

**The Effects of Self-Management Strategies on Toothbrushing for Adults in a Supported
Community Living**

By

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Abstract

Personal hygiene is an important area related to positive health. Three participants who independently brushed their teeth but did not brush frequently or completely were taught to record and implement a self-management checklist. Behavioral Skills Training (BST) was used to train participants to accurately complete and implement the checklist. Results showed that all participants increased accuracy of toothbrushing steps and learned to independently implement the checklist. Limitations and recommendations for future research were discussed.

Keywords: self-management, BST, Toothbrushing, independent, accuracy, supported community living

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The Effects of Self-Management Strategies on Toothbrushing for Adults in Supported Community Living

Hygiene is a critical personal living skill (Garff & Storey, 1998). It is essential for improving both personal and professional relationships (Gushanas & Thompson, 2019), and overall health (CDC, 2021). The World Health Organization (WHO; 2021) indicated that oral health conditions such as tooth dental caries (tooth decay) and gum disease affect people throughout their lifetime, causing pain and discomfort for about 3.5 billion people globally. According to the Center for Disease Control and Prevention (CDC; 2021) oral health is essential to overall general health and well-being. The oral health surveillance report (CDC, 2016) indicated that there was a high prevalence of dental caries among adults aged 20–64-year-old in the United States. Anders and Davis (2010) and O’Keefe (2010) discovered that individuals diagnosed with Intellectual and Developmental Disabilities (IDD) had poorer oral hygiene and higher prevalence of periodontal disease and caries rates. Despite effective preventative strategies such as daily oral care, access to dental services, and provision available today, the burden of poor oral hygiene remained high among individual with IDD (Ward et al., 2019). Wilder and Bray (2016) asserted that, while consistent dental visits and daily oral hygiene is essential to minimize harmful effects of plaque biofilm and to improve gingival health, getting patients to adhere to these regimens is often difficult. Wilder and Bray noted that patients often forget the information recommended by clinician within one hour of a dental visit and fail to follow instructions provided to them. They further suggested that incorporating behavioral strategies to increase oral self-care might enhance dental health.

Many behavioral change strategies that have been used to improve oral and personal hygiene, including video modeling (Campbell et al., 2015; Piccin et al., 2018; Popple et al.,

2016; Rosenberg et al., 2010), antecedent manipulations (Kang & Chang, 2019; Probst & Walker, 2017; Van Laarhoven et al., 2010), and consequence manipulations (Chang et al., 2011; Cicero & Pfadt, 2002; Garff & Storey, 1998; Gushanas & Thompson, 2019). For example, Popple et al. (2016) used an electronically delivered video modeling approach to improve oral hygiene for children with autism. Their participants were 18 children between 5-and 14-years-old who were receiving dental treatment at the local pediatric dental clinic. During the 3-week intervention, children were randomly assigned to either a control video group or intervention video group. The intervention video modeled a proper brushing technique with narration and closed captioning. The video begins with a title screen and audio prompts (“Time to brush!”) that signaled to the subject to start brushing. A 10-year-old child then modeled the technique by brushing each quadrant, ending with the anterior teeth. An adult voice narrated the video. In contrast the control group videos displayed a moving and colorful fractal image with background music. A Qualtrics online survey software was used to deliver 1min 6 s long videos at 5:30 AM and again at 4:30 PM daily. To ensure children watched the video, they were prompted to answer a two-question survey at the end of each video. At the end of the intervention, they were given a YouTube link, so they could continue watching the videos as needed. They were evaluated for plaque index by a dentist not involved with the study. The results indicated improvement for both groups, with the intervention group showing less plaque. A small sample size was cited as a potential limitation. The authors indicated that future research should address whether combining the video modeling with other behavioral changes techniques would improve brushing experience for individuals in this age group.

Another way to achieve behavioral change is through self-management. Self-management is defined as action people take to influence their own behavior (Browder &

Shapiro, 1985, as in Harchik et al., 1992). Self-management involve (a) determining whether a specific behavior has occurred/not occurred, (b) recording the occurrence/nonoccurrence of the behavior, and (c) obtaining a reward (Koegel et al., 1990). Broadly, self-management interventions include antecedent procedures (e.g., pictures cues, self-instruction, and auditory prompts) and consequence procedures such as self-monitoring, self-evaluation, self-recruited feedback, self-reinforcement, and self-recording (Storey, 2007). According to Baer (1984), a person manages their own behavior if they acknowledge that there is a problem, break down the problem, and uses self-management procedures to support behavioral change. However, appropriate conditions (Epstein, 1997; Goldiamond, 1965) and pre-requisites such as behavior being under specific rules, generalized control of rules, self-delivery, behavioral consequences repertoire, and language skills (e.g., follow instruction) must also be in place for behavioral change (Malott, 1984) to occur.

Self-management procedures have been used for individuals diagnosed with disabilities to improve academic performance (e.g., Albion & Salzberg, 1982; McDougall & Brady, 1998; Koegel et al., 1999), enhance work performance (e.g., Lagomarcino et al., 1989; Storey, 2007), increase physical activity (e.g., Hayes & Van Camp, 2015; Normand, 2008), increase independent grocery shopping (e.g., Douglas et al., 2015), increase appropriate social behaviors (e.g., Wheeler et al., 1988), decrease inappropriate interaction (e.g., Embregts, 2000, 2003), as well as to improve reciprocal conversational skills (e.g., Koegel et al., 2014). However, there have been few published studies focusing on improving personal hygiene in individuals diagnosed with IDD.

