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Care partner–assisted intervention to improve oral health for older adults with cognitive impairment: A feasibility study

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Abstract

Background and Objectives: Older adults with cognitive impairment often experience poor oral health outcomes due to inadequate oral hygiene practices. This pilot study aimed to evaluate the feasibility of a care partner–assisted intervention to improve the oral hygiene of community-dwelling older adults with cognitive impairment.

Material and Methods: The 6-month intervention included 25 older adults with mild dementia or mild cognitive impairment, who were randomly assigned to Treatment Group 1 or Treatment Group 2. Treatment Group 1 (n = 7) received an educational booklet. Treatment Group 2 (n = 18) received a booklet, a tailored care plan for the participants with cognitive impairment and the care partner received four coaching sessions to learn to facilitate good oral hygiene. Both groups received electric toothbrushes. The study consisted of a 3-month active intervention and 3-month maintenance phase. The outcomes of gingival index, plaque index and overall oral health status based on the Oral Health Assessment Tool were measured at baseline, 3 months (end of active intervention) and 6 months of the study.

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Results: This study had very low dropout rate. Participants' oral hygiene improved in this study. In comparison to Treatment Group 1, participants in Treatment Group 2 had a greater reduction in plaque level and gingival inflammation, and greater improvement in overall oral health status.

Conclusion: This study demonstrates the feasibility of this intervention designed to improve the oral health of persons with cognitive impairment and it lays the foundation for using this protocol in a future large randomised clinical trial.

1 | INTRODUCTION

Poor oral health has a significant effect on the overall health and well-being of older adults, and negatively influences functional ability, diet and nutrition.[1,2] Despite the fact that poor oral health is common among older adults, it is often an overlooked area of healthy aging.[3,4] Poor oral health is increasingly linked to adverse health outcomes, including chronic pain, aspiration pneumonia, diabetes and cardiovascular disease. [5] Poor oral health is especially pronounced among cognitively impaired older adults, including those with mild cognitive impairment (MCI) and mild dementia.[6,7] Cognitively impaired older individuals have been reported to have more dental plaque, more serious periodontal disease, more dental caries, and less teeth than cognitively intact older individuals.[3,8–10] Side effects of medications that older adults take may contribute to poor oral health. For example, medications with high anticholinergic burden can cause salivary gland hypofunction.[11] In addition, older adults with cognitive impairment are more likely to delay seeking dental treatments.[12] Despite these factors, inadequate oral hygiene practices play an important role in oral health among cognitively impaired individuals, and a lack of mouth care provided by both formal and informal care providers may contribute to poor oral hygiene.[3,5]

A few studies conducted in nursing homes have provided some evidence that standard routine oral hygiene practices implemented with the assistance of nurses, dental staff or caregivers are effective in improving oral health among older adults.[1,13–16] Yet, to date, there have been no intervention studies focused on improving oral hygiene practices of community-dwelling older adults with cognitive impairment. The majority of early stage cognitively impaired individuals, including those with MCI and mild dementia, still reside in the community. In many cases, these individuals need supportive care to obtain good standards of oral hygiene. Care partners, such as spouses, adult children and extended family members, can play an important role in supervising and providing care for cognitively impaired individuals in the community.[17] An important piece of this care is ensuring good oral hygiene practices, but these tasks are often neglected. While informal care partners play an important role in caring for persons with cognitive impairment, they often lack the knowledge and resources to assist with basic oral hygiene practices. To our knowledge, no study has examined a care partner's role in improving oral health for community-dwelling persons with cognitive impairment.

One barrier for an informal caregiver providing assistance of any kind is care-resistant behaviours on the part of the cognitively impaired individuals. These behaviours are shown to increase exponentially as the severity of dementia increases.[18] Moreover, increasing decline in cognitive function makes it more difficult for cognitively impaired individuals to follow standard instructions to complete adequate oral hygiene care.[19] For these reasons, early stage cognitive impairment is an ideal stage for an oral hygiene intervention that involves a care partner. Implementing the intervention while individuals are in the mild stages of cognitive impairment may make it possible for them to maintain better oral hygiene practices further into the course of progressive functional decline with the support of a care partner. Although persons with cognitive impairment may have trouble learning complex new tasks or performing multi-step tasks, such as following a recipe or performing complex household chores, they retain procedural memory despite their cognitive decline.[20,21] Toothbrushing is well-learned procedural skill, and with the support of a care partner to provide reminder and cueing—these basic skills can be maintained and improved.[22] Thus, supporting procedural memory through cueing and/or reminding strategies is a reasonable approach for improving oral health among these older adults with early stage of cognitive impairment.

Based on previous literature, we developed a care partner–assisted intervention protocol. We use the term care partner in this study to capture the notion that not all participants may feel they need a caregiver and that the intervention is focused on the two individuals working together in partnership. Before performing a large-scale intervention, we conducted the pilot study, reported here, in which we implemented a care partner-assisted intervention among community-dwelling older adults. The purpose of this study was to first test the feasibility of this pilot behavioural intervention, and the participant retention rate. Second, we examined the impact of this intervention on participants' oral hygiene outcomes.

