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A prospective cohort study on factors related to dental care and continuation of care for older adults receiving home medical care

Kumi Tanaka[1,2] · Takeshi Kikutani[1,2] · Noriaki Takahashi[1,2] · Takashi Tohara[1,2] · Hiroyasu Furuya[1,2] · Yoko Ichikawa[1,2] · Yuka Komagata[1,2] · Arato Mizukoshi[1] · Maiko Ozeki[1] · Fumiyo Tamura[1,2] · Tomokazu Tominaga[3]

Abstract

Information on the effects of dental treatment must be identified and factors that hinder the continuation of dental treatment must be identified to provide appropriate domiciliary dental care (DDC). This study aimed to clarify the treatment outcomes of DDC for older adults and the factors that impede the continuation of such care. This prospective study was conducted at a Japanese clinic specializing in dental care for older adults. The functional status, nutritional status, oral assessment, details of the dental treatment, and outcomes after 6 months of older adults receiving DDC were surveyed. The Oral Health Assessment Tool (OHAT) was used for oral assessment. Cox proportional hazards analysis was used to analyze the factors at the first visit that were associated with treatment continuation. A total of 72 participants (mean age, 85.8 ± 6.9) were included. Twenty-three participants (31.9%) could not continue treatment after 6 months. The most frequently performed procedures were oral care and dysphagia rehabilitation, followed by prosthetic treatment, then tooth extraction. The percentage of participants with teeth that required extraction after 6 months and the total OHAT score decreased significantly. The Barthel Index, Mini Nutritional Assessment Short-Form, and rinsing ability were significantly associated with treatment continuation. Furthermore, instrumental activities of daily living (ADL) and the OHAT "tongue" sub-item were correlated with treatment continuation. In conclusion, DDC improved the oral health status of older adults after 6 months. Factors that impeded treatment continuation were decreased ADL, decreased nutritional status, difficulty in rinsing, and changes in the tongue such as tongue coating.

Keywords Domiciliary dental care · Home medical care · Older adults · Dental treatment

Introduction

Dental care is mainly provided at outpatient clinics, which means that appropriate dental treatment cannot be provided to older adults who receive home medical care. Oral diseases have a significant impact on physical and mental health conditions [1, 2]; hence, appropriate domiciliary dental care (DDC) must be provided for the well-being of older adults who receive home medical care.

Several studies have reported the progress and effects of dental treatment at hospitals and facilities [2–7]. Professional oral hygiene care and multidisciplinary oral hygiene program education can reportedly lead to favorable outcomes, such as reduced incidence of pneumonia, improved oral intake, increased home discharge, and reduced in-hospital mortality. However, there is insufficient data regarding the course of dental treatment and its association with outcomes in older adults who receive home medical care. Oral hygiene programs [8–10] and dysphagia rehabilitation [11] have also yielded positive outcomes for community-dwelling older adults with dementia and frail older adults. A preliminary study on older adults who require home care focused on occlusal restoration with removable prostheses and reported that maintaining and restoring occlusal support

✉ Takeshi Kikutani
kikutani@tky.ndu.ac.jp

1 The Nippon Dental University, Tama Oral Rehabilitation Clinic, 4-44-19 Higashi-cho, Koganei-city, Tokyo 184-0011, Japan

2 Division of Rehabilitation for Speech and Swallowing Disorders, The Nippon Dental University, Tokyo, Japan

3 Koganei Family Clinic, Tokyo, Japan

was associated with a better survival prognosis in < 85-year-old participants; however, the effect decreased in ≥ 85-year-old participants [12]. However, the relationship between oral changes that are associated with comprehensive dental treatment and factors that impede dental treatment continuation has yet to be clarified.

There is a growing need to promote preventive and curative oral health and dental care for older adults who live at home. Therefore, information on the effects of dental treatment must be disseminated, and factors that impede treatment continuation must be identified. With this in mind, this study aimed to clarify the treatment outcomes of DDC and factors that impede treatment continuation among older adults receiving DDC.

Materials and methods

This prospective study was conducted in a city with a population of approximately 120,000 people in Tokyo, Japan, from May 2018 to March 2023. We included older adults who were (1) ≥ 65 years old, who received home medical care at a single in-home treatment support clinic and (2) recommended for DDC by their physician and gave their consent. The physicians asked the patients and their families whether they wished to receive DDC within the scope of a regular home visit. If requested, the participant was referred to Tama Oral Rehabilitation Clinic, The Nippon Dental University, a clinic that specializes in dental care and dysphagia rehabilitation for older adults. Thereafter, a dentist with more than 5 years of experience in gerodontology at the same clinic started providing DDC. Older adults who (1) did not want to continue DDC and refused treatment and (2) had terminal cancer were excluded from the study. The results of dental treatment, changes in the oral status, and treatment continuation were evaluated 6 months after the first visit.