To date, only three studies (Garff & Storey, 1998; Gushanas & Thompson, 2019; Stokes et al., 2004) examined the effects of self-management strategies on general personal hygiene for

individuals diagnosed with IDD. For example, Garff and Storey (1998) used these strategies to improve hygiene (e.g., appearance) of three participants between the ages of 26-and-56-year-old. The setting of the hygiene trainings took place in the participants' residences and their personal appearances were assessed at their supported employment setting. During baseline, participants continued with their regular hygiene routines and their appearances were evaluated by supervisors upon their arrival at work, using "yes" and "no" questionnaires. During the intervention, reinforcer assessments were conducted, and participants were then introduced to and trained using the self-management checklist. Their results showed that the ratings of the individuals' appearances improved compared to the baseline ratings. The authors cited a lack of research on use of self-management strategies to teach and improve personal hygiene and indicated that future research should continue to explore what are the best self-management strategies to address hygiene, and to report the degree to which the level of behavioral change obtained through self-management strategies were maintained over time.

Stokes et al. (2004) examined the effects of a multi-component training package (e.g., task analysis, correspondent training, and self-instruction) to improve personal hygiene. Participants were adults between the ages of 34- and 38-years-old. All three participants had varied diagnoses—one diagnosed with autism spectrum disorder (ASD) and the remaining two had mental health diagnoses. All participants were capable of learning complex skills. Their target behavior was proper cleaning after bowel movements. The sessions were conducted in the individuals' bathrooms. After the participants wiped, a three-point Likert scale (i.e., (1) clean, (2) discolored without matter, and (3) discolored with matter) was used to assess the thoroughness of the cleaning by examining the appearance of the wipe that the participant used. Participants were trained to examine their wipes using self-instruction and self-feedback, (e.g., to "say" whether

they need to clean themselves more or the wipe was clean). Results showed that all participants learned the steps (10 steps task analysis) and achieved an acceptable level of hygiene after bowel movements (Stokes et al., 2004).

Gushanas and Thompson (2019) also targeted general hygiene with self-management. In this study, participants were five adults between the ages of 19-and-22-years-old diagnosed with IDD. The target behaviors were a distracting body odor and participant's completion of the self-monitoring checklist. Body odor was defined as the level of distraction due to aversive body odor when within arm's length of an individual for a minimum of 30 s. They used a five-level Likert-type scale to measure the level of distracting body odor. To ensure accuracy of measurement, the data collectors were trained to distinguish between the smells of onions, lemons, cheese crackers, potatoes, and paper towel. IOA and social validity data were also collected. The main components used in training of the self-monitoring included: (a) importance of personal hygiene, (b) importance of self-monitoring, and (c) how to self-monitor distracting body odor. Results demonstrated that the level of distracting body odor decreased compared to the baseline phase.

In sum, research has shown that self-management procedures can improve academic and work performance, physical activity, appropriate behaviors, and communication for children and adults diagnosed with IDD. However, only a few studies have evaluated self-management strategies personal appearances (Garff & Storey, 1998), cleanliness (Stokes et al., 2004), and distracting body odor (Gushanas & Thompson, 2019). Although these studies examined the effects of self-management on general hygiene, none has focus on specific area of hygiene. In addition, no study has evaluated the effects of teaching individual to implement a self-management checklist for tracking and recording the completion of their personal hygiene. Thus, the purpose of the current study was to examine the effects of self-management strategies for

improving toothbrushing for adults residing within a supported community living. The current study also examined the extent to which participants accurately implemented the self-management checklist immediately after toothbrushing.

Method

Participants and Settings

Three adults between ages of 31-and-39-years-old with varying diagnoses participated in this study. All participants lived in a supported community living (SCL) residence in Iowa. All displayed poor oral hygiene (i.e., not brushing teeth thoroughly and regularly). Diagnoses were retrieved from participants' individual service plans (ISPs) available in their files at the host site.

Chris was a 31-year-old male with diagnoses major depression and impulse control disorder. Chris communicates verbally and in writing. His personal hygiene goal includes brushing teeth and showering three times a week with staff's prompts. He has been working on this goal for three years.

Bill was a 36-year-old male with diagnoses of bipolar disorder and schizoaffective disorder. He communicates both verbally and in writing. Bill's hygiene goal was to brush his teeth and shower three times a week. He has been working on his personal hygiene goals for three to four years.

Young, was a 39-year-old has diagnoses of mild ID, autism spectrum disorder (ASD), Anxiety, Depression, Oppositional Defiant Disorder (ODD). He communicates verbally and in writing. His hygiene goal includes brushing teeth and showering daily. He has been working on his hygiene goal for 5 years. During the interview, Young indicated that he does not brush his teeth "I just don't do it" he said, when he was asked what types of toothbrushes he used.

The inclusionary criteria included being able to: (a) follow simple instructions and execute toothbrushing independently, (b) read or discriminate steps of toothbrushing symbols, (c) rely on staff prompts to maintain toothbrushing, (d) have difficulty with toothbrushing defined as (e.g., not brushing teeth thoroughly or regularly), and (e) agree to participate in the study.

The setting for all experimental sessions was the group homes in which the participants reside. Typically, the group homes have three to five bedrooms with one or two standard bathrooms. The bathrooms comprised of one or two sinks, a counter, mirror, cabinets, and one shower with a standard bathtub and shower curtain for privacy.

Materials

All participants used an electric toothbrush (e.g., Philips Sonicare 7400 ExpertClean and typical materials and items used when brushing teeth, such as toothpastes) during all phases of the study. Self-management checklists (Appendix A) were placed on the clipboards with pens attached and placed on the counter or hooked on the wall in the bathroom visible to participants during the baseline. During the self-management and maintenance, Chris and Bill decided to keep checklist in their rooms. Young kept his clipboard with checklist and pens hooked on his bathroom wall. Reusable stars (used for exchanging items) were attached on the wall during the training and self-management only. A DreamSky battery operated digital timer with a Large Red LED Display was used for training. An Onn. Surf 8 Gen 2 Tablet with Android was attached to an Onn. adjustable 67in Tripod, for recording all experimental sessions. Rewards were stored in a clear white 20 Qt./18.9 L storage box.