2 | RESEARCH DESIGN AND METHODS

2.1 | Study design

The 6-month pilot study was a two-group pretest-posttest design. We obtained Institutional Review Board (IRB) approval from the Duke University (Pro00039035). The participants and their care partners signed informed consent forms.

2.2 | Participants

Using a purposive sampling strategy, we recruited participants from the Duke University Memory Disorders Clinic and local caregiver support groups. Both participants with cognitive impairment and their care partners were recruited. Participants were included if they (a) were age 60 or above; (b) had a clinical diagnosis of mild cognitive impairment (MCI) or mild dementia (MD) within the past year; (c) had at least 4 natural teeth; (d) lived with an informal, unpaid, care partner who was willing to participate; (e) were community-dwelling; and (f) were physically able to brush their own teeth. Participants were excluded if they (a) were unable to have an oral health evaluation done; (b) had sensory or physical problems that prevented participation in the intervention; (c) had a terminal illness or behavioural or psychiatric disorder that would interfere with participation

in the intervention; or (d) were at increased risk of bleeding due to haemophilia or due to anti-platelet therapy. This was a study with 25 participants (15 with MCI and 10 with MD) divided into 2 groups, who were randomly assigned to Treatment Group 1 or Treatment Group 2. The random assignment was determined at the beginning of the study using a block random allocation algorithm generated a priori by the statistician on the study team. In order to evaluate the feasibility of the procedures in the group receiving the more intense intervention (Treatment Group 2), we included 18 participants in Treatment Group 2 and 7 in Treatment Group 1.

2.3 | Intervention

We used a two-group design with active intervention for 3 months, followed by passive follow-up and final measures at 6 months. The intervention components are summarised in Table 1, including timing of home or phone contact.

Treatment Group 1. The participants and care partners in Group 1 received the materials and equipment listed in Table 1. The educational booklet was tailored to older adults and included techniques to maintain good oral health, common oral health problems and resources for receiving additional oral health related information. In Group 1, the educational booklet was not explained or discussed with participant and care partner until the final study visit. The participants in Group 1 also received instructions from a dental hygienist on how to safely use the electric toothbrush and a sheet to monitor brushing frequency as a backup for the data from the electronic toothbrush. The number of visits approximately matched the number provided to Treatment Group 2.

Treatment Group 2. Participants and care partners in Treatment Group 2 received several additional intervention components as listed in Table 1. Group 2 components targeted oral hygiene knowledge and technique with individualised instructions and care plan. A dental hygienist completed the oral examination (e.g. plaque and gingivitis). At this point, the care partner joined the session as the hygienist assessed the participant's brushing and flossing technique. The hygienist personalised the oral hygiene instruction, providing demonstration of proper brushing and flossing technique with return-demonstration by the participant and his/her care partner. The hygienist used the assessment results to provide an individualised care plan that was reviewed with the participant and care partner.

The second major focus of the Group 2 intervention was the coaching sessions (content outlined in Table 1) designed to help the care partners learn behaviours for cueing[23,24] and communication techniques.[25,26] These techniques are tailored for individuals with cognitive impairment to help participants remember to complete tasks such as oral care and to learn[24] the new skills such as proper technique for oral self-care. The intervention targeted the care partner's: (a) self-efficacy for confidence in his/her ability to do their own oral self-care appropriately; (b) self-efficacy for confidence in facilitating the participant to perform oral self-care properly; and (c) leadership behaviours in facilitating implementation of the care plan. The leadership behaviours included use of cueing and tailored communication techniques (FOCUSED communication) to remind and prompt the desired oral hygiene self-care behaviour by the participant. The participant joined the coaching sessions for the last ten minutes of the sessions to provide input on setting SMART goals.[27] SMART goals

are Specific, Measurable, Action-oriented, Reasonable and Timely. They are designed to reduce a process into smaller, more manageable steps. Examples of SMART goals common in this study were to use C-shaped flossing technique; aiming for flossing daily, early goals were to floss 3 times a week; aiming for 2 minutes of continuous brushing, the goals often were to engage in brushing for 30 seconds and increased as goals were met.

2.4 | Measures

A dental hygienist performed an oral health evaluation on all participants at each in-home visit. The hygienist used a mirror, a probe, a magnification loupe with headlight, and gauze. Participants lay in a reclining chair/sofa for the oral health evaluation. Plaque levels were assessed using the University of North Carolina (UNC) Modified Greene and Vermillion Oral Hygiene Index 1960.[28] Plaque was measured as 0 = no plaque, 1 = plaque covers 1/3 tooth, 2 = plaque covers >1/3 but 2/3 tooth, and 3 = plaque covers >2/3 tooth. The plaque index measure was calculated as the percentage of sites with plaque deposits on at least less than 1/3 of crown.

Gingival inflammation was assessed using the UNC Modification of the Löe and Silness Gingival Index.[29] Gingival probing was conducted by sweeping with probe no more than 1mm below sulcus. Gingival inflammation was classified as 0 = normal gingiva, 1 = mild inflammation, no bleeding on probing, 2 = moderate inflammation, bleeding on probing, 3 = severe inflammation, tendency to spontaneous bleeding. The gingival index measure was calculated as the percentage of sites with at least some mild inflammation.