DDC in Japan

Only a handful of countries provide DDC. To the best of our knowledge, such services were only available in Taiwan [13, 14]. Japan has a universal health insurance coverage system, and DDC was included in the medical insurance in 1998. Thereafter, this was also covered by long-term care insurance for people who require nursing care while living at home. In other words, services are integrated from both the medical insurance and long-term care insurance business. There are several issues concerning DDC, such as the increased number of dental treatment fee items and the fact that the system has changed according to the current demands.

However, most of these issues can be resolved by the patient or family members who contact the (1) dental clinic directly and (2) the person in charge, such as a government agency or a medical care professional. If patients and their families do not understand the existence or necessity of DDC, medical care professionals may refer them to dental clinics that provide DDC.

Measurements

Functional status

Level of care In 2000, Japan implemented a long-term care insurance system. Individuals are categorized into one of seven levels of care based on the estimated total hours of caregiving required: comprising two support levels and five care levels. The spectrum ranges from the lowest support level 1 to the highest care level 5 [15]. Services are tailored according to the individual's assigned level of care.

Activities of daily living (ADL) The Barthel Index [16] and Lawton's Instrumental Activities of Daily Living (IADL) [17] were used.

Charlson comorbidity index (CCI) The Charlson Comorbidity Index (CCI) [18, 19] was assessed based on the patient information form submitted by the physician.

Living with family We inquired whether the participant lived together with family members.

Treatment results

After starting DDC, data on death, institutionalization, and hospital admission were collected. After 6 months, those who continued receiving DDC were regarded as participants who were able to continue treatment, and those who did not were regarded as those who were unable to continue treatment.

Nutritional status

The Mini Nutritional Assessment-Short Form [20] was used.

Oral intake function

Oral intake function was evaluated using the Food Intake LEVEL Scale (FILS) [21]. FILS was defined as follows: Level 1–6, tube feeding; Level 7, easy-to-swallow food orally ingested in three meals with no alternative nutrition given; Level 8, the patient eats three meals, only excluding food that is particularly difficult to swallow; Level 9, no

dietary restriction, and patient ingesting three meals orally, with medical considerations; and Level 10, normal.

Dental assessment

The total number of teeth, number of functional teeth, number of caries, number of mobile teeth, Japanese version of the Oral Health Assessment Tool (OHAT-J) score [22], details of dental treatment, and other items were surveyed.

Number of functional teeth Teeth that were useful for mastication were counted regardless of whether they were natural or treated teeth. Prostheses were also included.

Carious teeth The number and proportion of caries were calculated. The severity of caries was assessed using periapical radiographs. Teeth with severe carious lesions that were deemed untreatable with any restorative treatment were recorded as "Teeth that require extraction" [23].

Mobile teeth According to Miller's classification [24], the number of teeth with 1–2 mm horizontal mobility (Class 2 mobility) and > 2 mm horizontal and vertical mobility (Class 3 mobility) were counted. Teeth with Class 3 mobility are more likely to fall out. Tooth extraction is favored in cases such as in older adults with reduced functional status that are prone to accidental ingestion and aspiration [25]. Severely carious teeth and teeth with Class 3 mobility were recorded as "Teeth that require extraction".

OHAT OHAT-J was used as an assessment tool for oral health status [22]. OHAT [26] is an oral assessment tool developed for older adults and is used by many professions in various fields [27]. The evaluation items comprise eight items: lips, tongue, gums and tissues, saliva, natural teeth, dentures, oral cleanliness, and dental pain. Each item is evaluated on a three-point scale, with each score indicating the following: "healthy" (0 points), "some changes observed" (1 point), and "unhealthy" (2 points). The total score of OHAT ranges from 0 to 16 points. A previous study conducted at an acute care hospital reported that a total score of ≥ 3 was an independent predictor of death [28], whereas a study conducted at a rehabilitation hospital demonstrated that a total score of ≥ 4 indicated that ADL is unlikely to improve [29]. OHAT classified the sub-items into two groups of 0 and ≥ 1 points.

Dental treatment The details of the dental treatment performed within 6 months were tabulated by multiple choice. Dental treatments were classified into prosthetic treatment (new and adjustment/repair), oral care, extraction, restorative treatment, and dysphagia rehabilitation.

Other measures The other measures used were (1) the presence or absence of assistance for oral cleaning, (2) rinsing ability, and (3) the last dental visit.

Sample size calculation

The sample size was calculated using G*Power 3.1.9.4 Statistical Power Analyzes (University of Dusseldorf, Germany) with an α error of 0.05, β of 0.8, and medium effect size, requiring a minimum of 88 individuals.