Dependent Variables and Measurements

The primary dependent variable was the percentage of toothbrushing steps completed each morning. *Toothbrushing* was defined as independently putting a toothpaste on toothbrush and brushing all four quadrants thoroughly (e.g., moving the toothbrush back and forth from side to side, inside and out) through front teeth, right side teeth, left side teeth, and bottom teeth in any order for a minimum of 2 min (see Appendix A). Toothbrushing was not achieved if participant (1) brushed teeth without toothpaste, (2) failed to brush exterior and interior of all four quadrants, or (3) failed to brush teeth for a minimum of 2 min. The second dependent variable was the duration of toothbrushing. The duration of toothbrushing was defined as the time participants spent brushing teeth-with toothbrush in mouth. The experimenter started a stopwatch when the participant put the toothbrush in their mouth and stopped it when the participant removed the toothbrush from their mouth and put it on the counter. The third dependent variable was the accurate implementation of the self-management checklist. Self-management was consisted of self-recording, whereby the participant needed to score, on paper, whether toothbrushing was done correctly. The accurate implementation was defined as percentage of steps in self-management checklist that the participant completed correctly. Self-recording must have started within one minute after the participant put toothbrush and toothpaste on the counter, rinsed his/her mouth, and dried their mouth with a towel. At that point the participant had one minute to: the definition of correct self-recording is: (a) locating the self-management checklist, (b) marking “Yes” on all completed toothbrushing steps, and (c) marking “No” on all toothbrushing steps missed. Data were collected every morning between 7:00 AM and 10:00 AM.

Experimental Design

A multiple baseline across participants (Horner & Baer, 1975) was used to examine the effects of self-management on toothbrushing. Baseline data were collected on all dependent variables. Once the baseline data stabilized for the first participant, the self-management checklist training was implemented individually until each participant demonstrated skills with 100% accuracy for 3 consecutive days. Next the self-management intervention began for the first participant while the other participants remained in the baseline phase. As the first participant began to demonstrate change in the dependent variables, the self-management intervention was started for the second and third participant respectively. This general procedure continued until all participants completed the self-management intervention.

General Procedure

All sessions were video recorded. The tablet was attached on the adjustable tripod to capture toothbrushing and checklist completion. The tablet was either behind or on the right side of the participant who was standing facing the mirror with the bathroom counter and sink in front of them. The toothbrush and toothpaste were on the counter on the right side of the participant. The experimenter stood about two feet on the left side by the door slightly behind the participant. The timer was placed directly in front of the participant. The self-management checklist, pen, and re-usable stars were on the bathroom counter or hooked on the wall next to the mirror between the participant and experimenter. The preferred items identified during the preference assessment were in the storage box within 6 feet from the experimenter where the participants exchanged their stars for a preferred item.

Assessment. As soon as the participant or legal guardian signed the consent form, the experimenter interviewed the participants (see Appendix B). The purpose of the interview was to obtain a list of possible items and activities that the participant preferred. Next, the experimenter

used the list of items generated by participants to assess participants' preference using the Multiple Stimulus Without Replacement (MSWO; DeLeon & Iwata, 1996) preference assessment method (see Appendix C for the MSWO data sheet). Assessment sessions were either conducted in participants' homes or in the service provider conference room. Before each session began, the experimenter prompted the participant to sit in the chair across the table from the experimenter. Then, the experimenter said, "When I put the items on the table, you will have 30 s to pick one favorite item." Next, the experimenter put 6 items on the table and then prompted the participant to "select one." The participant had 30 s to choose. If the participant chooses an item, the experimenter allowed the participant access to the item for 10 s. If the participant selected two items within 30 s, the experimenter said, "say the name of the item you like most!" If the participant did not select an item within 5 s, the experimenter then switched the order of the remaining items on the table for 30 s and moved on to the next trial. This procedure continued until all items had been selected. If the participant did not select any of the remaining items within 30 s of the experimenter requests, the session was terminated.

Pre-baseline. One week before the baseline condition started, participants were provided with electric toothbrushes, toothpastes, and all other materials needed. After participants used their new toothbrushes for one week, data collection began.

Baseline. The experimenter prompted toothbrushing by saying, "Time to brush teeth." Participants were observed brushing their teeth in their bathrooms. Although the self-management checklist was placed on the counter or hooked on the bathroom wall, accessible to the participants, no training was provided on how to complete the checklist. The experimenter observed and collected data on the dependent variables. Baseline consisted of a minimum of

three days, and after the data stabilized for Chris, self-management training began while Bill and Young remained in the baseline.

Training. The experimenter used Behavioral Skills Training (BST; Miltenberger et al., 2009; Wheeler et al., 1988) to train the participants to use the self-recording procedure. The training took place during the toothbrushing sessions. To ensure that participants contacted a reinforcer identified during the preference assessment, reusable stars were used to reward the accurate completion of the self-management checklist. Participants were also praised for completing the checklist accurately during the training. The experimenter adhered to the following procedures when conducting each step of BST:

Verbal Instruction. The experimenter began training by explaining the goal and rationale for the self-management objective (see Appendix D).

Modeling. The experimenter read the script (see Appendix D), while modeling the checklist. After the experimenter gave at least one examples of a correct and incorrect way of completing the checklist, the experimenter asked the participant whether they had any questions. If the participant said “yes,” more examples were provided. If they said “no,” the rehearsal began. Before the rehearsal, the experimenter verbally asked the participant to say the name of the items they wanted to get, if they completed the checklist correctly.

Rehearsal/Feedback. Within 30 s of toothbrushing, the experimenter prompted, the participant by saying, “Now, complete your checklist!” If the participant completed their checklist correctly, the experimenter delivered praise (e.g., “*Good job for completing your checklist correctly!*”). The participant then exchanged the stars with the preferred item they chose at the beginning of the rehearsal. If the participant made an error on their checklist, the experimenter gave specific feedback on what the participant did correctly, as well as what was

done incorrectly. An example was, “You did good by marking yes here and here, but you mark yes or no here by mistake, now, let’s work on it together!” This process was repeated until each participant completed their checklist with 100% accuracy for three consecutive days. This criterion was selected because the training occurred during the toothbrushing session.

