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Original Article

Investigating the Effectiveness of Oral and Dental Care on Deglutition Disorders in Patients with Multiple Sclerosis

Noemie Drancourt[1,2], Nada El Osta[1]*, Nicolas Decerle[1,2], Martine Hennequin[1,2]

[1]Centre de Recherche en Odontologie Clinique (CROC), Université Clermont Auvergne, F-63000 Clermont-Ferrand, France.
[2]CHU of Clermont-Ferrand, Service d'Odontologie, F-63003 Clermont-Ferrand, France.

***E-mail** ✉ nada.el_osta@uca.fr

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ABSTRACT

Deglutition disorders are one of the main problems of patients with multiple sclerosis. Education and implementation of oral and dental care for these individuals can be effective in reducing the complications of deglutition disorders, such as pneumonia and aspiration. The present study was conducted to determine the effect of implementing oral and dental care on swallowing disorders in patients with multiple sclerosis. This study was a single-group quasi-experimental study before and after the intervention. 25 patients with multiple sclerosis who met the inclusion criteria were selected from among the patients using a convenient sampling method and entered the study. The Dysphagia Problems in Multiple Sclerosis (DYMUS) questionnaire was completed to assess the Deglutition disorders of the clients before and after the intervention. The comparison of the results was examined using SPSS-v23 statistical software. The average age of the participants was 41 years. According to the findings, the number of patients with swallowing disorders was 20 before the intervention, which decreased to 7 after the intervention. In addition, the average scores of dysphagia problems according to the DYMUS questionnaire before the intervention were 4.52, which decreased to 1.88 after the intervention, which was significant according to the paired t-test ($P < 0.001$). According to the results of the study, the implementation of oral and dental care intervention can be effective on swallowing disorders in patients with multiple sclerosis; and help improve the quality of care for these clients in rehabilitation hospitals.

Keywords: Multiple sclerosis, Oral care, Dental care, Deglutition disorders

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Introduction

Multiple sclerosis (MS) is an autoimmune disease in which the immune system attacks the myelin sheath of the central nervous system and forms sclerotic plaques [1-3].

Symptoms of this debilitating neurological disease include muscle weakness, facial spasms, tremors, involuntary contractions of the facial muscles, visual impairment, and dysphagia [4, 5], which can cause personal, social, and occupational limitations [6].

Dysphagia, or swallowing disorder, is one of the most common complications of MS [4, 5], affecting up to 43% of patients with MS [7]. Swallowing disorder can lead to serious complications, including increased risk of dehydration, weight loss, malnutrition, aspiration pneumonia [8], and even death in patients with MS [7]. The etiology of deglutition disorders includes disease-related and patient-related factors, which in MS can be caused by brain lesions in the brainstem and forebrain. Oral cavity disorders, including poor oral and dental hygiene, are also important factors in the development of deglutition disorders in patients with MS [9-11].

Some of the treatment approaches that have been used to reduce swallowing disorders in patients with MS include a variety of methods such as swallowing retraining, dietary modification, respiratory strength training, exercise, posture correction, electrical stimulation of the oral muscles, and botulinum toxin injections. However, a recent review found that most of these interventions are long-term (several months), highly repetitive (several times a day), and require complex and expensive equipment, which limits their widespread use. In addition, there is insufficient evidence to support the effectiveness of most of them [12, 13].

Recently, researchers have emphasized in their descriptive studies that poor oral and dental care can be associated with swallowing disorders in patients with MS [14, 15]. For example, studies have shown that poor oral hygiene, such as not brushing your teeth, increases the risk of developing dysphagia by up to 2-fold [16-18]. Many medications used to treat MS, such as immunosuppressants, corticosteroids, and antispasmodics, have known side effects on oral health, such as gingival hyperplasia, dry mouth, inflammation, and oral fungal infections [9]. On the other hand, many MS patients neglect oral hygiene, which worsens their dysphagia [6]. For example, less than one-third of MS patients brush their teeth properly and are more than three times more likely to report toothache, have fewer healthy teeth, and visit the dentist less often for oral health care [19]. As a result, MS patients are twice as likely to experience chronic gum disease than the general population [20].