We also assessed study participants' oral health using the Oral Health Assessment Tool (OHAT), a modification of the Brief Oral Health Status Examination that was developed for older adults with cognitive impairment,[30,31] and assessed by a dental hygienist. OHAT measures eight categories designating specific oral structures: lips, tongue, gums and tissues, saliva, natural teeth, dentures, oral cleanliness and dental pain. Each category was coded as 0 (healthy), 1 (changes from normal appearance/minor problems) and 2 (unhealthy/major problems). The total score ranged from 0 to 16, with a lower score indicating better oral health.

2.5 | Data analysis

Data were analysed by Stata version 15.1. An a level of 0.05 (two-tailed) was used. Descriptive analyses included frequencies, means and standard deviations (SD) for MCI groups, MD groups and the total groups, separately. A χ^2 or t test was used to evaluate the differences between Treatment Group 1 and the Treatment Group 2. Since there were multiple observations for a single participant across different time points, we used multi-level modelling to evaluate the impact of the intervention on the participants with MCI and MD, respectively. In Model 1, we examined the main effect of treatment and time. In Model 2, we added the interaction between treatment groups and time. Due to the small sample, we did not include other covariates in the analysis. The smart electric toothbrushes did not consistently record the brushing data; thus, we did not include tooth brushing data in the analysis.

Multi-level modelling using maximum likelihood estimation provides unbiased estimation of the regression coefficients and standard errors when the sample size is small. [32,33] However, restricted maximum likelihood is recommended rather than maximum likelihood estimation when the number of clusters is small.[33,34] Thus, the model was fitted with restricted maximum likelihood estimation in the present study.

3 | RESULTS

3.1 | Feasibility

The rate of retention in this study was high. Only two participants and their care partners withdrew from the study after the baseline visit: one was due to the death of the care partner, and the other was withdrawn by the PI because the participant's level of cognitive impairment was deemed to be too advanced to be able to complete the protocol. We achieved 100% completion of questionnaires and attendance at the four coaching modules.

3.2 | Baseline characteristics

Baseline comparison of participants suggested comparability between the Treatment Groups 1 and 2 on demographic characteristics, frequency of dental visits and frequency of tooth brushing (Table 2). However, among the strata of participants with MCI, those randomly assigned to the Treatment Group 2 had significantly higher levels of education than those assigned to Treatment Group 1 (years of education, means = 17.1 and 12.6, respectively, $P <$ .01). Apart from educational levels for the MCI groups, there were no significant differences in demographics between Treatment Groups 1 and 2 for the total group (ie MCI and MD groups combined).

3.2.1 | Rate of improvement—The benefit of participation in the intervention was evidenced by a significant reduction in plaque and gingival inflammation among all participants. Figures 1 and 2 show the rates of improvement in plaque index and gingival index, respectively. Oral health of the participants, including the plaque index and gingival index, in both treatment groups improved, but Treatment Group 2 (care partner-assisted intervention) showed slightly greater improvement. For example, the rates of improvement in the plaque index among MCI in Treatment Group 2 were 65.7% vs 16.4% in Treatment Group 1 during the 3-month intervention period (See Figure 1). Similarly, for the gingival index among MCI, the rates of improvement were higher in Treatment Group 2 (69.1%) vs Treatment Group 1 (45.3%) during the 3-month period (see Figure 2).

3.2.2 | Results from multi-level modelling—Table 3 shows the impact of the intervention on plaque levels. In Model 1, across all groups, study participants had significantly lower plaque levels at the 3-month and 6-month time point than at the baseline assessment. Among study participants with MCI, in Model 2, the interaction between the time of data collection and treatment groups showed that individuals with MCI in Treatment Group 2 had significant lower plaque levels than those in Treatment Group 1 (B = −0.247, $P <$ .05) at the 3-month time point. Plaque levels decreased most significantly among participants in Treatment Group 2 between the baseline and the 3-month time point.

Table 4 shows the effects of the intervention on gingival inflammation. In Model 1, across all groups, study participants had significantly lower gingival inflammation at the 3-month and 6-month time points than at the baseline assessment. There were no significant differences in the rate of decline in gingival inflammation between Treatment Group 1 and Treatment Group 2.

Table 5 shows the effect of intervention on OHAT score. In Model 1, among the MCI group and the total group, participants in Treatment Group 2 had significantly lower score than those in Treatment Group 1 at all time points (B = −1.767, $P <$ .01; B = −1.223, $P <$ .05, respectively). In Model 1, among the MD group, study participants had a significantly lower OHAT score at the 3-month time point than at the baseline (B = −1.4, $P <$ .05). In Model 2, for the MCI group and the total group, the interactions between time of data collection and being in Treatment Group 2 were significant. This indicates that study participants in Treatment Group 2 had significantly better oral health than those in Treatment Group 1 at the two follow-up data collection time points. The OHAT score improved more for Treatment Group 2 than Treatment Group 1 for the participants in the MCI and the total group.