Self-Management Intervention. The same procedure above was used. Participants reward themselves for correct and accurate completion of the checklist. Self-management sessions began by asking the participant to verbally said the name of the preferred items they wanted to reward themselves with after the accurate completion of the checklist established during the training. The participant had 1 min to enter the bathroom and initiated toothbrushing. If the participant did not initiate toothbrushing within 30 s of experimenter’s prompt, the experimenter said, “Let’s start!” Sessions were terminated if the participant verbally informed the experimenter that they didn’t want to brush their teeth. If the participant walked into the bathroom and initiated the toothbrushing, the session began. The experimenter collected data as the participant brushed their teeth. Participant were to fill out their checklist within 1 min of toothbrushing ending as defined above. If the participant did not initiate self-recording within 30 s of toothbrushing, the experimenter said, “Time to complete your checklist.” If the participant completed their checklist, it was compared with the experimenter’s the checklist. If the checklists matched, the experimenter delivered a praise, “Good job for completing your form correctly!” The participant then exchanged their stars with the item they verbally chose at the beginning of the session. If the participant’s checklist did not match the checklist completed by the experimenter, the participant was praised for each correct completion and given corrective feedback for each error. An example was, (“You did good by marking ‘Yes’ here and here, but you marked ‘Yes’ or ‘No’ here by mistake.” No changes were made to their checklist. No exchanged occurred.

Fading. After the participants reach the mastery criteria (e.g., completing the checklist with 90% accuracy for three consecutive days), the experimenter began to systematically fade themselves by increasing their distance from 2 ft in the training phase to 6 ft in the maintenance phase. If the participant continued to complete their checklist with an increasing trend from 90% accuracy for the next three sessions (e.g., first, second, & third) after meeting the criteria, the experimenter then, for the next two sessions: (1) stood at about 4 ft from the participant, and (2) gave feedback as needed (e.g., ask the participant to re-evaluate their checklist), if an error occurred. If the participant performed below the mastery criteria, the pre-intervention process was reinitiated. If the participant continued to perform above mastery criteria, the experimenter increased his distance from 4 to 6 ft. All prompts were delivered as needed. After a minimum of 6 data points in the intervention phases with performance above mastery criteria, the intervention ended, and maintenance began.

Maintenance. At the end of the intervention, participants were asked to continue using the self-management checklist. One week after each participant met the mastery criteria, maintenance was checked daily (e.g., Monday-Friday) for one week. The same procedure used in the self-management phase continued, except that no reward or corrective feedback was given in maintenance.

Social Validity. The participants' satisfaction and acceptability of the procedure, and the outcome of the study were measured using a ten-questions survey (see Appendix E). At the conclusion of the study, each participant completed this questionnaire.

Interobserver Agreement, and Treatment Integrity

Interobserver agreement (IOA) data were collected in 33% of the sessions (Kang & Chang, 2019) across all phases. A trained observer watched the video recording and collected

IOA data in all phases. Percent agreement was calculated using the following formula: $\text{agreements} / (\text{agreements} + \text{disagreements}) * 100\%$. The IOA averages in the baseline were 100%, (range, 83%-100%) for Chris, 92.5% (range, 85%-100%) for Bill, and 94% (range, 83%-100%) for Young. The IOA averages in the self-management phases were 100% for Chris, 100% for Bill, and 100% for Young. The IOA averages in the maintenance were 100% for Chris, 100% for Bill, and 100% for Young. The trained observer also collected data on the procedural fidelity. Fidelity of treatment were considered met if the experimenter (1) provided rationale (verbal instruction), (2) modeled the correct and incorrect completion of the checklist, (3) prompted participant to rehearse/gave feedback. Fidelity of Treatment were considered not met if the experimenter did not provided rationale (verbal instruction), (2) didn't modeled correct/incorrect completion of the checklist, (3) didn't prompted participant to rehearse/gave feedback. Procedural fidelity was calculated by dividing the observer scored by the overall total multiply by 100. Those were 100% across all participants.

Results

The percentage of toothbrushing steps completed by participants each morning is shown in Figure 1. Chris completed 83% of the toothbrushing steps with exception of one outlier performance of 100% during the second session in baseline condition. His performance stabilized at 83%, until he was trained on the accuracy of brushing. His performance increased from 83% in the baseline to 100% in the self-management phase. He maintained 100% performance in the maintenance phase as well. Chris refused to brush his teeth for one day in the baseline. Refusal was designated by (star) in the graph. Bill demonstrated consistent performance in baseline, implementing 83% of the steps correctly for the first 3 sessions, before decreasing to 67%. Bill refused to brush his teeth during session 3, 5, 6, 7, 8, and 9 in the baseline. Once Bill

was trained to use the checklist and implemented each step of brushing with 100% over 3 consecutive days. He maintained consistent performance of brushing with 100% accuracy with 1 refusal in the self-management phase. Maintenance checks revealed that Bill initially completed between 71% and 86% of toothbrushing steps, then performed perfectly over the last 3 sessions of maintenance. He had 1 refusal in the maintenance. Young also demonstrated a consistent performance in the baseline, completing 83% of the toothbrushing steps across the 13 days of baseline, with performance ranging between 50% and 67% during the session 5, 6, 11, and 12 respectively. He only had 1 refusal in the baseline. Once acquired the use of the self-management checklist during the training phase, Young implemented correct toothbrushing with 100% accuracy in both self-management and maintenance phases.