However, empirical studies that have examined the effect of oral health care on swallowing disorders in patients with MS have been few or have mixed and ambiguous findings, mostly involving daily toothbrushing training, mouthwash use, or a combination of both. Most oral health intervention studies measure things like aspiration rates and death as response variables, and so far, no study has examined the effect of these interventions on various types of deglutition disorders [21]. In addition, most of these studies do not use valid instruments to measure treatment responses, which reduces the validity of the study findings [21, 22]. Therefore, stronger evidence is needed to determine the effect of oral healthcare interventions on swallowing disorders [22]. As a result, the present study was conducted to investigate the effect of oral health care on deglutition disorders in patients with multiple sclerosis.

Materials and Methods

The present study was a quasi-experimental, single-group, before-and-after study. The subjects were selected through convenience sampling from patients with MS who were hospitalized. The minimum sample size in the present study was estimated to be 22 people using the formula for calculating the sample size and selecting an effect size of 0.6, a power of 0.8, and a confidence level of 0.95, which increased to 25 people by considering a 10% probability of loss.

The inclusion criteria for the study included the ability to brush teeth (by oneself or with a companion), a minimum age of 18 years, no participation in other similar interventions, at least one dysphagia problem based on a questionnaire assessment, no other acute health problems, no use of medications that affect oral and dental health, and no diseases associated with swallowing disorders such as Parkinson's disease, stroke, cervical spinal cord injury, concussion, and myasthenia gravis in the patient's medical history. The exclusion criteria also included developing serious health problems during the study that prevented the patient from participating and the patient's withdrawal from participating in the study.

The data collection tool consisted of a demographic questionnaire and the Dysphagia Problems in Multiple Sclerosis (DYMUS) questionnaire, which was completed by the participants as a self-report. The demographic questionnaire included information on age, gender, marital status, employment status, education level, medical history, and frequency of tooth brushing. The Dysphagia Problems in Multiple Sclerosis (DYMUS) questionnaire was developed by Bergamaschi *et al*. in 2008 to screen for dysphagia in patients with MS [7]. Each item has a score of 0 to 1, and therefore the total score ranges from 0 to 9. A higher score means more Deglutition Disorders, and if the total score of the questionnaire is 1 or more, the person has Deglutition Disorders [19, 23-25]. In the present study, the DYMUS questionnaire was completed by 25 patients before and after the intervention, and its reliability was 0.70 using Cronbach's alpha.

The duration of the intervention was one month. During the first three days of the intervention, participants were trained daily in three individual face-to-face sessions, each session lasting 30 minutes. Then, daily follow-ups were conducted from the fourth day until the end of one month. In the first session, by providing educational tools such as mouth molds, soft toothbrushes, fluoride toothpaste, a receiver, a glass of water, gloves, and dental floss, they were taught how to properly clean the tongue, palate, and teeth, which are the main places where microorganisms accumulate.

Then, the patients were asked to implement the training learned in the presence of the researcher. After ensuring the accuracy of the patients' performance, they were asked to use dental floss and a toothbrush twice a day and after consuming sweet snacks [26]. Cleaning the tongue, if possible, using special brushes or a toothbrush, once a day was recommended [27]. In the second session, the patients were asked to implement the training learned. The researcher re-trained the participants who had difficulty in implementing oral and dental care. During this session, it was also recommended to visit the dentist every 6 months. Participants were also instructed on the appropriate volume of fluids (3.7 liters in men and 2.7 liters in women) throughout the day to maintain oral moisture, with the condition of not consuming fluids during meals and half an hour after meals [28] and proper consistency and correct position when eating. In the third session, the patient's oral care performance was monitored and problems were corrected. Participants were also instructed to limit or eliminate the consumption of sweet snacks between main meals (at most once a day) and to brush their teeth immediately if consumed [29]. Patients were also instructed to avoid breaking hard foods with their teeth. Then, from the fourth day to the end of the thirtieth day of the intervention, participants were followed up daily via smartphones and available virtual networks, and care recommendations were sent to them in the form of photos, videos, and educational texts. The researcher also ensured the implementation of oral care in the participants by asking them daily questions. For two participants who were unclear about the implementation of the interventions, a face-to-face practical training session was repeated.

SPSS version 23 software was used to analyze the data. Descriptive data were displayed by reporting frequency and percentage frequency, and the distribution of the response variable (Deglutition Disorders) was examined using the mean and standard deviation index, skewness and kurtosis, and the Shapiro-Wilk test. Paired t-test was used to compare intra-group changes before and after the intervention at a significance level of 0.05.

