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## Providing Daily Oral Infection Control to Persons Dependent on others for Activities of Daily Living: A Semi-Qualitative Descriptive Study

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### Abstract

**Background:** The purpose of this study is to evaluate caregiver assessment of the ease of use of a specially designed toothbrush for providing daily oral infection control (toothbrushing) to persons dependent upon others for activities of daily living.

**Method:** Eighty-eight caregivers accepted surveys and multi-surface toothbrushes to provide daily oral infection control to the person to whom they assisted. They were asked to evaluate the ease of use of the multi-surface toothbrush, and provide comments about it.

**Results:** There were 30 surveys returned (34.1% response rate). In terms of the ease of use, 90.0% of the caregivers agreed (63.3% strongly agreed, and 26.7% agreed) that the multi-surface toothbrush was easier to use than their previous toothbrush. Comments about the toothbrush were predominantly positive.

**Conclusion:** It is difficult to provide daily oral infection control to another individual. Having an efficient oral health aid which makes it easier to do so is important to caregivers. With the overwhelming positive response to the multi-surface toothbrush, it is important to disseminate the information about its ease of use.

vast. As the USA population ages, it is expected that the prevalence of the need for caregivers to assist persons dependent on others for activities of daily living (PD-ADL) is going to increase.

Provision of care involves medical, psychological, mental, physical, social, and dental factors among many others. One of the dental ADL which often requires assistance is daily oral infection control (toothbrushing). There is limited information on assisted daily oral infection control in the current peer-reviewed literature, and a text book for long-term management often has only a paragraph or two concerning oral care [4]. There is a need for improved oral hygiene in PD-ADL. Dental care provision to PD-ADL is becoming recognized as an important component of general health. PD-ADL in the 21st century are more likely to have retained more teeth than PD-ADL of previous generations due to increased knowledge, community water fluoridation, and the provision of daily oral infection control with fluoridated toothpaste. However, inadequate daily oral infection control for PD-ADL can have and has had systemic consequences.

The oral hygiene of older adults who are completely dependent has been reported as significantly poorer than people who are partially dependent [5]. Effective oral health care in PD-ADL reduces the number of respiratory pathogens such as *Staphylococcus species*, *Pseudomonas aeruginosa* and *Candida albicans* [6], thereby reducing the potential for pneumonia and other respiratory complications. Adequate oral health care is important for overall health.

**Keywords:** Multi-surface toothbrush; Activities of daily living; Oral health care

### Introduction

Worldwide, 15% of the population (1 billion people) has a disability [1]. In the USA, the prevalence of people with disabilities is approximately 19%. Of the people with disabilities in the USA, more than 50% have severe disabilities [2]. As a specific example, 40% of the 795,000 people in the USA who had an incident stroke have moderate to severe impairments which require assistance [3]. Disabilities range from those which are limited/occasional to those which are permanent/life-long. The implications of impaired function are

In addition to the overall health complications which may result from inadequate oral health care, researchers reported that poor and deteriorating oral health and poor oral health-related quality of life have the potential to increase the risk of depressive symptoms in older adults [6]. Oral health is an important factor in the well-being of older adults [7].

A caregiver's own physical health is often impacted by the challenges of brushing a PD-ADL's teeth. In a study of female caregivers, low back pain was related to brushing the teeth of a PD-ADL in 28% of caregivers with an unadjusted odds ratio of 1.66 (0.73, 3.73) [8]. Researchers reported that people with special health care needs bite, spit, hit and/or kick caregivers [9]. Caregivers often are confronted with issues of non-compliance, refusal, lack of time, lack of training, and lack of

appropriately designed cleaning aids. Providing care to someone requires the ability to determine (through touch) the appropriate amount of pressure on the toothbrush without causing discomfort to a PD-ADL. Caregivers want quality, effective, efficient, and easy to use aids to provide care.

Toothbrush quality varies from good toothbrushes with soft rounded bristles to jagged hard bristles. Prices vary accordingly. Consequences of inadequate daily oral infection control are dental caries, periodontal disease, and tooth loss. PD-ADL incur dental caries, gingivitis, and periodontal diseases at high rates [10]. Caregivers have a critical need for a toothbrush design to improve the toothbrushing experience for both the PD-ADL and for themselves. Soft-bristled toothbrushes with adapted handles and battery powered toothbrushes have helped people improve their own oral hygiene. However, the provision of care to someone else has been reported by caregivers as difficult. A multi-surface toothbrush (Collis Curve<sup>®</sup>, Brownsville, TX) was specifically designed to be easy to use for caregivers to provide oral infection control to PD-ADL. The handle is designed for the caregiver; the bristles are soft; and the bristles are designed in such a manner that the occlusal (biting), buccal (cheek side) and lingual (tongue side) surfaces of the teeth are cleaned simultaneously to shorten the time needed to provide effective oral infection control. The multi-surface toothbrush has been evaluated in previous studies as effective in removing plaque (**Figure 1**) [11,12].