Statistical analysis

The chi-square test, Fisher's exact test, and Kruskal–Wallis test were used to examine each baseline endpoint for treatment continuation. The Wilcoxon's signed and McNemar's tests were performed for changes in the oral status due to dental treatment. For the details of the dental treatment, crude hazard ratios and hazard ratios adjusted for age (years), care level, and total OHAT score were calculated with a 95% confidence interval using the Cox proportional hazards model with treatment continuation as the objective variable. Similarly, for factors that impede treatment continuation, crude hazard ratios and hazard ratios adjusted for age (years) and level of care were calculated with a 95% confidence interval using the Cox proportional hazards with treatment continuation as the objective variable. IBM SPSS Statistics for Windows, version 27 (IBM Corp., Armonk, N.Y., USA) was used for all statistical processing. The significant difference was set at < 5%. For the missing data, each analysis was performed with complete cases.

Results

Figure 1 shows the study flow chart. Among the 87 participants, seven people with terminal cancer and eight people who refused treatment were excluded. The final number of participants was 72 (34 men, 38; women, 72; mean age, 85.8 ± 6.9 years; median, 87.0 years [interquartile range (IQR), 82.0–90.75]). Table 1 shows the baseline characteristics classified by whether or not participants continued treatment. The average care level was 2.99 ± 0.98 (median, 2.0; IQR, 2.0–5.0). The average OHAT total score was 5.55 ± 2.50 (median, 5.0; IQR, 4.0–7.5). After 6 months, 49 patients continued treatment, and 23 (31.9%) were unable to continue. Among those who were unable to continue, 15 died, four were admitted to an institution, and four were hospitalized. The mean number of days to the event was 76.9 ± 47.2 days (median, 73 days; IQR, 37.0–117.0).

Figure 2 and Table 2 show the details of the dental treatment. Overall, 70 participants (97.2%) received treatment, and two participants (2.8%) were followed up. Thirty-one

Fig. 1 Flowchart of this study
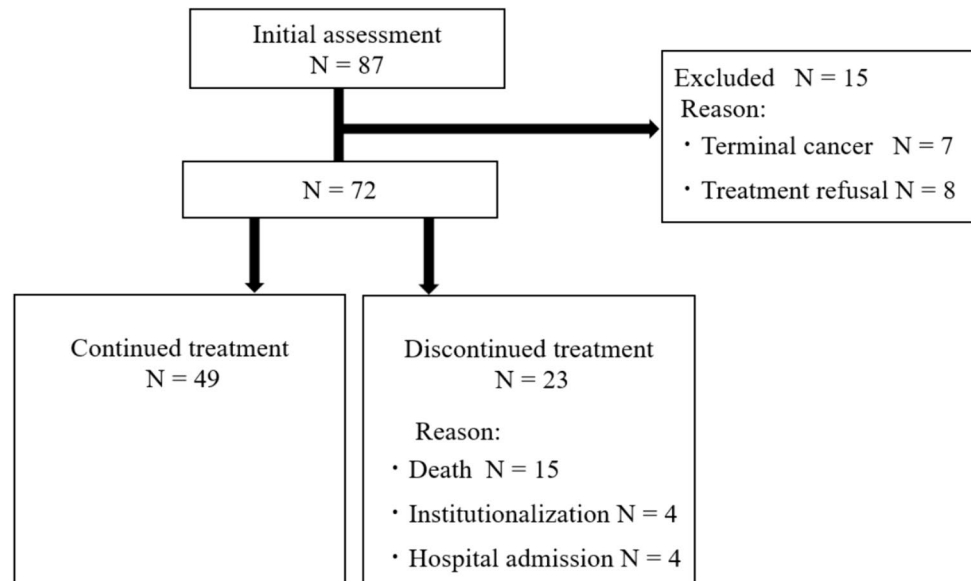
participants out of 70 (44.3%; 26 participants for prosthetic repair, and 16 participants for new prostheses) received prosthetic treatment, 39 participants (55.7%) received oral care, and 23 participants (32.9%) underwent extraction. The number of extracted teeth (minimum–maximum) was 1–24, 11 participants (15.7%) underwent restorative treatment, and the number of treated teeth was 1–9 (minimum–maximum). Thirty-seven patients (52.9%) received dysphagia rehabilitation (Multiple choice).

Table 2 shows the results of the Cox proportional hazards analysis on treatment continuation and differences in details of the dental treatment. In a multivariate model adjusted for age, care level, and OHAT total score, tooth extraction was significantly performed in those who were able to continue treatment compared with those who were not. Prosthetic adjustment/repair tended to be less frequent among those who were unable to continue treatment, and oral care tended to be more frequent among those who were unable to continue treatment.