3.3 | Discussion and implications

Older adults with cognitive impairment often have poor oral health; thus, it is important to develop good oral hygiene practices in the earlier stages of cognitive impairment. Previous studies suggest that standard routine oral hygiene practices implemented with the assistance of professional care providers are effective in improving oral health among nursing home residents with dementia. To our knowledge, the current study is the first to test the feasibility of a care partner–assisted intervention to improve oral health for community-dwelling older adults with cognitive impairment.

This pilot study provided evidence for the feasibility of the intervention by demonstrating a low attrition rate and acceptability of the participants and care partners reported previously.[22] The qualitative results from our post-intervention interview (at months), demonstrated strong acceptability and feasibility of this intervention by both the participants and the care partners, and their awareness of the importance of maintaining good oral hygiene.[22]

Our findings also indicated a potentially positive impact of the behavioural intervention on oral hygiene among older adults with cognitive impairment. These outcomes, measured by plaque and gingival inflammation, showed a sustained improvement in both Treatment Group 1 and Treatment Group 2 in MCI, MD and combined groups over 6-month period (3 months after the active intervention). Interestingly, the MCI Treatment Group 2 had greater plaque reduction than their counterparts in Treatment Group 1, and MCI Treatment Group 2 had a lower OHAT score than those in Treatment Group 1.

The oral hygiene may have been improved due to awareness and knowledge of oral health among participants in both Treatment groups.[22] Receiving an electric toothbrush and having someone come to download the data could also have prompted participants and care partners to pay more attention to their oral hygiene practices and, thus, may have contributed to

a change in oral hygiene behaviours for both Treatment Groups 1 and 2. Because both groups demonstrated improved oral health status, future research is needed to test the active component of the intervention by including a control group that does not receive a study-provided electric toothbrush. This would help us to test the change in oral health in three groups: (1) a group with a study-provided electric toothbrush only, (2) a group with a study-provided electric toothbrush and the care partner-assisted intervention with an individualised oral hygiene care plan and (3) a control group with neither a study-provided electric toothbrush or the care partner-assisted intervention.

These findings suggest that implementing a home-based intervention may be effective when individuals are in the earlier stages of cognitive impairment, as they may be better able to learn new skills and perform independently of their care partners. As cognition continues to decline, more behavioural symptoms may rise. It is possible that care partners who care for persons in the earlier stages of cognitive impairment may find it easier to work with the care recipient and to remain focused on implementing the intervention, rather than struggling with increased behavioural symptoms of the care recipient. In a future large-scale intervention study, we plan to test the mechanisms of the intervention by assessing key mediators such as the care partner's oral care self-efficacy, use of cueing methods and focused communication.

There were some limitations in this study that should be considered. With 25 participants, the sample size for this study was small. This was especially true for Treatment Group 1, with only 7 participants. We chose to maximise what we could learn about feasibility of the intervention by including more participants in Treatment Group 2 than in Treatment Group 1. This may have impacted the results of the study, as a small sample size reduced the statistical power of our analysis. We used a pilot randomised clinical trial design by including two treatment groups and did not include a control group in this study. Also, the dental hygienist was not blinded to the intervention groups, which might affect the accuracy of the data. This study was not able to test for active components of the intervention.

4 | CONCLUSION

This pilot study provides preliminary results of the feasibility of a care partner–assisted intervention on oral hygiene of community-dwelling older adults with cognitive impairment. This study suggests that oral health outcomes among older adults with cognitive impairment can be improved with a home-based, care partner–assisted oral hygiene intervention. Our research team developed an innovative model to improve oral hygiene behaviours at earlier stages of cognitive impairment with the help of informal care partners in a home-based setting. A large-scale intervention is needed to further test the efficacy of the intervention and the mechanisms of the intervention to improve oral health of older adults with cognitive impairment. With the significant increase in numbers of older adults with cognitive impairment, this type of behavioural intervention would provide the foundation for an evidence-based rubric to empower older adults with cognitive impairment and their care partners to improve their self-care skills, and ultimately improve the health and well-being of the older adults and their care partners.

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DATA AVAILABILITY STATEMENT

The dataset used in this study is available upon request.

REFERENCES

1. Nihtilä A, Tuuliainen E, Komulainen K, et al.Preventive oral health intervention among old home care clients. Age Ageing. 2017;46(5):846–851. [PubMed: 28200017]

2. Rouxel P, Tsakos G, Chandola T, Watt RG. Oral health—a neglected aspect of subjective well-being in later life. J Gerontol A Biol Sci Med Sci. 2018;73(3):382–386.

3. Lee KH, Plassman BL, Pan W, Wu B. Mediation effect of oral hygiene on the relationship between cognitive function and oral health in older adults. J Gerontol Nurs. 2016;42(5):30–37. [PubMed: 26716459]

4. Syrjälä AMH, Ylöstalo P, Ruoppi P, et al.Dementia and oral health among subjects aged 75 years or older. Gerodontology. 2012;29(1):36–42. [PubMed: 20604811]

5. Sloane P, Chen X, Cohen L, Barrick AL, Poole P, Zimmerman S. Oral health outcomes of person-centered mouth care for persons with cognitive or physical impairment: Mouth care without a battle. Alzheimers Dement. 2012;8(4):P251–P252.