Figure 2 displays the number of minutes the participants spent brushing their teeth each session. The experimenter started a stopwatch when the participant picked up the toothbrush and stopped it when the participant removed the toothbrush from their mouth and put it on the counter. In the baseline, Chris's average toothbrushing time was 1 min 46 s (range, 1 min 28 s – 1 min 42 s). After the training, his averaged 2 min 86 s (range, 2 min 34 s - 3 min 34 s). Chris's performance stabilized in the maintenance phase averaging 2 min .08 s (range, 2 min – 2 min 52 s). For Bill, the average toothbrushing time in baseline was 1 min 35 s (range, 0 min 56 s – 2 min). After performing at 100% for three consecutive days in the training phase, Bill's average toothbrushing time improved, performing on average at 2 min 68 s (range, 2 min 40 s – 3 min 20 s). Bill's toothbrushing time decreased to the pretraining performance at 1 min and 55 s during the first session of the maintenance phase, however, his duration remained above 2 min for the remaining 5 data points, bringing his average toothbrushing time to 2 min 29 s (range, 1 min 55 s -3 min .05 s) in the maintenance phase. Young's duration was 1 min 36 s (range, 0 min 54 s – 1

min 41 s) in baseline. After performing at 100% for three consecutive days in the training phase, his average increased to 2 min .02 s (range, 2 min .02 s – 2 min .05 s). Young's toothbrushing duration stabilized in the maintenance phase averaging 2 min 02 s (range, 2 min – 2 min .03 s).

Figure 3 shows the results for accuracy of implementation of the self-management checklist. Although the checklists were accessible to the participants in the baseline, they did not attempt to complete them. After they were trained to use the self-management checklists, Chris implemented the self-management checklist with 100% accuracy in the self-management and in maintenance phases. Bill completed his checklists with 100% accuracy in the intervention phase but made a few errors during the maintenance with mean of 93%, (range, 71%-100%). Young consistently implemented his self-management checklist with 100% accuracy in both the intervention and maintenance phases.

Figure 4 shows the results of the social validity survey. All three participants liked making self-management goals for themselves. All three found the checklist helpful to them, but only 2 of 3 thought completing it was easy. There was universal agreement that the program was efficient and fast to complete, and all participants enjoyed the self-rewarding aspect of the program. All three participants thought they could see themselves using a similar self-management program on other behaviors they might want to change and would recommend this type of program to others.

Discussion

The results of the current study also compare favorably to previous self-management studies on hygiene in that participants' appearances (Garff & Storey, 1998), level of cleanliness (Stokes et al., 2004), and level of body order (Gushanas & Thompson, 2014) improved after self-management training. The results of the current study also demonstrated that participants'

duration of the toothbrushing improved. Both Garff and Storey (1998) and Stokes et al. (2004) showed maintenance of the skills, as was evident in two out of the three participants of the present study.

Several behavioral mechanisms may have been responsible for the effects obtained. Improvements in toothbrushing accuracy and duration may have been due to stimulus control (Noell et al., 2021) and reinforcement (Koegel & Koegel, 1990). The presence of the checklist may have served as a cue or discriminative stimulus (Malott, 1984), which guided task completion (Storey, 2007). Researchers applied positive reinforcement in the form of praise and preferred items to increase accurate implementation of the self-management checklist during training (Koegel & Koegel, 1990). By reinforcing participants' accurate checking of the occurrence or nonoccurrence of the target behavior, the check marks may have come to serve as conditioned reinforcers, thereby contributing to participant use of the self-management checklist during maintenance.

Unlike previous research, the current study targeted toothbrushing, with the participants taught to complete the self-management checklist immediately after they completed toothbrushing. Interestingly, the participants both improved their toothbrushing and accurate completion of the checklist. Although previous studies used self-management checklists to train hygiene steps, the researchers did not teach participants how to independently implement them. This study extended the results of the self-management to this specific area of hygiene by teaching participants to self-assess and to accurately complete the checklists.

During the last two sessions of the maintenance check, the experimenter observed that Young would complete his brushing and then turn toward the door as if he was about to exit the bathroom, but immediately turn back to complete his checklist within the 1min limit. It is also

worth noting that the camera that was used to record the sessions was directly behind the participant, which may have functioned as a prompt for the participant to return and complete his checklist. It would be interesting to know whether Young would continue to exit the bathroom or complete his checklist within the time frame in absence of the recording equipment. Another observation concerned Bill. In the maintenance phase, there were two sessions in which both the toothbrushing accuracy and the implementation of the checklist were also poor.

A financial analysis showed that the hygiene equipment (electric toothbrushes, reward items) for three participants was \$635.24, with an average cost of \$211.75 per person. The experimenter did not incorporate any technology more than the electric toothbrushes. These electric toothbrushes have built in Bluetooth that can be linked to smart phones apps. However, because not everyone owns a smart phone, the cost of including the technology could increase the funding needs. Some participants may also have internet restriction, which would make it difficult to incorporate technology. Thus, continuing to research strategies for both technology and non-technology interventions would be important.

Limitation and Recommendations for Future Research

There are several potential limitations that lower the confidence of a causal relationship between the self-management implementation and improvement in brushing. First, participants in the current study were all male with a high level of functioning. It would be of interest to see if the current results would generalize to a more diverse population. Second, the presence of the experimenter, video recordings of the sessions, and self-management components, (e.g., reward, BST, electric toothbrushes) made it unclear whether any of these components may have contributed to the positive results. Future research could conduct a component analysis to analyze this issue. It may be necessary to include participants who could not execute

toothbrushing independently, to see if self-management could improve both their accuracy and independence. In addition, future research could examine whether intervening on toothbrushing could be generalized to other areas of hygiene (e.g., showering & cleanliness), and effect of self-management without reward. Furthermore, evaluating whether incorporating the technology (e.g., sonic app) that tracks and records brushing frequency and duration for data collection and reliability could have a benefit when the experimenter is not onsite.

Concluding Remarks and Practical Implication

Given the importance of personal hygiene on both professional and personal relationships (Garff & Storey, 1998; Stokes et al., 2004; & Gushanas & Thompson, 2019), and on overall health (CDC, 2021), strategies on how to improve durable behavioral changes in area of personal hygiene should continue to be explored. On the practical side, finding ways to incorporate these strategies into regular staff training should also be studied. Given the intrusiveness of recording and presence of the experimenter, the use of technology should also be examined. Some providers may or may not have the funding to help teach these skills. Investing in these skills could have long term benefit for individuals, their families, and society.

