD

**Table—Summary of the 4-Week Gingival Index Scores for Subjects Who Completed the 4-Week Clinical Study**

Parameter	Treatment	n	4-Week Summary*	Within-treatment Analysis		Between-treatment Analysis	
				Percent Reduction <sup>†</sup>	Significance <sup>‡</sup>	Percent Difference <sup>§</sup>	Significance <sup>  </sup>
Gingival Index	Colgate® 360™	39	0.964 ± 0.067	10.0	<i>P</i> < .05	9.9	<i>P</i> < .05
	Oral-B® Indicator®	42	1.070 ± 0.058	0.9	NS		
Gingivitis Severity Index	Colgate® 360™	39	0.030 ± 0.029	67.0	<i>P</i> < .05	72.0	<i>P</i> < .05
	Oral-B® Indicator®	42	0.107 ± 0.141	-24.4	NS		

\*Mean ± standard deviation.  
<sup>†</sup>Reduction between the baseline and 4-week mean scores, expressed as a percentage of the baseline mean score. Positive values indicate lower gingivitis scores at the 4-week examination than at the baseline examination.  
<sup>‡</sup>Significance of paired *t* test comparing the baseline and 4-week examinations. NS = *P* > .05.  
<sup>§</sup>Difference between the 4-week mean scores, expressed as a percentage of the 4-week mean score for the Oral-B® Indicator®. Positive values indicate lower gingivitis scores for the Colgate® 360™.  
<sup>||</sup>Significance of postanalysis of covariance comparison of baseline-adjusted mean scores.  
 NS = not significant.

The objective of this controlled, examiner-blind, 4-week clinical study was to evaluate and compare the safety and efficacy of a newly designed manual toothbrush (Colgate® 360™) to the Oral-B® Indicator® toothbrush for the control of supragingival plaque and gingivitis. A total of 82 subjects from the northern New Jersey area reported to the clinical facility for a base-

line plaque and gingivitis examination after having refrained from all oral hygiene procedures for 12 hours, as well as from eating, drinking, and smoking for 4 hours. The population was comprised of healthy adult men and women 30 to 68 years of age. After the baseline examinations, qualifying subjects were randomized into two groups to one of the two test toothbrushes. All subjects were

instructed to brush their teeth for 1 minute under supervision, after which they were again examined for supragingival plaque. They were then instructed to brush their teeth twice a day for 1 minute with their assigned toothbrush and a commercially available toothpaste (Colgate® Cavity Protection Great Regular Flavor Fluoride Toothpaste) for the next 4 weeks. After 4 weeks, subjects

**Table—Summary of the Pre- and Postbrushing Plaque Index Scores for Subjects Examined After a Single Toothbrushing**

Parameter	Treatment	n	Prebrushing Summary*	Postbrushing Summary*	Pre- to Postbrushing Reductions in Plaque Index			
					Difference Mean ± SD	Percent Reduction <sup>†</sup>	Between-treatment Analysis	
						Percent Difference <sup>‡</sup>	Significance <sup>§</sup>	
Whole-mouth Plaque Index	Colgate® 360™	39	0.641 ± 0.032	0.303 ± 0.090	0.338 ± 0.084	52.7 <sup>  </sup>	27.1	<i>P</i> < .05
	Oral-B® Indicator®	42	0.652 ± 0.050	0.386 ± 0.066	0.266 ± 0.068	40.8 <sup>  </sup>		
Plaque Index on Interproximal Sites	Colgate® 360™	39	0.986 ± 0.044	0.584 ± 0.221	0.402 ± 0.218	40.8 <sup>  </sup>	77.1	<i>P</i> < .05
	Oral-B® Indicator®	42	0.998 ± 0.008	0.771 ± 0.194	0.227 ± 0.195	22.7 <sup>  </sup>		
Plaque Index on Gumline Sites	Colgate® 360™	39	0.998 ± 0.012	0.479 ± 0.180	0.519 ± 0.178	52.0 <sup>  </sup>	31.1	<i>P</i> < .05
	Oral-B® Indicator®	42	0.996 ± 0.015	0.600 ± 0.144	0.396 ± 0.148	39.8 <sup>  </sup>		