**Figure 1** Collis Curve<sup>®</sup> toothbrush.

The purpose of this study is to evaluate caregiver assessment of the ease of use of the specially designed toothbrush for providing daily oral infection control to PD-ADL. Our research hypothesis is that caregivers will assess the multi-surface toothbrush as easier to use as compared with the toothbrush with which they had been using to provide oral care to their PD-ADL. Our rationale is that it is important to determine if the multi-surface toothbrush can improve the ease of providing daily oral infection control, and thereby increase the likelihood of more frequent oral care to PD-ADL.

## Methods

This semi-qualitative descriptive research study received West Virginia university institutional board approval (1411496869). Caregivers of PD-ADL over age 18 years, were

recruited to complete a pre-survey and post-survey concerning the ease of use of a multi-surface toothbrush (Collis Curve<sup>®</sup>, Brownsville, TX). Caregiver recruitment occurred in a special needs dental clinic by RRD. She asked caregivers of PD-ADL to evaluate the ease of use of an adult-sized multi-surface toothbrush. They were provided verbal and written instructions in the use of the toothbrush. She also instructed the caregivers to complete the pre-survey related to the toothbrush that they had been using to provide care to their PD-ADL prior to the study and to clean their PD-ADL's teeth with the multi-surface toothbrush for three days. Following the three days of use, the caregivers were asked to complete the post-survey and return the surveys in postage-paid return envelopes. Eighty-eight caregivers accepted the surveys and multi-surface toothbrushes, and 30 caregivers returned their surveys (The survey is presented in the Appendix).

## Key response

The key response was the ease of use of the multi-surface toothbrush as compared with the toothbrush that the caregiver had been using previously. The caregivers were asked to respond to the Likert-style statement in the post-survey: "The Collis Curve<sup>®</sup> toothbrush was easier to use for assisted care than the toothbrush that was being used before". The possible responses were: strongly agree; agree; neutral; disagree; and strongly disagree.

## Other responses

Other important variables derived from the survey were: the number of times the PD-ADL had his/her teeth brushed (pre-survey and post-survey), change in compliance and combativeness behavior of the PD-ADL after using the multi-surface toothbrush; quality of the toothbrush used in the pre-evaluation; and toothbrush type used in the pre-evaluation. Demographic variables concerning the caregiver and PD-ADL were: age; sex; race/ethnicity; and education. Other questions which were presented were if the caregiver was a paid caregiver, family member, or other (volunteer, student, etc.); residence of the PD-ADL (independent/with family at home, group); and condition/disability of the PD-ADL.

Additionally, caregivers were asked for their comments about the multi-surface toothbrush at the end of the survey.

## Results

### Sample Description

There were 88 surveys and toothbrushes distributed to caregivers and 30 caregivers returned their surveys (34.1% response rate). Most (93.3%) of the caregivers were female, had more than a high school education (60.0%), were ages 36-55 years (66.7%), and were non-Hispanic white (93.3%). Their relationships with their PD-ADL were evenly distributed between being a family member (46.6%) and paid caregiver (50.0%).

The PD-ADL were evenly distributed by age among the categories from age 1 year to age 65 years. There were fewer PD-ADL who were age 66 years and above. Most PD-ADL (66.7%) had less than a high school education, were non-Hispanic white (86.7%) and lived independently or with a family member (66.7%).

Before the use of the multi-surface toothbrush, the caregivers typically used a conventional toothbrush (60.0%) and most caregivers (90.1%) rated it as good to excellent. There were 53.3% caregivers who reported brushing the teeth of their PD-ADL 2 or more times per day.

### Ease of use results

In terms of the ease of use, 90.0% of caregivers agreed (63.3% strongly agreed and 26.7% agreed) that the multi-

surface toothbrush was easier to use than their previous toothbrush.

There were 70.0% of participants who agreed or strongly agreed that their PD-ADL was more compliant, and 77.0% agreed or strongly agreed that their PD-ADL was less combative during oral care. There were 53.3% who reported brushing their PD-ADL 2 or more times per day, however there were 6.7% more who reported not brushing every day as compared with the responses to the pre-test. Details are presented in **Table 1**.

Eighteen participants provided comments about the multi-surface toothbrush at the end of the survey. One expressed that the toothbrush head was too large for his/her PD-ADL. Most of the comments were positive and suggested satisfaction with the toothbrush.