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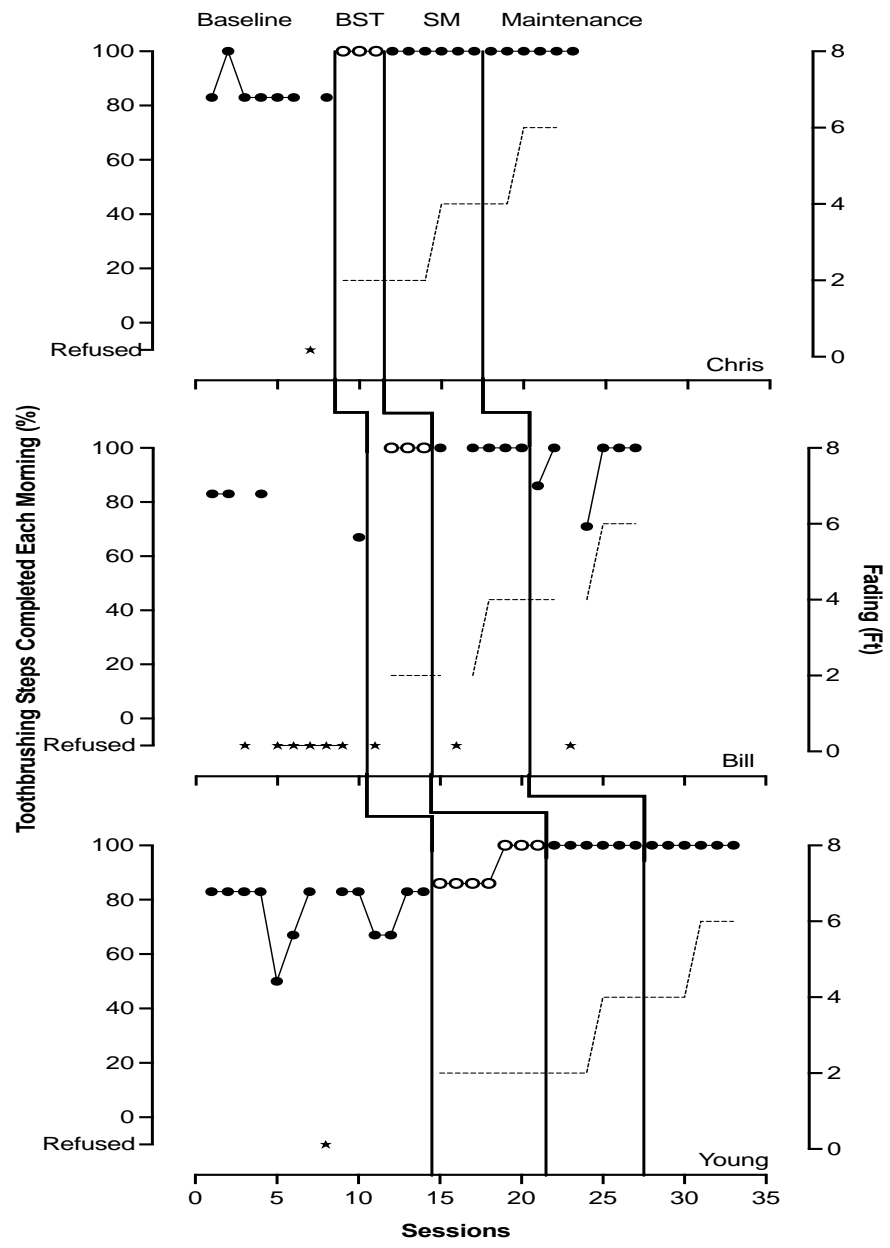
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Figure 1