Table 3 shows the changes in the oral status of 49 participants who continued treatment. After 6 months, the number of carious teeth, number of mobile teeth, number of teeth, and proportion of teeth that required extraction decreased significantly. In terms of OHAT, there were no significant changes in the "tongue" and "dental pain" sub-items; however, the total score, lips, gums and tissues, saliva, natural teeth, dentures, and oral cleanliness significantly decreased. The number of functional teeth increased significantly. In terms of oral hygiene, there were no significant differences in the proportion of rinsing ability and participants who needed assistance after 6 months.

Table 4 shows the results of the Cox proportional hazards analysis on the factors at the time of the first visit that were related to treatment continuation. In the multivariate model

that was adjusted for age and care level, the Barthel Index and MNA-SF were significantly lower for those who were unable to continue treatment, as well as significant difficulty rinsing. IADL also tended to decline, and OHAT tongue score tended to be ≥ 1 point.

Discussion

This prospective study is the first to clarify the dental treatment outcome and factors affecting treatment discontinuation in older adults who receive home medical care (i.e., older adults with many medical needs). The dental treatments performed were oral care, dysphagia rehabilitation, prosthetic treatment, extraction, and restorative treatment. The oral health status of participants who could continue treatment improved after 6 months. On the other hand, 31.9% of the patients were unable to continue DDC after 6 months due to the deterioration of their general condition. Factors that impeded treatment continuation were decreased ADL, decreased nutritional status, and difficulty in rinsing. Changes in the tongue such as tongue coating was also tended to be a factor.

Among the participants in this study, 97.2% received dental treatment. The dental treatment conducted included oral care, dysphagia rehabilitation, denture treatment, tooth extraction, and restorative treatment, all of which contributed to the improvement of oral health condition after 6 months. The need for dental treatment among older adults with reduced functional status is high, with 72% to 90% or more in hospitals [30, 31], facilities [32–34], and older adults who receive home medical care with stable functional status [35]. The actual dental treatment is generally prosthesis (69–96.4%) and oral care (80–90.6%) [36, 37]. Among

Table 1 Baseline characteristics of the participants

	Overall (N=72)				Continued (N=49)				Discontinued (N=23)				P
	Mean/N	SD/%	Median	IQR	Mean/N	SD/%	Median	IQR	Mean/N	SD/%	Median	IQR	
Sex													
Female	38	52.8			27	55.1			11	47.8			0.564
Male	34	47.2			22	44.9			12	52.2			
Age, years	85.8	6.9	87.00	82.0–90.75	85.9	6.9	87.00	82.0–91.0	85.7	7.1	87.00	82.0–89.0	0.976
Care level	2.99	0.98	2.00	2.0–5.0	3.08	1.58	3.00	2.0–5.0	2.78	1.51	2.00	2.0–4.0	0.444
Charlson comorbidity index	1.79	0.98	2.00	1.0–2.0	1.73	1.02	2.00	1.0–2.0	1.91	0.90	2.00	1.0–3.0	0.344
Barthel index (points)	48.8	33.7	50.00	15.0–80.0	53.4	34.7	50.00	25.0–90.0	37.5	28.6	45.00	6.25–50.0	0.083
IADL (points)	1.72	2.35	1.00	0.0–3.5	1.96	2.50	1.00	0.0–4.0	1.2	1.90	0.00	0.0–1.0	0.236
Household composition													
Living with family members	58	80.6			37	75.5			21	91.3			0.200
None	14	19.4			12	24.5			2	8.7			
MNA-SF (points)	7.83	2.8	8.00	6.0–10.0	8.31	2.5	9.00	6.0–10.5	6.68	3.4	6.00	4.0–9.0	0.045
FILS	7.71	1.6	8.00	7.0–9.0	7.80	1.5	8.00	7.0–9.0	7.52	1.8	7.00	7.0–9.0	0.519
Dental assessment													
Time since last dental visit	41.0	49.7	24.00	6.0–60.0	41.9	53.2	21.00	3.25–60.0	39.2	43.2	24.00	12.0–60.0	0.555
Total number of teeth	14.88	9.7	15.50	4.35–24.0	14.94	9.50	14.00	5.0–24.0	14.7	10.49	17.00	4.0–24.0	0.971
Functional teeth	27.03	2.2	28.00	27.0–28.0	27.03	2.13	28.00	27.0–28.0	27.0	2.31	28.00	27.25–28.0	0.656
Wearing removable dentures	39	54.2			29	59.2			10	43.48			0.212
None	33	45.8			20	40.8			13	56.5			
Caries	4.57	5.3	3.00	1.0–6.0	4.93	5.6	3.00	1.0–7.5	3.75	4.39	3.00	1.0–4.0	0.567
Severe caries	2.85	4.2	1.00	0.0–4.0	3.18	4.3	2.00	0.5–5.0	2.10	3.78	1.00	0.0–2.75	0.153
Presence of dental caries	55	76.4			39	79.6			16	69.6			0.482
None	10	13.9			6	12.2			4	17.4			
Morbidity	0.85	1.2	0.00	0.0–1.0	0.55	0.94	0.00	0.0–1.0	0.80	1.20	0.00	0.0–1.0	0.845
Presence of mobile teeth	30	41.7			21	42.9			9	39.1			0.901
None	35	48.6			24	49.0			11	47.8			
Presence of teeth for extraction	51	70.8			37	75.5			8	34.8			0.332
None	14	19.4			8	16.3			12	52.2			
OHAT													
Total points	5.69	2.4	6.0	4.0–7.75	5.55	2.50	5.0	4.0–7.5	6.00	2.24	6.0	4.0–8.0	0.449
Lips	0.31	0.46	0.0	0.0–1.0	0.33	0.47	0.0	0.0–1.0	0.26	0.45	0.0	0.0–1.0	0.575
Tongue	0.61	0.55	1.0	0.0–1.0	0.53	0.54	1.0	0.0–1.0	0.78	0.52	1.0	0.0–1.0	0.065
Gums and tissues	1.03	0.79	1.0	0.0–2.0	1.00	0.82	1.0	0.0–2.0	1.09	0.73	1.0	1.0–2.0	0.672
Saliva	0.44	0.50	0.0	0.0–1.0	0.45	0.50	0.0	0.0–1.0	0.43	0.51	0.0	0.0–1.0	0.911
Natural teeth	1.46	0.71	2.0	1.0–2.0	1.40	0.71	2.0	1.0–2.0	1.61	0.72	2.0	1.0–2.0	0.145