Results and Discussion

The present study included 25 patients with a mean age of 41 years (range 29-58). **Table 1** presents the demographic information of the patients in the study. As can be seen in **Table 1**, most of the clients in the study were in the age group of 30-40 years (52%), male (56%), university-educated (56%), single (56%), and unemployed (40%). In addition, most of the patients (44%) had been suffering from the symptoms of the disease for 10-15 years, and in terms of the frequency of brushing, most of the clients (60%) brushed their teeth less than twice a day.

Table 1. Demographic information of the clients (N = 25)

Variable	Classification	N	%
Age (years)	20-30	1	4
	30-40	13	52
	40-50	6	24
	50-60	5	20
Gender	Male	14	56
	Female	11	44
Education level	Diploma	11	44
	University	14	56
Marital status	Single	14	56
	Married	6	24
	Divorced	2	8
	Widowed	3	12
Employment status	Unemployed	10	40
	Employee	4	16
	Freelance	7	28
	Student	1	4
	Retired	3	12

Duration of symptoms onset (years)	< 5	2	8
	5-10	6	24
	10-15	11	44
	> 15	6	24
Daily brushing frequency	Once or less	15	60
	Twice or more	10	40

Table 2 shows the Deglutition Disorders of patients based on the yes response to the questions in the DYMUS questionnaire before and after the implementation of the oral and dental care intervention. As can be seen, before the implementation of oral and dental care intervention, the most common Deglutition Disorders were related to coughing after swallowing liquids (84%), compulsion to turn food into small pieces (64%), coughing after swallowing solid food (64%), and compulsion to drink liquids in sips (60%). The compulsion to drink liquids in sips (52%), coughing after swallowing liquids (44%), and compulsion to turn food into small pieces (28%) were the most common disorders observed in patients after the implementation of the intervention. In addition, the number of Deglutition Disorders before the implementation of the intervention was 80% and after the implementation of the intervention was 28%.

Table 2. Frequency distribution of swallowing disorders of clients (N = 25)

No.	Questions	Before intervention		After intervention	
		N	%	N	%
1	Difficulty swallowing solid foods	9	36	4	16
2	Difficulty swallowing liquids	11	44	6	24
3	The feeling of food sticking in the throat	7	28	1	4
4	Feeling a lump in the throat when swallowing	11	44	1	4
5	Coughing after swallowing solid foods	16	64	1	4
6	Coughing after swallowing liquids	21	84	11	44
7	Frequent difficulty swallowing	7	28	3	12
8	The compulsion to break food into small pieces	16	64	7	28
9	The compulsion to sip liquids	15	60	13	52

To select the appropriate statistical test, first, the distribution of the total Deglutition Disorders scores of the patients was examined using the skewness and kurtosis index and the Shapiro-Wilk test (given that, the number of clients was less than 50). The skewness and kurtosis index of swallowing disorders were 0.14 and -0.44 before the intervention and 0.53 and 0.36 after the intervention, respectively, which is within the acceptable range (-1 to +1). Also, based on the Shapiro-Wilk test (P> 0.05), the total Deglutition Disorders scores of the clients followed a normal distribution. Therefore, considering the confirmation of the normal distribution of the Deglutition Disorders variable of the patients before and after the oral care intervention, a paired t-test was used to compare the changes within the Deglutition Disorders group (**Table 3**). As can be seen, the average score of swallowing disorders before the intervention was 4.52, which decreased to 1.88 after the intervention, which was significant based on the paired t-test (P < 0.001).

Table 3. Comparison of mean Deglutition Disorders scores of patients before and after intervention (N = 25)

Variable	Time	Mean	Standard Deviation	T-Statistic	Degrees of Freedom	P-Value	Mean Difference	95% Confidence Interval for Mean Difference	
								Lower limit	Upper limit
Dysphagia problems	Before intervention	4.52	2.10	8.66	25	0.001	2.64	2.01	3.26
	After intervention	1.88	1.23						

The present study was conducted to determine the effect of oral and dental care on deglutition disorders in patients with multiple sclerosis. In previous studies [24], such as the study by Printeza *et al*. in 2020, the

results obtained were consistent with the results of the present study. According to a recent study, the prevalence of deglutition disorders in patients with multiple sclerosis using the DYMUS questionnaire is different and higher than when other general questionnaires are used to investigate deglutition disorders [30].