\*Mean ± standard deviation.  
<sup>†</sup>Reduction between the pre- and postbrushing scores, expressed as a percentage of the prebrushing score.  
<sup>‡</sup>Difference between the pre- and postbrushing reductions in plaque, expressed as a percentage of the reduction for the Oral-B® Indicator®. Positive values indicate greater plaque reductions for the Colgate® 360™.  
<sup>§</sup>Significance of postanalysis of covariance comparison of mean plaque reductions, adjusted for prebrushing plaque scores.  
<sup>||</sup>Statistically significant reduction from pre- to postbrushing measurements.  
 SD = standard deviation.

returned to the clinical facility for a final gingivitis and plaque examination. Eighty-one subjects complied with the protocol and completed the 4-week clinical study. The results of the study indicated that the new manual toothbrush was statistically significantly effective in reducing

gingivitis after 4 weeks and in removing plaque after a single toothbrushing and after 4 weeks of use. Also, the new manual toothbrush exhibited a statistically significantly greater reduction in gingivitis and in gingivitis-related bleeding sites after 4 weeks of use as well as statistically signifi-

cantly greater plaque removal after a single toothbrushing and after 4 weeks of use, as compared to the Oral-B® Indicator® toothbrush. This superior plaque removal performance was found in separate analyses of the whole mouth, at interproximal surfaces, and at the gumline.

**Table—Summary of the 4-Week Plaque Index Scores for Subjects Who Completed the 4-Week Clinical Study**

Parameter	Treatment	n	4-Week Summary*	Within-treatment Analysis		Between-treatment Analysis	
				Percent Reduction†	Significance‡	Percent Difference§	Significance¶
Whole-mouth Plaque Index	Colgate® 360™	39	0.466 ± 0.078	27.3	<i>P</i> < .05	16.5	<i>P</i> < .05
	Oral-B® Indicator®	42	0.558 ± 0.071	14.4	<i>P</i> < .05		
Plaque Index on Interproximal Sites	Colgate® 360™	39	0.828 ± 0.190	16.0	<i>P</i> < .05	11.3	<i>P</i> < .05
	Oral-B® Indicator®	42	0.934 ± 0.096	6.4	<i>P</i> < .05		
Plaque Index on Gumline Sites	Colgate® 360™	39	0.781 ± 0.137	21.7	<i>P</i> < .05	15.4	<i>P</i> < .05
	Oral-B® Indicator®	42	0.923 ± 0.076	7.3	<i>P</i> < .05		

\*Mean ± standard deviation.

†Reduction between the baseline and 4-week mean scores, expressed as a percentage of the baseline mean. Positive values indicate lower plaque scores at the 4-week examination than at the baseline examination.

‡Significance of paired *t* test comparing the baseline and 4-week examinations.

§Difference between the 4-week mean scores, expressed as a percentage of the 4-week mean score for the Oral-B® Indicator®. Positive values indicate lower plaque scores for the Colgate® 360™.

¶Significance of postanalysis of covariance comparison of baseline-adjusted means.

## Clinical Comparison of the Gingivitis Reduction and Plaque Removal Efficacy of a New Manual Toothbrush

Salim Nathoo, PhD, DDS; Patricia Chaknis, BS; Margaret Petrone, JD; William DeVizio, DMD

The objective of this controlled, examiner-blind, 4-week clinical study was to evaluate and compare the safety and efficacy of a newly designed manual

toothbrush (Colgate® 360™) to the Oral-B® CrossAction® toothbrush for the control of supragingival plaque and gingivitis. A total of 80 subjects from the central New Jersey

area reported to the clinical facility for a baseline plaque and gingivitis examination after having refrained from all oral hygiene procedures for 12 hours, as well as from eating,

**Table—Summary of the 4-Week Gingival Index Scores for Subjects Who Completed the 4-Week Clinical Study**

Parameter	Treatment	n	4-Week Summary*	Within-treatment Analysis		Between-treatment Analysis	
				Percent Reduction†	Significance‡	Percent Difference§	Significance¶
Gingival Index	Colgate® 360™	39	1.321 ± 0.292	9.8	<i>P</i> < .05	1.9	NS
	Oral-B® CrossAction®	39	1.347 ± 0.291	8.4	<i>P</i> < .05		
Gingivitis Severity Index	Colgate® 360™	39	0.359 ± 0.245	25.8	<i>P</i> < .05	2.7	NS
	Oral-B® CrossAction®	39	0.369 ± 0.260	21.0	<i>P</i> < .05		

\*Mean ± standard deviation.