Table 1 (continued)

	Overall (N = 72)				Continued (N = 49)				Discontinued (N = 23)				P
	Mean/N	SD/%	Median	IQR	Mean/N	SD/%	Median	IQR	Mean/N	SD/%	Median	IQR	
Dentures	0.90	0.92	1.0	0.0–2.0	0.90	0.88	1.0	0.0–2.0	0.91	1.04	0.0	0.0–2.0	0.974
Oral cleanliness	0.82	0.39	1.0	1.0–1.0	0.82	0.39	1.0	1.0–1.0	0.83	0.39	1.0	1.0–1.0	0.921
Dental pain	0.13	0.33	0.0	0.0–0.0	0.12	0.33	0.0	0.0–0.0	0.13	0.34	0.0	0.0–0.0	0.924
Oral hygiene													
Assisted	29	40.3			18	36.7			11	47.8			0.371
Independent	43	59.7			31	63.3			12	52.2			
Difficulty rinsing	21	29.2			11	22.5			10	43.5			0.067
Able	51	70.8			38	77.5			13	56.5			

Among participants with natural teeth ≥ 1, 65 participants were at Overall, 45 were at Continued, and 32 were at Discontinued

IADL, Instrumental Activities of Daily Living; MNA-SF, mini-nutritional assessment-short form; FILS, the Food Intake LEVEL Scale; OHAT, Oral Health Assessment Tool; SD, standard deviation; IQR, interquartile range
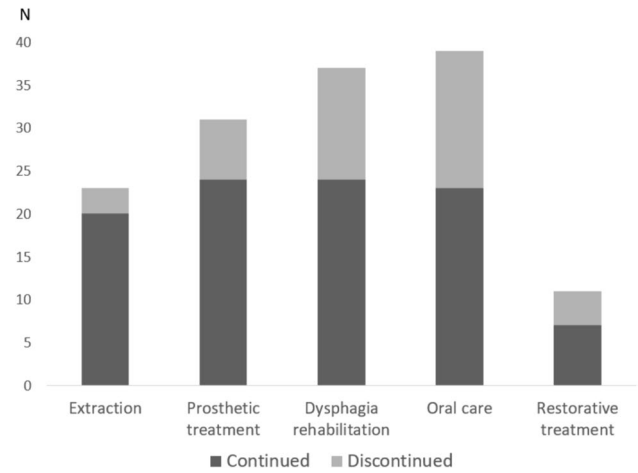
Fig. 2 Details of dental treatment

the dentists who actively performed DDC, dysphagia rehabilitation was also reported as a common treatment (64.5%) [37]. The details of the dental treatment are affected by the patient's (family's) understanding and barriers experienced by the dentist [36, 38, 39] (lack of knowledge, time, low remuneration, infection control, emergency medicine, lack of appropriate equipment, difficulty in transporting equipment), and participant's dependence. Therefore, we believe that differences arise depending on the setting. This institution specializes in DDC for older adults, including dysphagia rehabilitation. Thus, at the very least, barriers on the part of dentists had a low impact on treatment outcomes. In addition, in cooperation with the referring physician, it was possible to grasp and respond to the general condition; hence, almost all patients were treated according to their needs and demands.