The findings of the present study after the implementation of the intervention were also consistent with the results of the study by Eraković *et al*. [30]; which was conducted using longitudinal data and observed that the compulsion to break food into small pieces is a common deglutition disorder in patients with multiple sclerosis that continues even after receiving rehabilitation interventions [30]. A 2020 study by Novotná *et al*. also found that compulsive sipping and coughing after drinking fluids were among the most common deglutition disorders reported by patients after one year of receiving oral care [31]. It appears that sipping and breaking food into small pieces are coping mechanisms in patients to prevent painful swallowing. Researchers have also noted that patients rarely follow the prescribed diet, which is restricted and requires a thin liquid diet, which can lead to coughing when consuming thin liquids [32]. In addition, one of the factors that play a role in the severity and frequency of swallowing disorders in patients with multiple sclerosis is the duration of multiple sclerosis, such that clients who have been suffering from the disease for more than ten years have a greater number and type of deglutition disorders and experience these disorders more severely [33]. In the present study, more than two-thirds of clients reported a history of multiple sclerosis of more than ten years, and as a result, the effectiveness of the intervention may not be sufficient to eliminate their swallowing disorders and some of their most severe disorders may continue.

Finally, based on the findings of the present study, oral and dental care was able to reduce deglutition disorders in clients with multiple sclerosis. This finding is consistent with the study by Aoyagi *et al*. [34] in Japan, Yan *et al*. [35] in China, and Espinosa-Val *et al*. [36] in Spain, who showed that implementing oral care can significantly reduce swallowing problems and their complications such as aspiration. The following can be mentioned in the justification of this finding. First, implementing oral care can help eliminate deglutition disorders by improving the general condition of the mouth and teeth, such as reducing dry mouth, and gingivitis, and removing food residues in the mouth and on the tongue [6]. In the present study, following the implementation of the intervention and regular daily follow-ups, all participants were required to observe oral hygiene. Therefore, as shown in the study by Quagliarello *et al*. [37], the oral hygiene intervention of brushing teeth is not only feasible compared to other interventions, but also as effective as the other two interventions, using mouthwash, and observing proper position in reducing swallowing disorders [37]. Second, oral care interventions may reduce deglutition disorders by preventing the growth of opportunistic bacteria [38, 39]. In a 2018 quasi-experimental study, Mituuti *et al*. [40] showed that the use of oral hygiene interventions (including brushing and using mouthwash twice a day) during hospitalization can increase safe and efficient swallowing and reduce the risk of aspiration and other swallowing disorders by preventing the growth of opportunistic bacteria in the mouth. Third, the implementation of oral hygiene can indirectly reduce deglutition disorders by improving the nutritional intake of patients [40]. According to the study by Martin *et al*., improving gum health, preventing tooth decay and the deterioration and wear of oral and dental structures following oral care, increases the consumption of food, especially protein, in patients, which in turn strengthens the health of the oral muscles and reduces swallowing disorders [38]. In the present study, in addition to teaching how to care for your mouth and teeth, regular visits to the dentist were emphasized, and therefore similar results can be expected. Fourth, the next factor that could have caused the effectiveness of the present intervention is related to modifying food texture and advising on the proper use of teeth (such as not breaking hard foods with your teeth), which reduces the rate of swallowing disorders in clients. Since patients with multiple sclerosis are faced with increased tone and stiffness of the oral muscles, modifying food texture can play a helpful role in reducing swallowing disorders [21, 41].

Conclusion

Based on the findings of the study, implementing a one-month oral care intervention can play an effective role in reducing deglutition disorders in patients with multiple sclerosis. It is recommended that future researchers investigate the effectiveness of these interventions over a longer period. It is recommended that future studies with the participation of an elderly control group and using accurate clinical criteria such as X-ray imaging be used to investigate the effect of oral care intervention on changes in oral muscles related to reducing swallowing disorders. In addition, given that the ultimate goal of rehabilitation and nursing care is to improve the quality of life of patients,

it is recommended that future researchers investigate the effect of oral care intervention on swallowing-related quality of life in patients with multiple sclerosis.

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