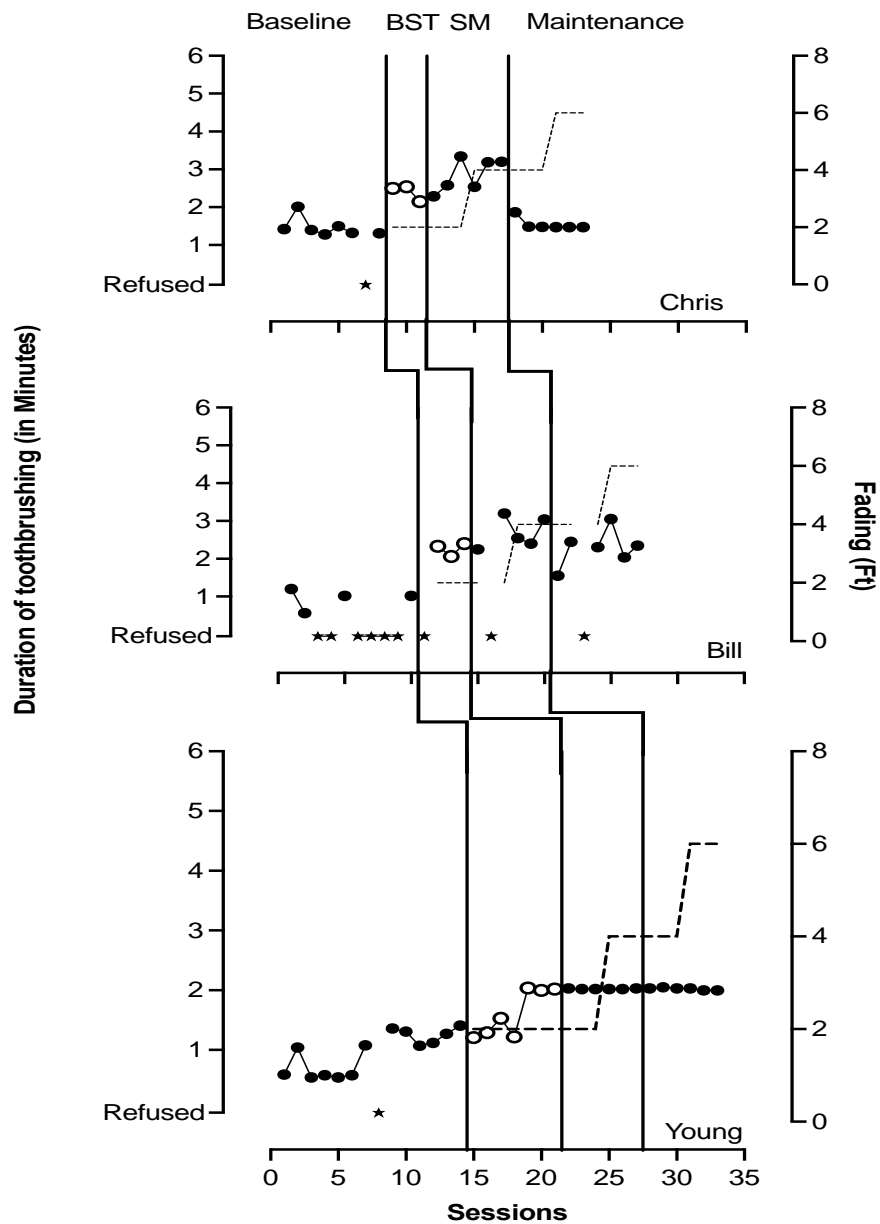
The Percentage of Toothbrushing



Note. This figure displays the percentage of toothbrushing steps. Stars represent the days participant chose not to brush their teeth.

Figure 2

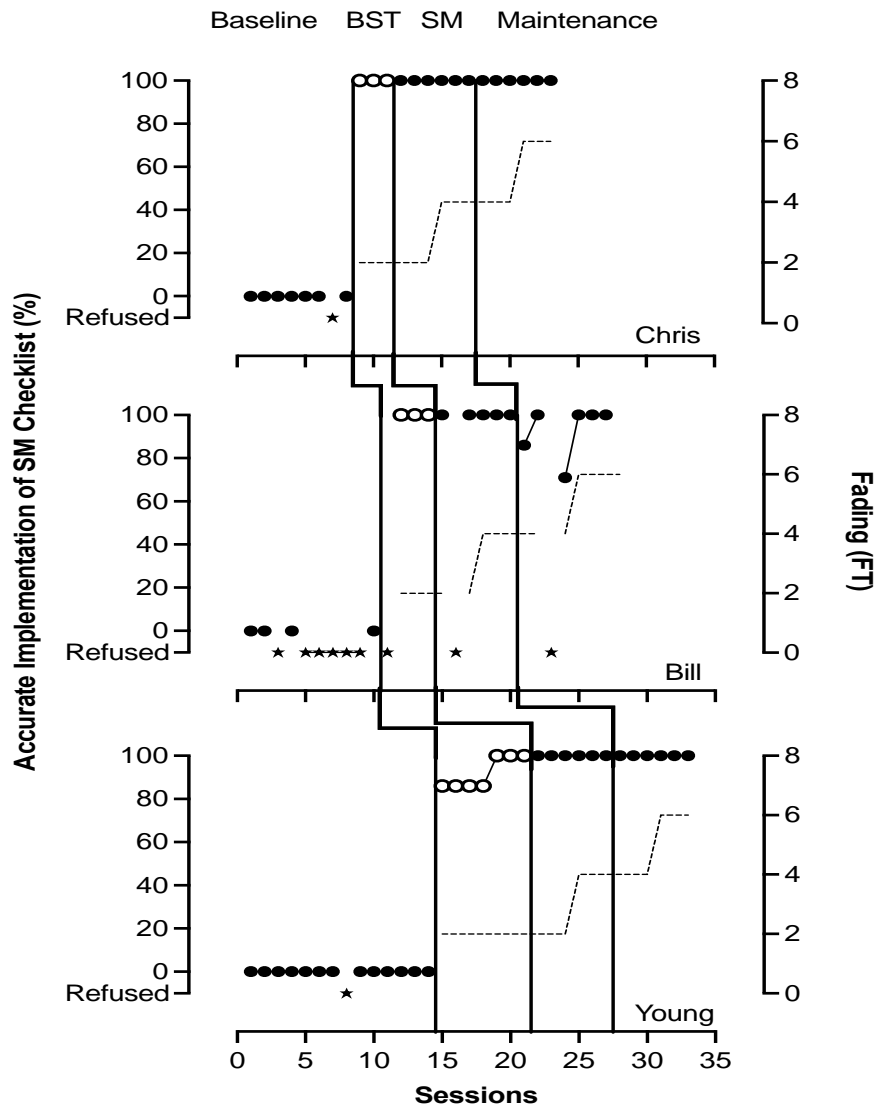
Time Participants Spend Brushing Teeth Every Morning



Note. Shows the participants' duration of toothbrushing (closed circles). The stars represent days participants refused to brush their teeth. Open circles represent the training sessions. The fading steps were represented by closed squares.

Figure 3

Implementation of The Self-Management Checklist



Note. This figure displays the accurate implementation of the self-management checklist. All participants did not complete the checklists in the baseline. Stars represent days participant decided not to brush their teeth.

Figure 4

Social Validity Outcome


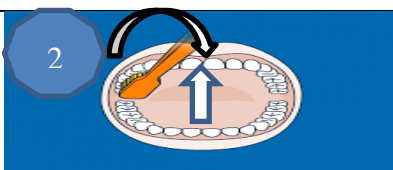
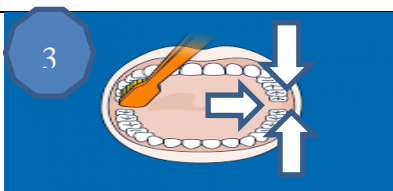
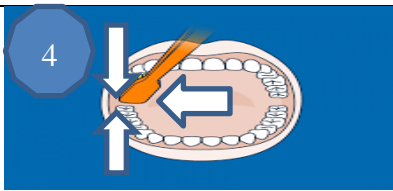
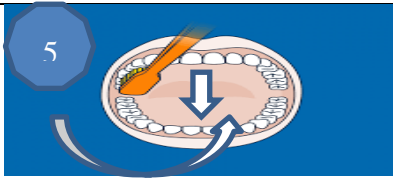




Note. This figure shows the participants' response to 10 questions Likert scale in which 1= (strongly disagree), 2=(disagree), 3= (slightly agree), 4= (agree, 5= (strongly agree). Black bars represent P1, pink bars represent P2, and yellow bars represent P3 responses.