There was a relationship between treatment continuation and dental treatment details. Patients who were unable to continue treatment received less tooth extraction and instead tended to receive prosthetic treatment and more oral care. At baseline, there were no differences in the presence of teeth that require extraction, state of prosthesis, and oral hygiene status. Therefore, the reasons for the difference in treatment details were (1) the number of days until the participant's death, hospital admission, and institutionalization (i.e., physical barriers), and (2) oral care that was less burdensome to the participant was prioritized over aggressive dental treatment, apart from the necessary oral care (i.e., general condition barriers).

Dental treatment improved the oral health status of participants who continued treatment. There have been reports that show the effectiveness of dental treatment in older adults who receive home medical care. Studies have reported that oral hygiene programs and education improved oral hygiene [8–10] and multidisciplinary awareness [10, 40], restored

Table 2 Differences in dental treatment content depending on treatment continuation

	Overall				Crude model		Multivariate model	
	N			N	HR (95% CI)	P	HR (95% CI)	P
Extraction	23		Continued	20	3.97 (1.18–13.36)	0.026	5.04 (1.45–17.61)	0.011
			Discontinued	3	Reference		Reference	
Prosthetic treatment	31		Continued	24	1.93 (0.80–4.71)	0.146	2.07 (0.83–5.19)	0.117
			Discontinued	7	Reference		Reference	
New prosthesis	16		Continued	13	2.03 (0.60–6.83)	0.253	2.40 (0.69–8.34)	0.169
			Discontinued	3	Reference		Reference	
Prosthetic adjustment/repair	26		Continued	21	2.36 (0.88–6.36)	0.09	2.61 (0.94–7.30)	0.067
			Discontinued	5	Reference		Reference	
Dysphagia rehabilitation	37		Continued	24	0.80 (0.35–1.82)	0.591	0.69 (0.29–1.66)	0.411
			Discontinued	13	Reference		Reference	
Oral care	39		Continued	23	0.48 (0.20–1.18)	0.11	0.43 (0.16–1.14)	0.089
			Discontinued	16	Reference		Reference	
Restorative treatment	11		Continued	7	0.90 (0.31–2.66)	0.854	1.01 (0.34–3.04)	0.985
			Discontinued	4	Reference		Reference	

The multivariate model included the following potentially confounding baseline factors: age, care level, total OHAT points

49 people continued treatment while 23 people discontinued treatment

45 people who could continue treatment while 20 people who could not continue treatment had ≥ 1 natural teeth

CI, confidence interval; HR, hazard risk

occlusal support [12], and improved the oral intake function of parenteral users through dysphagia rehabilitation [11], However, there have been no reports that compared before and after extraction and caries treatment or showed the therapeutic effect using a comprehensive oral evaluation tool, such as OHAT, which was used in this study. Since OHAT is an oral health evaluation tool that can be shared across different professions [26], the results of this study may contribute to the transmission of dental treatment effects to medical care workers who are involved in home visits.

On the contrary, while there was a reduction in the number of carious teeth and those requiring extraction following treatment, some teeth persisted even after 6 months. We attribute this persistence to certain participants who could initiate but were unable to complete active treatment within the 6-month timeframe due to specific barriers encountered by older adults receiving home medical care. These barriers include their overall health condition, coordination with other medical and nursing care services, as well as considerations regarding the wishes of the patient and their family.

Factors that impeded treatment continuation were decreased ADL, decreased nutritional status, difficulty in rinsing, and changes in the tongue. In Japan, decreased ADL and nutritional status have been identified as risk factors for death at home and interruption of home medical care [41, 42]. Rinsing ability requires many difficult functions, such as fluid and instrument management, pharyngeal function, oral pressure control, saliva control skills, and coordination with respiratory function [43]. It is impaired by cognitive,

oral, and swallowing dysfunction [44, 45]. The tongue is a well-known factor that indicates oral functions. Apart from poor hygiene, tongue changes, especially tongue coating, indicate decreased tongue motility [46, 47]. These changes are widely observed in older adults. Tongue hygiene and function are related to respiratory function, swallowing function, nutritional status, physical function, and life prognosis, among others [47, 48]. Therefore, in addition to ADL and nutritional status, rinsing ability and tongue changes are novel in extracting oral factors that may impede home medical care in older adults who receive such services.