6. Iwasaki M, Kimura Y, Ogawa H, et al.Periodontitis, periodontal inflammation, and mild cognitive impairment: A 5-year cohort study. J Periodontal Res. 2019;54(3):233–240. [PubMed: 30345659]

7. Li J, Xu H, Pan W, Wu B. Association between tooth loss and cognitive decline: a 13-year longitudinal study of Chinese older adults. PLoS One. 2017;12(2).

8. Delwel S, Binnekade TT, Perez RS, Hertogh CM, Scherder EJ, Lobbezoo F. Oral hygiene and oral health in older people with dementia: a comprehensive review with focus on oral soft tissues. Clin Oral Investig. 2018;22(1):93–108.

9. Maldonado A, Laugisch O, Bürgin W, Sculean A, Eick S. Clinical periodontal variables in patients with and without dementia—a systematic review and meta-analysis. Clin Oral Investig. 2018;22(7):2463–2474.

10. Wu B, Fillenbaum GG, Plassman BL, Guo L. Association between oral health and cognitive status: a systematic review. J Am Geriatr Soc. 2016;64(4):739–751. [PubMed: 27037761]

11. Wiener RC, Wu B, Crout R, et al.Hyposalivation and xerostomia in dentate older adults. J Am Dent Assoc. 2010;141(3):279–284. [PubMed: 20194383]

12. Wu B, Plassman BL, Liang J, Wei L. Cognitive function and dental care utilization among community-dwelling older adults. Am J Public Health. 2007;97(12):2216–2221. [PubMed: 17971546]

13. Hoben M, Kent A, Kobagi N, Huynh KT, Clarke A, Yoon MN. Effective strategies to motivate nursing home residents in oral care and to prevent or reduce responsive behaviors to oral care: A systematic review. PLoS One. 2017;12(6):e0178913. [PubMed: 28609476]

14. Jablonski RA, Therrien B, Mahoney EK, Kolanowski A, Gabello M, Brock A. An intervention to reduce care-resistant behavior in persons with dementia during oral hygiene: a pilot study. Spec Care Dentist. 2011;31(3):77–87. [PubMed: 21592161]

15. Lewis A, Kitson A, Harvey G. Improving oral health for older people in the home care setting: An exploratory implementation study. Australas J Ageing. 2016;35(4):273–280. [PubMed: 27226074]

16. Volk L, Spock M, Sloane PD, Zimmerman S. Improving evidence-based oral health of nursing home residents through coaching by dental hygienists. J Am Med Dir Assoc. 2020;21(2):281–283. [PubMed: 31780411]

17. Egan KJ, Pinto-Bruno ÁC, Bighelli I, et al.Online training and support programs designed to improve mental health and reduce burden among caregivers of people with dementia: a systematic review. J Am Med Dir Assoc. 19(3):200–206.e1. [PubMed: 29306605]

18. Mahoney EK, Hurley AC, Volicer L, et al.Development and testing of the Resistiveness to Care Scale. Res Nurs Health. 1999;22(1):27–38. [PubMed: 9928961]

19. Wu B, Plassman BL, Crout RJ, Liang J. Cognitive function and oral health among community-dwelling older adults. J Gerontol A Biol Sci Med Sci. 2008;63(5):495–500. [PubMed: 18511753]

20. Zanetti O, Binetti G, Magni E, Rozzini L, Bianchetti A, Trabucchi M. Procedural memory stimulation in Alzheimer's disease: impact of a training programme. Acta Neurol Scand. 1997;95(3):152–157. [PubMed: 9088383]

21. Clare L, Woods RT. Cognitive training and cognitive rehabilitation for people with early-stage Alzheimer's disease: A review. Neuropsychol Rehabil. 2004;14(4):385–401.

22. Anderson RA, Wang J, Plassman BL, et al.Working together to learn new oral hygiene techniques: Pilot of a carepartner-assisted intervention for persons with cognitive impairment. Geriatr Nurs. 2019;40(3):269–276. [PubMed: 30522909]

23. Kirk M, Berntsen D. A short cut to the past: Cueing via concrete objects improves autobiographical memory retrieval in Alzheimer's disease patients. Neuropsychologia. 2018;110:113–122. [PubMed: 28676268]

24. Bird MBehavioural difficulties and cued recall of adaptive behaviour in dementia: Experimental and clinical evidence. Neuropsychol Rehabil. 2001;11(3–4):357–375.

25. Ripich DN. Functional communication with AD patients: a caregiver training program. Alzheimer Dis Assoc Disord. 1994;8:95–109. [PubMed: 7999352]

26. Ripich DN, Wykle M, Niles S. Alzheimer's disease caregivers: The FOCUSED program: A communication skills training program helps nursing assistants to give better care to patients with Alzheimer's disease. Geriatr Nurs. 1995;16(1):15–19. [PubMed: 7859996]

27. Page J, Roos K, Bänziger A, et al.Formulating goals in occupational therapy: State of the art in Switzerland. Scand J Occup Ther. 2015;22(6):403–415. [PubMed: 26087696]

28. Greene JC, Vermillion JR. The oral hygiene index: a method for classifying oral hygiene status. J Am Dent Assoc. 1960;61(2):172–179.