**Table 1** Descriptive statistics (Number, %).

Characteristics of the caregiver		
Age	18-35 years	3, 10.0%
	36-55	20, 66.7%
	36-55	4, 13.3%
	66 and above	3, 10.0%
Education	Less than high school	0
	High school graduate	11, 36.9%
	More than high school	18, 60.0%
	Missing	1, 3.3%
Sex	Female	28, 93.3%
	Male	2, 6.7%
Race/ethnicity	Non-Hispanic white	28, 93.3%
	Non-Hispanic black	1, 3.3%
	Hispanic	0
	Other	0
	Missing	1, 3.3%
Relationship with PD-ADL	Family	14, 46.6%
	Paid caregiver	15, 50.0%
	Other (volunteer, student, etc.)	1, 3.3%
Characteristics of the PD-ADL		
Age	1-17 years	8, 26.7%
	18-35	9, 30.0%
	36-55	9, 30.0%
	56-65	4, 13.3%
	66 and above	0
Education	Less than high school	20, 66.7%
	High school graduate	10, 33.3%

	More than high school	0
Sex	Female	16, 53.3%
	Male	14, 46.7%
Race/ethnicity	Non-Hispanic white	26, 86.7%
	Non-Hispanic black	3, 10.0%
	Hispanic	0
	Other	1, 3.3%
Residence	Independent, or with family at home	20, 66.7%
	Group home	10, 33.3%
<b>Assessments before the use of the multi-surface brush</b>		
Characteristics of toothbrush		
Type	Conventional	18, 60.0%
	Battery powered	10, 33.3%
	Rechargeable electric	2, 6.7%
Assessment of the toothbrush	Excellent	11, 36.7%
	Very good	5, 16.7%
	Good	11, 36.7%
	Fair	2, 6.7%
	Poor	1, 3.3%
Number of times teeth were brushed	Not every day	2, 6.7%
	Once a day	12, 40.0%
	2 or more times per day	16, 53.3%
<b>Assessments after the use of the multi-surface brush</b>		
Easier to use	Strongly agree	19, 63.3%
	Agree	8, 26.7%
	Neutral	2, 6.7%
	Disagree	1, 3.3%
	Missing	
PD-ADL was more compliant	Strongly agree	15, 50.0%
	Agree	6, 20.0%
	Neutral	8, 26.7%
	Disagree	1, 3.3%
	Strongly disagree	1, 3.3%
PD-ADL was less combative	Strongly agree	16, 53.3%
	Agree	7, 23.7%
	Neutral	5, 16.7%
	Disagree	2, 6.7%
	Strongly disagree	0
Number of times teeth were brushed	Not every day	4, 13.3%

	Once a day	12, 33.3%
	2 or more times per day	16, 53.3%

These qualitative assessments helped to enrich the quantitative results of the survey. The caregiver comments are presented in **Table 2**.

**Table 2** Caregiver comments.

"We loved this and would like to know how to get some for our other clients."
"1. Cleaning is more thorough-gets both sides of a tooth. 2. Bristles are softer and more pliable."
"Pt more relaxed during brushing; brush was easier to use."
"I believe the brush would have been better if a little firmer. I liked the curled edges and they seemed to work better reaching all teeth."
"We loved this toothbrush."
"It brushes good (Sic)."
"I like it better than a normal toothbrush but he still hates getting his teeth brushed."
"My daughter even initiated a brushing (Sic) (first time ever). She is much more compliant now."
"Great-it's a life changer."
"Great concept, however, my daughter didn't seem to like the length of the brush. It was too big for her mouth. The battery operated one we use has a small round head."
"Love the toothbrush, easier to brush. Client don't (Sic) tolerate teeth being brushed for long. The fact that the Collis toothbrush goes around both sides of tooth (Sic) is a big "plus."
"This brush is easier to get in the mouth. Client tolerates it well."
"It works great."
"Much better than the regular toothbrush."
"Really improves the quality of the person ability (Sic) to tolerate teeth being brushed. Less combative and teeth was (Sic) cleaned much easier. Love the Collis toothbrush."
"Like toothbrush (Collis curve) Less time to brush, client doesn't like teeth brushed. I feel I do a better job brushing with this toothbrush since it goes around tooth (Sic)."
"It is awesome!"
"My son's teeth is (Sic) difficult to brush. The Collis brush is so much better. Best toothbrush ever."

## Discussion

In regard to the ease of use of a toothbrush for providing care to PD-ADL, the multi-surface toothbrush was reported as being easier to use as compared to the toothbrushes which caregivers had previously used by 90.0% of the caregivers (63.3% strongly agreed and 26.7% agreed). The multi-surface toothbrush was designed as an oral healthcare aid for caregivers to provide daily oral infection control to another individual. It has been available for over 25 years, and has been previously shown to be effective in plaque removal [11,12]. In a study in which a small sample of healthy

volunteers had their teeth cleaned by a non-professional caregiver, the multi-surface toothbrush and a reciprocal rotating brush were equivalent in plaque removal [12]. In the comparison of the multi-surface toothbrush with a conventional toothbrush, the multi-surface toothbrush was better in plaque removal [12]. It should be noted that ease of use without this evidence of effectiveness in plaque removal would not justify use of the multi-surface toothbrush. For example, disposable foam brushes or swabs, are easy to use, but result in plaque scores which are similar to pre-brushing plaque score [12]. Additionally, lemon swabs may lower oral pH to 2-4, well below the normal pH of 6-7 [13], and though easy to use, may be harmful to oral tissue.