†Reduction between the baseline and 4-week mean scores, expressed as a percentage of the baseline mean score. Positive values indicate lower gingivitis scores at the 4-week examination than at the baseline examination.

‡Significance of paired *t* test comparing the baseline and 4-week examinations.

§Difference between the 4-week mean scores, expressed as a percentage of the 4-week mean score for the Oral-B® CrossAction®. Positive values indicate lower gingivitis scores for the Colgate® 360™.

¶Significance of postanalysis of covariance comparison of baseline-adjusted mean scores. NS = *P* > .05.

NS = not significant.

**Table—Summary of the Pre- and Postbrushing Plaque Index Scores for Subjects Examined After a Single Toothbrushing**

Parameter	Treatment	n	Prebrushing Summary*	Postbrushing Summary*	Pre- to Postbrushing Reductions in Plaque Index			
					Difference Mean ± SD	Percent Reduction <sup>†</sup>	Between-treatment Analysis	
							Percent Difference <sup>‡</sup>	Significance <sup>§</sup>
Whole-mouth Plaque Index	Colgate® 360 <sup>o™</sup>	40	0.710 ± 0.065	0.436 ± 0.066	0.274 ± 0.074	38.6 <sup>  </sup>	15.1	P < .05
	Oral-B® CrossAction®	40	0.714 ± 0.056	0.476 ± 0.064	0.238 ± 0.062	33.3 <sup>  </sup>		
Plaque Index on Interproximal Sites	Colgate® 360 <sup>o™</sup>	40	0.945 ± 0.092	0.487 ± 0.181	0.458 ± 0.176	48.5 <sup>  </sup>	19.3	P < .05
	Oral-B® CrossAction®	40	0.961 ± 0.067	0.577 ± 0.173	0.384 ± 0.183	40.0 <sup>  </sup>		
Plaque Index on Gumline Sites	Colgate® 360 <sup>o™</sup>	40	1.000 ± 0.000	0.934 ± 0.067	0.066 ± 0.067	6.6 <sup>  </sup>	29.4	NS
	Oral-B® CrossAction®	40	1.000 ± 0.000	0.949 ± 0.065	0.051 ± 0.065	5.1 <sup>  </sup>		

\* Mean ± standard deviation.  
<sup>†</sup> Reduction between the pre- and postbrushing scores, expressed as a percentage of the prebrushing score.  
<sup>‡</sup> Difference between the pre- and postbrushing reductions in plaque, expressed as a percentage of the reduction for the Oral-B® CrossAction®. Positive values indicate greater plaque reductions for the Colgate® 360<sup>o™</sup>.  
<sup>§</sup> Significance of postanalysis of covariance comparison of mean plaque reductions, adjusted for prebrushing plaque scores. NS = P > .05.  
<sup>||</sup> Statistically significant reduction from pre- to postbrushing measurements.  
SD = standard deviation; NS = not significant.

drinking, and smoking for 4 hours. The population was comprised of healthy adult men and women 20 to 58 years of age. After the baseline examinations, qualifying subjects were randomized into two groups and assigned to one of the two test toothbrushes. All subjects were instructed to brush their teeth for 1 minute under supervision, after which they were again examined for supragingival plaque. They were then instructed to brush their teeth

twice a day with their assigned toothbrush and a commercially available toothpaste (Colgate® Cavity Protection Great Regular Flavor Fluoride Toothpaste) for the next 4 weeks. After 4 weeks of use, subjects returned to the clinical facility for a final gingivitis and plaque examination. Seventy-eight subjects complied with the protocol and completed the 4-week clinical study. The results of the study indicated that the new manual tooth-

brush was statistically significantly effective in reducing gingivitis after 4 weeks and in removing plaque after a single toothbrushing and after 4 weeks of use. Also, the group using the new manual toothbrush exhibited a statistically significantly greater reduction in plaque of up to 40% and no statistically significant difference in gingivitis reduction after 4 weeks of use, as compared to the Oral-B® CrossAction® toothbrush.