29. Löe H, Silness J. Periodontal disease in pregnancy I. Prevalence and severity. Acta Odontol Scand. 1963;21(6):533–551. [PubMed: 14121956]

30. Chalmers J, King P, Spencer A, Wright F, Carter K. The oral health assessment tool—validity and reliability. Aust Dent J. 2005;50(3):191–199. [PubMed: 16238218]

31. Kayser-Jones J, Bird WF, Paul SM, Long L, Schell ES. An instrument to assess the oral health status of nursing home residents. Gerontologist. 1995;35(6):814–824. [PubMed: 8557208]

32. Huang FL. Using cluster bootstrapping to analyze nested data with a few clusters. Educ Psychol Meas. 2018;78(2):297–318. [PubMed: 29795957]

33. McNeish DM, Stapleton LM. The effect of small sample size on two-level model estimates: A review and illustration. Educa Psychol Rev. 2016;28(2):295–314.

34. Huang FL. Multilevel modeling myths. Sch Psychol Q. 2018;33(3):492. [PubMed: 30070555]

35. Bovend'Eerdt TJ, Botell RE, Wade DT. Writing SMART rehabilitation goals and achieving goal attainment scaling: a practical guide. Clin Rehabil. 2009;23(4):352–361. [PubMed: 19237435]
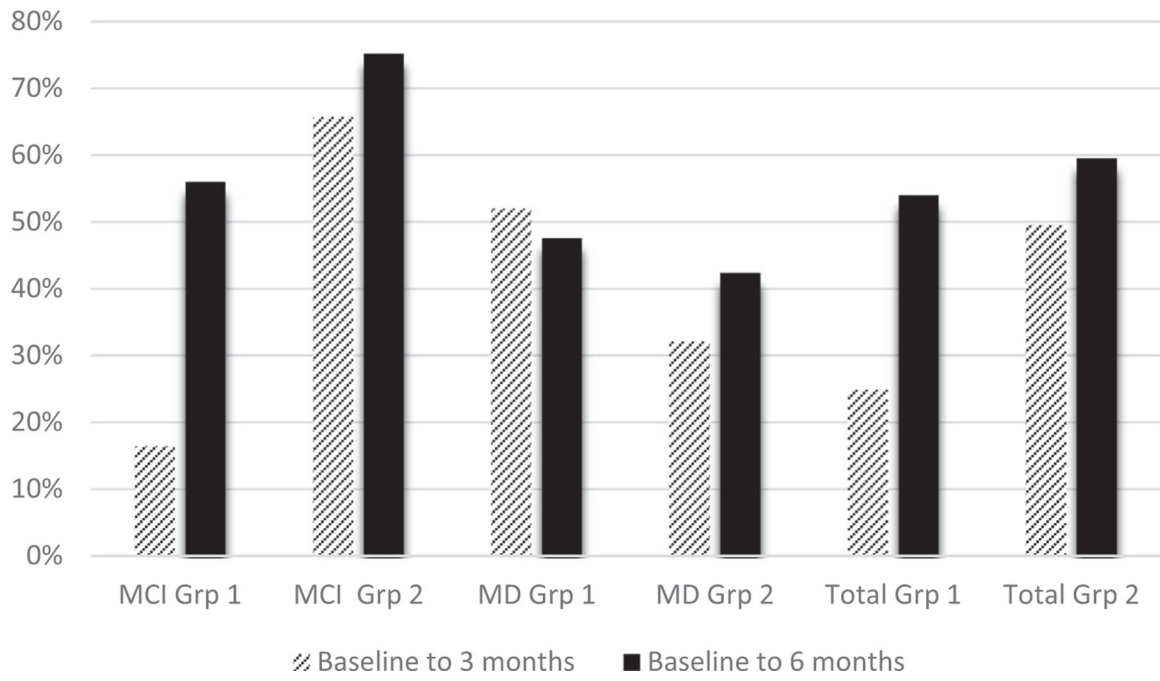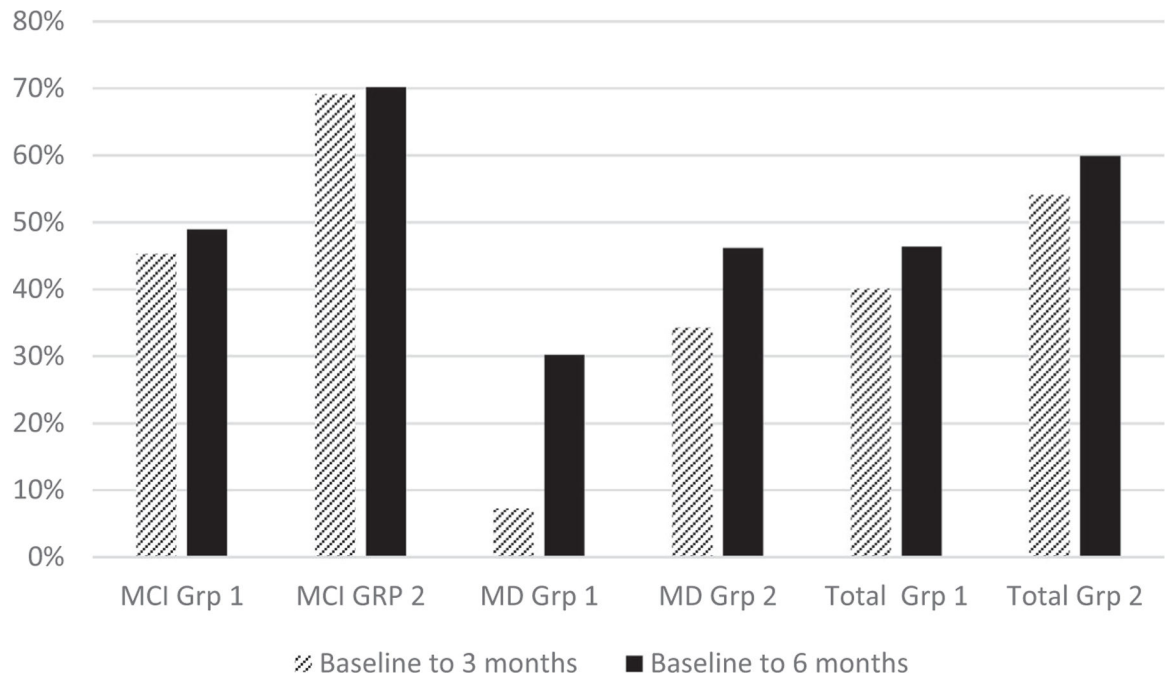
FIGURE 1.
Rate of Plaque Improvement