Appendix A: Self-Management Checklist

Self-Management Procedure:

1. Independently putting a toothpaste on your toothbrush and brushing your front teeth, left side teeth, right side teeth, and bottom teeth in any order for 2-min or more.
2. Within 1-min of putting your toothbrush or toothpaste on the counter, locate your checklist on the counter,
3. Mark **“YES”** for brushing your front teeth, left side teeth, right side teeth, and bottom teeth for 2-min or more.
4. Mark **“NO”** if you did not brush your front teeth, left side teeth, right side teeth, or bottom teeth for 2-min or more.

Saturday				
AM/PM	Steps	Picture	YES	NO
1.	Toothpaste on toothbrush			
2.	Brush front teeth			
3.	Brush right side teeth			
4.	Brush left side teeth			
5.	Brush bottom teeth			
6.	Brush teeth for 2-min or more			
7.	Complete checklist within 1-min of completing toothbrushing			

Appendix B: Initial Interview Questions

ID	Questions	Notes
1.	What types of activities do you like to do during your free time?	
2.	What types of food do you like to eat?	
3.	What types of music do you like listen to?	
4.	What are your favorite movies?	
5.	What are your favorite games?	
6.	What are your favorite books/magazines to read?	
7.	How long does it take you to brush your teeth?	
8.	At what time do you brush your teeth in the morning and at night?	
9.	How many times a day do you brush your teeth?	
10.	How would you describe toothbrushing?	

Appendix D: Behavior Skills Training (BST)

Verbal instruction. Brushing teeth twice a day can prevent cavity built up, tooth decay, and tooth pain. To increase your dependent, use self-management checklist to track and monitor your toothbrushing.

- (1) put a toothpaste on toothbrush and mark a “Yes” on checklist,
- (2) brush front teeth for 30s and mark a “Yes” on checklist,
- (3) brush left side teeth for 30s and mark a “Yes” on checklist,
- (4) brush right side teeth for 30s and mark a “Yes” on checklist,
- (5) brush bottom teeth for 30s and mark a “Yes” on checklist,
- (6) Mark a “Yes” on checklist for brushing teeth in any order for a minimum of 2 min,
- (7) mark a “Yes” for filling out checklist within 1min of completing toothbrushing.
- (8) Mark a “No” for any area of your mouth you did not brush.
- (9) Count the number of “Yes” on your checklist and match it with the experimenter’s checklist. (10) Get a star for each “Yes” on the checklist.
- (11) Exchange your stars with item.

For example, if you have 7 “Yes” on your checklist, you will get 7 stars and get the item with 7 stars on it. Now, let show you how this will work.

Modeling. The experimenter read the following script, while modeling the checklist: Within 1 min of toothbrushing, put toothbrush and toothpaste on the counter, rinsed, and dried mouth with a towel, and locate the checklist on the counter. Mark “Yes” for all areas of your mouth that you brushed. For example, if you brushed front teeth, left side teeth, right side teeth, bottom teeth, brushed for a minimum of 2 min, start checklist within 1 min of putting toothbrush, toothpaste on the counter, and rinsing/cleaning mouth with towel,

- (1) mark a “Yes” for putting toothpaste on toothbrush,
- (2) mark a “Yes” front teeth,
- (3) mark a “Yes” for left side teeth,
- (4) mark a “Yes” for right side teeth,
- (5) mark a “Yes” for bottom teeth,
- (6) mark a “Yes” for brushing for a minimum of 2 min, and
- (7) mark a “Yes” for filling out checklist within 1 min of toothbrushing.

If you forgot to brush any of the area (quadrant) of mouth, mark a “No” on your sheet for that area. For example, if you brush front teeth, left side teeth, right side teeth, brush for a minimum of 2 min, but forgot to brush bottom teeth, mark a “Yes” for front, left side, right side, and marked “No” for bottom teeth, and do better next time to get all “Yes” on checklist.

Appendix E: Social Validity Questions

Please let me know how you feel about the program by answering the questions below.

1-strongly disagree 2-disagree 3-slightly agree 4-agree 5-strongly agree

1. I liked making the self-management goals

1-strongly disagree 2-disagree 3-slightly agree 4-agree 5-strongly agree

2. The checklist was easy

1-strongly disagree 2-disagree 3-slightly agree 4-agree 5-strongly agree

3. I wanted to improve my tooth-brushing

1-strongly disagree 2-disagree 3-slightly agree 4-agree 5-strongly agree

4. Using the checklist was helpful

1-strongly disagree 2-disagree 3-slightly agree 4-agree 5-strongly agree

5. The program was fast to complete

1-strongly disagree 2-disagree 3-slightly agree 4-agree 5-strongly agree

6. The prompts were useful

1-strongly disagree 2-disagree 3-slightly agree 4-agree 5-strongly agree

7. I like rewarding myself

1-strongly disagree 2-disagree 3-slightly agree 4-agree 5-strongly agree

8. The program helped me be more independent

1-strongly disagree 2-disagree 3-slightly agree 4-agree 5-strongly agree

9. I would use the program for other behaviors

1-strongly disagree 2-disagree 3-slightly agree 4-agree 5-strongly agree

10. I would recommend the program to others

1-strongly disagree 2-disagree 3-slightly agree 4-agree 5-strongly agree