However, even in participants who were able to continue treatment, there was no change in rinsing ability and tongue condition even after 6 months of dental treatment. The participants in this study had poor oral health, and approximately 40% of participants required assistance in cleaning their oral status. As such, since it is necessary to pay attention to meals, these functions (rinsing ability and tongue function) may be inevitably difficult to improve. The maintenance of residual functions and well-being are important for older adults who have high medical needs and are in the final stages of life. Although no improvement in functions was observed, the fact that they did not deteriorate can be seen as a positive result.

This study has some limitations. First, generalizability may be limited since the participants of this study were visiting patients at a single clinic. Second, selection bias may have affected the results since DDC was only recommended by the physicians, and the patients only agreed to

Table 3 Changes in the oral status among those who are able to continue treatment

	Baseline				After 6 months				P
	Mean/N	SD/%	Median	IQR	Mean/N	SD/%	Median	IQR	
FILS	7.80	1.5	8	7–9	7.81	1.3	8	7–9	0.903
Dental assessment									
Total number of teeth	14.94	9.5	14.0	5.5–24.0	12.63	9.9	11.5	2.0–23.0	<0.001
Functional teeth	27.03	2.1	28.0	27.0–28.0	27.5	1.5	28.0	28.0–28.0	0.042
Caries	4.93	5.60	3.0	1.0–7.0	3.02	3.98	1.0	0.0–5.0	0.002
Severe caries	3.18	4.3	2.0	0.5–5.0	1.95	2.7	1.0	0.0–3.0	0.111
Presence of dental caries	39	86.7			29	64.4			0.008
None	6	13.3			13	28.9			
Morbidity	0.87	1.24	0.0	0.0–1.0	0.55	0.94	0.0	0.0–1.0	0.048
Presence of mobile teeth	21	46.7			13	28.9			0.065
None	24	53.3			29	64.4			
Presence of teeth that require extraction	37	82.2			12	24.5			0.004
None	8	17.8			30	61.2			
OHAT									
Total points	5.55	2.50	5.0	4.0–7.5	3.39	2.36	3.0	2.0–5.5	<0.001
Lips	0.33	0.47	0.0	0.0–1.0	0.18	0.06	0.0	0.0–0.0	0.108
Tongue	0.53	0.54	1.0	0.0–1.0	0.53	0.50	1.0	0.0–0.1	1.000
Gums and tissues	1.00	0.82	1.0	0.0–2.0	0.57	0.82	0.0	0.0–0.1	0.003
Saliva	0.45	0.50	0.0	0.0–1.0	0.24	0.43	0.0	0.0–0.5	0.012
Natural teeth	1.40	0.71	2.0	1.0–2.0	0.82	0.78	1.0	0.0–0.1	<0.001
Dentures	0.90	0.88	1.0	0.0–2.0	0.30	0.65	0.0	0.0–0.0	0.002
Oral hygiene	0.82	0.39	1.0	1.0–1.0	1.04	0.76	1.0	0.0–0.2	0.041
Dental pain	0.12	0.33	0.0	0.0–0.0	0.12	0.48	0.0	0.0–0.0	0.942
Oral hygiene									
Assisted	18	36.7			20	27.8			0.754
Independent	31	63.3			28	38.9			
Difficulty rinsing	11	22.5			12	16.7			1.000
Able	38	77.5			37	51.4			

45 of the 49 participants have ≥ 1 natural teeth

IQR, interquartile range; SD, standard deviation; FILS, the Food Intake LEVEL Scale; OHAT, Oral Health Assessment Tool

it. However, this indicates that it is difficult to start and continue DDC unless patients and their families are aware of oral problems. Third, the sample size was small, and the presence of β errors may have affected the results. Since it is difficult to secure participants for research on older adults receiving home medical care [49, 50], this study, which secured approximately 70 participants, has clinical significance. Thus, there is a need to increase the sample size.

Conclusions

After 6 months, dental treatment in DDC improved the oral health status of older adults who receive home medical care. On the other hand, 31.9% were unable to continue treatment due to the deterioration of their general condition within 6 months of dental treatment. Factors that impeded treatment continuation were decreased ADL, decreased nutritional status, difficulty in rinsing, and changes in the tongue such as tongue coating.