FIGURE 2.
Rate of Gingival Improvement

TABLE 1

Intervention components

Approximate weeks from baseline visit	Treatment Groups 1 and 2 intervention components	Additional components for Treatment Group 2
0	• Home visit • Oral hygiene exam • Complete questionnaires • Educational Booklet • Provide sheet to monitor brushing frequency • Participant receives an electronic toothbrush • Demonstration of safe use of electronic toothbrush	• Educational booklet with explanation and discussion • Care partner also receives an electronic toothbrush • Individualised instructions on oral hygiene techniques (demonstration/return demonstration) • Individualised care plan (eg type of floss to use, ways to correct poor technique) • Plaque disclosing tablets for evaluating brushing technique with instruction and return-demonstration. • Coaching module 1, including: • Session begins with care partner only • Assess challenges and motivation • Introduce cueing and reminding strategies and practice [23,35] • Invite participant to join coaching session • Jointly (ie participant, care partner, hygienist and interventionist) set SMART goals [35] for manageable steps (eg let toothbrush do the work, incremental goals for flossing and brushing to reach daily and 3 times daily respectively)
4	• Home visit to download data from toothbrush and collect sheet to monitor brushing frequency	• By phone, Coaching Module 2 (begin with care partner only) • Review care partner use of cueing and reminding strategies • Assess challenges and motivation • Assess progress on goals • Review and practice cueing strategies. • Introduce FOCUSED communication strategies and practice a few selected by care partner [26] • Invite participant to join phone-delivered coaching session and review his/her perceptions of progress • Jointly revise SMART goals to support progression
8	• Home visit to download data from toothbrush and collect sheet to monitor brushing frequency	• By phone, Coaching Module 3 (begin with care partner only) • Review care partner use of cueing, reminding, and FOCUSED communication strategies • Assess challenges and motivation • Assess progress on goals • Review cueing strategies. • Review and practice FOCUSED communication [26] • Revise SMART goals to support progression
12	• Final intervention home visit for oral hygiene examination and questionnaires	• Coaching Module 4 (session begins with care partner only) • Review care partner use of cueing, reminding, and FOCUSED communication strategies • Assess challenges and motivation • Assess progress on goals • Review and practice cueing strategies. • Review and practice FOCUSED communication [26] • Invite participant to join coaching session and review his/her perceptions of progress • Revise SMART goals to sustain behaviour changes