**Table—Summary of the 4-Week Plaque Index Scores for Subjects Who Completed the 4-Week Clinical Study**

Parameter	Treatment	n	4-Week Summary*	Within-treatment Analysis		Between-treatment Analysis	
				Percent Reduction <sup>†</sup>	Significance <sup>‡</sup>	Percent Difference <sup>§</sup>	Significance <sup>  </sup>
Oral-B® CrossAction®	39	0.391 ± 0.062	45.2	P < .05			
Plaque Index on Interproximal Sites	Colgate® 360 <sup>o™</sup>	39	0.246 ± 0.165	73.9	P < .05	39.9	P < .05
	Oral-B® CrossAction®	39	0.409 ± 0.179	57.4	P < .05		
Plaque Index on Gumline Sites	Colgate® 360 <sup>o™</sup>	39	0.797 ± 0.080	20.3	P < .05	8.8	P < .05
	Oral-B® CrossAction®	39	0.874 ± 0.075	12.6	P < .05		

\* Mean ± standard deviation.  
<sup>†</sup> Reduction between the baseline and 4-week mean scores, expressed as a percentage of the baseline mean. Positive values indicate lower plaque scores at the 4-week examination than at the baseline examination.  
<sup>‡</sup> Significance of paired t test comparing the baseline and 4-week examinations.  
<sup>§</sup> Difference between the 4-week mean scores, expressed as a percentage of the 4-week mean score for the Oral-B® CrossAction®. Positive values indicate lower plaque scores for the Colgate® 360<sup>o™</sup>.  
<sup>||</sup> Significance of postanalysis of covariance comparison of baseline-adjusted means.

# Laboratory Investigation of Colgate® 360°™ Toothbrush and Oral-B® Indicator® Toothbrush for the Removal of Dental Stains

Carl J Kleber, MSD, PhD; James H Kemp, BA; Michael H Moore, BS, MS; Thomas E Mintel, ME

The objective of this in vitro study was to evaluate the stain-removal efficacy of a newly designed manual toothbrush (Colgate® 360°™) relative to a commercially available toothbrush (Oral-B® Indicator®). A modification of Stookey et al was used to evaluate the stain-removal effects of toothbrushes instead of dentifrice on bovine teeth. A V-8 mechanical cross-brushing machine equipped with the test toothbrushes and adjusted to 500g force to enamel surfaces evaluated stain removal using a dentifrice slurry and water after 800 double strokes. The overall results of this laboratory investigation indicate that the Colgate® 360°™ toothbrush is more effective,  $P = .05$ , than the commercial Oral-B® Indicator® toothbrush in removing dental stain and brightening teeth using a standard toothpaste or water.