Table 4 Factors at first visit related to treatment continuation

	Mean/N	SD/%	Crude model			Multivariate model		
			HR	95% Cl	P	HR	95% Cl	P
Sex								
Female	38	52.8	0.78	0.35–2.90	0.557	0.79	0.35–1.82	0.584
Male	34	47.2		Reference			Reference	
Age, years	85.84	6.9	1.00	0.94–1.06	0.922	–		
Care level	2.99	0.98	0.92	0.71–1.20	0.548	–		
Charlson comorbidity index	1.79	0.98	1.15	0.77–1.71	0.505	1.14	0.76–1.72	0.529
Barthel index (points)	48.77	33.7	0.99	0.97–1.00	0.083	0.97	0.96–0.99	0.003
IADL (points)	1.72	2.3	0.87	0.69–1.10	0.251	0.78	0.60–1.03	0.077
Household composition								
Living with family members	58	80.6	0.35	0.08–1.50	0.159	0.30	0.07–1.31	0.109
No	14	19.4		Reference			Reference	
MNA-SF (points)	7.83	1.6	0.81	0.68–0.97	0.023	0.75	0.62–0.90	0.003
FILS	7.71	1.6	0.91	0.72–1.16	0.448	0.86	0.66–1.12	0.253
Dental assessment								
Time since last dental visit	41.00	49.7	1.00	0.99–1.01	0.806	1.00	0.99–1.01	0.849
Total number of teeth	14.88	9.7	1.00	0.96–1.04	0.915	1.00	0.95–1.04	0.865
Functional teeth	27.03	2.2	1.00	0.74–1.34	1.000	1.00	0.71–1.40	0.999
Wearing removable dentures	39	54.2		Reference			Reference	
None	33	45.8	1.72	0.75–3.92	0.198	1.96	0.81–4.74	0.137
Caries	4.57	5.3	0.96	0.87–1.06	0.448	0.96	0.86–1.06	0.428
Severe caries	2.85	4.2	0.94	0.81–1.09	0.406	0.93	0.80–1.09	0.382
Presence of dental caries	55	76.4	0.68	0.23–2.03	0.49	0.65	0.21–2.01	0.454
None	10	13.9		Reference			Reference	
Morbidity	0.85	1.2	0.95	0.65–1.38	0.78	0.95	0.65–1.38	0.774
With mobile teeth	30	41.7	0.93	0.39–2.25	0.88	0.94	0.39–2.29	0.889
None	35	48.6		Reference			Reference	
Teeth that require extraction	51	70.8	0.64	0.25–1.67	0.37	1.60	0.60–4.23	0.347
None	14	19.4		Reference			Reference	
OHAT								
Total points	5.69	2.4	1.06	0.90–1.26	0.49	1.07	0.90–1.27	0.444
Lips								
0	50	69.4		Reference			Reference	
≥ 1	22	30.6	0.81	0.32–2.06	0.660	0.87	0.33–2.33	0.787
Tongue								
0	30	41.7		Reference			Reference	
≥ 1	42	58.3	2.35	0.92–5.95	0.073	2.44	0.96–6.23	0.062
Gums and tissues								
0	21	29.2		Reference			Reference	
≥ 1	51	70.8	1.62	0.60–4.36	0.341	1.70	0.63–4.63	0.297
Saliva								
0	40	55.6		Reference			Reference	
≥ 1	32	44.4	0.97	0.43–2.21	0.943	0.96	0.42–2.20	0.916
Natural teeth								
0	9	12.5		Reference		1.15	0.34–3.97	
≥ 1	62	86.1	0.91	0.27–3.07	0.880	0.87	0.25–2.98	0.819
Dentures								
0	19	26.4		Reference			Reference	
≥ 1	22	50.6	0.65	0.20–2.15	0.484	0.66	0.20–2.20	0.504
Oral cleanliness								

Table 4 (continued)

	Mean/_N_	SD/%	Crude model			Multivariate model		
			HR	95% Cl	_P_	HR	95% Cl	_P_
0	13	18.1		Reference			Reference	
≥ 1	59	91.9	1.00	0.34–2.93	0.994	1.00	0.34–2.93	0.996
Dental pain								
0	63	87.5		Reference			Reference	
≥ 1	9	12.5	1.02	0.30–3.45	0.969	1.00	0.30	0.999
Oral cleanliness								
Assisted	29	38.7	1.45	0.64–3.28	0.378	1.87	0.75	0.182
Independent	43	59.7		Reference			Reference	
Rinsing								
Difficulty rinsing	21	26.9	2.23	0.98–5.10	0.057	2.97	1.20	0.018
Able	51	70.1		Reference			Reference	

65 of the 72 participants have ≥ 1 natural teeth

The multivariate model included the following potentially confounding baseline factors: age, care level

IADL, Instrumental Activities of Daily Living; MNA-SF, mini-nutritional assessment-short form; FILS, the Food Intake LEVEL Scale; OHAT, Oral Health Assessment Tool; SD, standard deviation; IQR, interquartile range

Declarations

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