In literature searches for the ease of use of multi-surface toothbrushes for PD-ADL, there were no similar studies with which to compare this study. Many caregivers are unaware of the availability of the multi-surface toothbrush and its potential to improve the daily oral infection control experience for themselves and their PD-ADL. It is important to provide daily oral infection control to PD-ADL. In a study of 184 nursing home residents who did not have oral healthcare assistance and 182 who had professional assistants provide 5 minutes of oral care after each meal, there were decreases in pneumonia, febrile days, and death; and improvements in cognitive function in the residents receiving oral care [14]. Similarly, in a study of 143 veterans in a Veterans Affairs nursing home, the veterans who did not have oral care assistance had a greater odds of pneumonia-related death (odds ratio=3.57, P=0.03) [15]. Effective brushing with assistance as needed is a significant factor in both oral healthcare and general health.

Although not a focus of this study, the knowledge, attitudes and actions of the caregiver in terms of his or her own dental health impact the provision of care for others [16]. The fears and negative attitudes by caregivers can become an obstacle for PD-ADL good oral health. Educating caregivers in oral healthcare and giving them practical ways for the PD-ADL to tolerate daily oral infection control is crucial. A few of the important techniques include having the ability to have someone take over an action when a PD-ADL is being non-compliant (rescuing), task breakdown (short steps are used in a process, such as toothbrushing), distraction (singing, playing, etc.), bridging (improving sensory connections and focus, if the PD-ADL can assist in a task), hand-over-hand if the PD-ADL can assist in a task, and chaining (the caregiver begins a task and the PD-ADL takes over where it is possible) [17]. Caregivers need good skills and innovative devices to improve the care that they can provide and to make their jobs easier.

## Study strengths and limitations

The multi-surface toothbrush has been evaluated as an effective tool for PD-ADL in the setting of clinical research. A strength of this study is that lay caregivers provided



information about the ease of use of the multi-surface toothbrush in non-clinical settings. This study was an evaluation of in-the-field use of the toothbrush from caregivers who actually provided daily care to specific PD-ADL. The evaluations were, therefore, what would be expected of typical use of the toothbrush—a study strength. This study strength is also a limitation in that standardized, calibrated examiners did not systematically determine ease of use of the multi-surface toothbrush; and that ease of use is a subjective report with the potential of bias. This study specifically examined ease of use of the multi-surface toothbrush; however, other factors are also involved in the provision of daily oral infection control to PD-ADL. For example, the knowledge (training), attitudes, available time, and actions of the caregiver in terms of his or her own dental health impact the provision of care for others [16]. The fears and negative attitudes by caregivers toward brushing the teeth of another individual (fears of being bitten, spat upon, hit or kicked, etc.) can become obstacles for providing good oral health in PD-ADL in addition to the ease of use of an oral aid.

Another study limitation was that the study was conducted at one health center in the Appalachian region. The results are potentially not generalizable to other settings or other regions. Also, there was a 34.1% response rate for this study. Although low, it is similar to the 31.5% published average response rates of mailed surveys in a study of survey response rates [18] and to the hospital consumer assessment of healthcare providers systems survey (sponsored by the centers for medicare and medicaid services and agency for healthcare research and quality) which had an average survey response rate of 32% over 3848 hospitals [19], and the response rate to the national household education survey, 2007 (38.9%). The decreasing response rates to surveys are challenges for all survey research in the USA [20].

Potentially, the response rate of this study could have been improved had a follow-up mailing to the caregivers been completed. However, the intent of this study was to provide as anonymous a survey as possible to decrease social desirability bias. As a result, the names and addresses of participants were not collected and follow-up of non-responders did not occur. A larger response rate and sample size would have provided more evidence for our conclusion. However, the overwhelming response indicating that the multi-surface toothbrush was easier to use would also be expected from a larger sample. Additionally, the caregivers provided positive descriptive comments which help to enrich the quantitative responses and strengthen the study.

## Conclusion

There were 90.0% of caregivers of PD-ADL who preferred the multi-surface toothbrush (Collis Curve®) to other toothbrushes as being easier to use. Healthcare professionals should inform caregivers of the availability of the multi-surface toothbrush as an option to improve oral healthcare for PD-ADL.

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