## Results

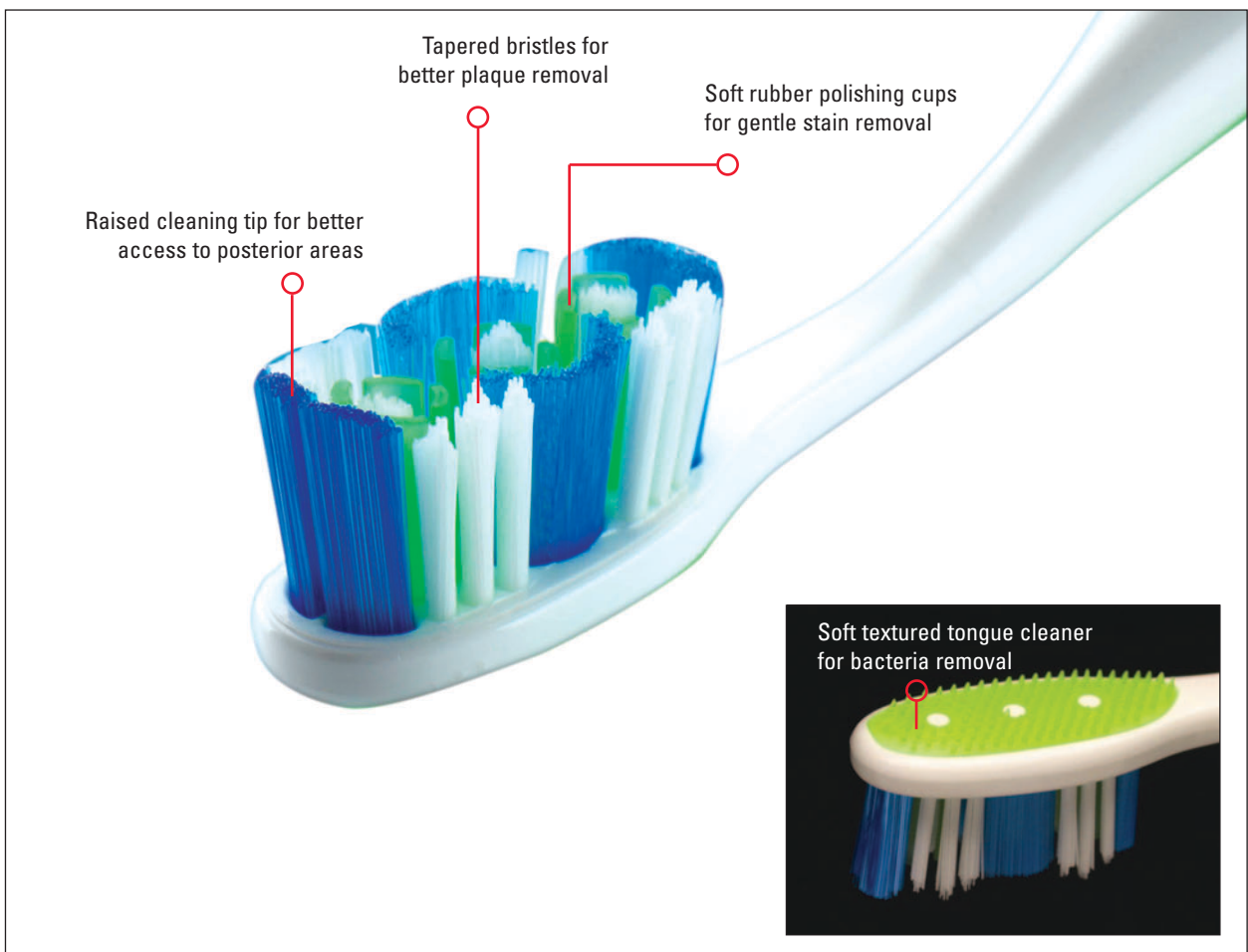
1. The Colgate® 360°™ toothbrush removed 50.22% of multiple stains compared with 46.66% for the Oral-B® Indicator®.
2. The Colgate® 360°™ toothbrush left 7% (using R%) less stain than the Oral-B® Indicator® (when comparing % Stain Remaining using the Bliss Modification of the Fieller Confidence Interval) with paste slurry.
3. The Colgate® 360°™ toothbrush removed 8% (using R%) more stain compared to the Oral-B® Indicator® (using the Bliss Modification of the Fieller Confidence Interval) with paste slurry.
4. The Colgate® 360°™ toothbrush removed 14.44% of multiple stains compared with 2.3% for the Oral-B® Indicator® with water.
5. The Colgate® 360°™ toothbrush left 12% (using R%) less stain than the Oral-B® Indicator® (when comparing % Stain Remaining using the Bliss Modification of the Fieller Confidence Interval) with water.
6. The Colgate® 360°™ toothbrush removed 600% (using R%) more stain compared to the Oral-B® Indicator® (using the Bliss Modification of the Fieller Confidence Interval) with water.

## Conclusions

1. The Colgate® 360°™ was more effective than the Oral-B® Indicator® toothbrush in removing dental stains from teeth when evaluated in vitro using a standard dentifrice slurry.
2. The Colgate® 360°™ toothbrush was more effective than the Oral-B® Indicator® toothbrush in removing dental stains from teeth when evaluated in vitro using water.
3. The overall results of this laboratory investigation indicate that the Colgate® 360°™ toothbrush is more effective than the commercial Oral-B® Indicator® toothbrush in clinically removing dental stain and brightening teeth using toothpaste or water.



For more information,  
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# Colgate® 360™ Whole Mouth Clean



## **A Preview Summary**

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