TABLE 2

Sample characteristics of study participants and care partners

	MCI		MD		Total	
	Treatment Group 1 N = 5	Treatment Group 2 N = 10	Treatment Group 1 N = 2	Treatment Group 2 N = 8	Treatment Group 1 N = 7	Treatment Group 2 N = 18
Characteristics of study participants						
Age, mean (SD)	71.8 (4.97)	72 (6.32)	72.5 (6.36)	73.4 (5.66)	72 (4.83)	72.6 (5.90)
Male %	60	80	100	50	71.4	66.7
Race: %						
White	60	90	100	75	71.4	83.3
Black	40	10	0	12.5	28.6	11.1
Asian	0	0	0	12.5	0	5.6
Education, mean (SD)	12.6 (2.19)	17.1 ** (0.99)	12.5 (0.71)	9.6 (2.33)	12.6 (1.8)	13.8 (4.2)
Had dental insurance (%)	80	40	100	62.5	85.7	50
Dental visit 2 or more times per year (%)	75 (n = 4)	88.9 (n = 9)	100	66.7 (n = 6)	83.4 (n = 6)	80 (n = 15)
Brushed teeth twice a day or more at baseline (%)	40	60	50	75	42.9	66.7
OHAT[1]	4.20 (2.39)	3.60 (1.71)	2.50 (2.12)	3.88 (1.46)	3.71 (2.29)	3.72 (1.56)
MoCA Score[2]	19 (3.94)	22.6 (3.92)	14 (5.66)	16.38 (3.46)	17.57 (4.65)	19.83 (4.82)
Characteristics of care partners						
Age, mean (SD)	68.6 (2.97)	66.2 (9.17)	67.5 (0.71)	68.1 (15.2)	68.3 (2.50)	67.1 (11.9)
Male, %	40	30	0	50	28.6	38.9
Race: %						
White	60	90	100	75	71.4	83.3
Black	40	10	0	12.5	28.6	11.1
Asian	0	0	0	12.5	0	5.6
Education, mean (SD)	15.4 (3.29)	15.5 (2.51)	10 (2.83)	8.25 (2.05)	13.9 (3.9)	12.3 (4.3)
Had dental insurance, %	80	50	100	50	85.7	50
Relationship with study participants (%)						
Spouses	100	70	100	87.5	100	77.8
Children	0	10	0	12.5	0	11.1

| | MCI | MCI | MD | MD | Total | Total |
	Treatment Group 1 N = 5	Treatment Group 2 N = 10	Treatment Group 1 N = 2	Treatment Group 2 N = 8	Treatment Group 1 N = 7	Treatment Group 2 N = 18
Others	0	20	0	0	0	11.1

[1] OHAT: Oral Health Assessment Tool.

[2] The Montreal Cognitive Assessment (MoCA) was used to measure cognitive function (score range: 0–30).

Significance levels:

*
$P < .05$

**
$P < .01$.

TABLE 3

The effect of intervention on plaque index (% of sites with at least some deposits on tooth)

Variables	MCI ($N_o = 45$, $N_P = 15$)		MD ($N_o = 30$, $N_P = 10$)		Total ($N_o = 75$, $N_P = 25$)	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Treatment Group 2 (ref = Treatment Group 1)	−0.073	0.005	0.172	0.193	0.020	0.078
Wave (ref = baseline)						
3 months	−0.214 ***	−0.032	−0.163 *	−0.164	−0.193 ***	−0.077
6 months	−0.295 ***	−0.259 **	−0.202 **	−0.150	−0.258 ***	−0.222 **
Interaction						
Treatment Group 2 * 3 months		−0.247 *		0.001		−0.154 †
Treatment Group 2 * 6 months		−0.048		−0.066		−0.047
Constant	0.475 ***	0.422 ***	0.332 †	0.315	0.429 ***	0.387 ***
Degrees of freedom	3	3	5	5	3	5
LR χ^2	4.80	5.21	13.64	11.45	23.21	22.93

Note: Significance levels:

† $P < .1$

* $P < .05$

** $P < .01$

*** $P < .001$.

TABLE 4

The effect of intervention on Gingival Index, (% of sites with at least some mild inflammation)

Variables	MCI ($N_o = 45$, $N_P = 15$)		MD ($N_o = 30$, $N_P = 10$)		Total ($N_o = 75$, $N_P = 25$)	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Treatment Group 2 (ref = Treatment Group 1)	−0.083	−0.036	0.129	0.210	−0.013	0.034
Wave (ref = baseline)						
3 months	−0.254 ***	−0.156	−0.108 *	−0.013	−0.195 ***	−0.114
6 months	−0.263 ***	−0.229 *	−0.152 **	−0.052	−0.218 ***	−0.176 *
Interaction						
Treatment Group 2 * 3 months		−0.133		−0.119		−0.107
Treatment Group 2 * 6 months		−0.046		−0.125		−0.056
Constant	0.474 ***	0.442 ***	0.238	0.173	0.397 ***	0.363 ***
Degrees of freedom	3	5	3	5	3	5
LR χ^2	10.71	9.63	19.28	17.14	27.25	26.18

Note: Significance levels:

[†] $P < .1$

[*] $P < .05$

[**] $P < .01$

[***] $P < .001$.

TABLE 5

The effect of intervention on The Oral Health Assessment Tool

Variables	MCI ($N_o = 45$, $N_p = 15$)		MD ($N_o = 29$, $N_p = 10$)		Total ($N_o = 74$, $N_p = 25$)	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Treatment Group 2 (ref = Treatment Group 1)	−1.767**	−0.864	0.072	1.375	−1.223*	−0.255
Wave (ref = baseline)						
3 months	−0.733†	0.475	−1.4*	0.00	−1**	0.225
6 months	−0.6	0.674	−0.726	1	−0.660†	0.694
Interaction						
Treatment Group 2 * 3 months		−1.648*		−1.75		−1.612*
Treatment Group 2 * 6 months		−1.737*		−2.188		−1.793*
Constant	4.98***	4.38***	3.54***	2.5***	4.60***	3.90***
Degrees of freedom	3	5	3	5	3	5
LR χ^2	7.01	5.81	1.12	1.23	9.49	10.48

Note: Significance levels:

† $P < .1$

* $P < .05$

** $P < .01$

*** $P < .001$.