Turkish Journal of Neurology

Turk J Neurol 2026;32(2):180-186
https://doi.org/10.55697/tnd.2026.542

ORIGINAL ARTICLE

Rehabilitation of swallowing disorders in patients with schizophrenia: A pilot study on efficacy and feasibility

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ABSTRACT

Objectives: This study aimed to evaluate the efficacy of swallowing disorder rehabilitation in patients with schizophrenia experiencing dysphagia and hypersalivation.

Patients and methods: A quasi-experimental pretest-posttest design was used. Forty-seven patients with schizophrenia with dysphagia were screened between April 2018 and January 2020. After exclusions due to noncompliance, seven patients (4 males, 3 females; mean age: 44.28 ± 21.81 years; range, 19 to 79 years) completed the study. Swallowing was assessed with the Eating Assessment Tool (EAT-10), salivary issues with the Saliva Control Severity and Frequency Scale, and mouth opening with trismus measurement before and after a 12-session rehabilitation program (3 sessions a week). The program included chewing training, oral motor exercises, laryngeal mobilization, thermal tactile stimulation, and neuromuscular electrical stimulation.

Results: After treatment, EAT-10, saliva severity, saliva frequency, and trismus scores significantly improved compared to baseline ($p < 0.05$). Disease history, education, and physical activity did not affect outcomes ($p > 0.05$).

Conclusion: Swallowing disorder rehabilitation effectively improves swallowing and saliva control in dysphagic patients with schizophrenia.

Keywords: Deglutition, dysphagia, hypersalivation, schizophrenia, rehabilitation.

Schizophrenia is a widely seen severe psychiatric disease, associated with recurrent or chronic psychotic symptoms, which affects approximately 0.7% of the population.[1] Swallowing and eating problems are common in schizophrenia and appear to be potentially severe, but they have not been comprehensively examined or characterized.[2]

Difficulty in swallowing (dysphagia) occurs during the passage of food from the mouth to the stomach. Antipsychotic drugs used in the treatment of schizophrenia may cause oral pigmentation, severe extrapyramidal symptoms, and dysphagia. Low-potency first-generation (classic) antipsychotic drugs, particularly chlorpromazine and thioridazine, may cause severe hyposalivation in these patients by blocking the parasympathetic stimulation of salivary glands (anticholinergic effect). These negative effects lead to clinical difficulties in speech, chewing, and swallowing.[3]

Sialorrhea, the overproduction of saliva, is a well-known side effect of clozapine, which has an important place in the treatment of schizophrenia. Sialorrhea is an unpleasant condition for the patient and those around them and can lead to excessive saliva flow and facial pain.[4] It is known that increased saliva decreases oral awareness and can cause a disorder in the swallowing function in the oral phase.

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Received: September 05, 2025 **Accepted:** May 29, 2026 **Published online:** June 02, 2026
Cite this article as: Altuntaş Yılmaz N, Aydın A, Şeker M, Tat AM, Yapali G. Rehabilitation of swallowing disorders in patients with schizophrenia: A pilot study on efficacy and feasibility. Turk J Neurol 2026;32(2):180-186. https://doi.org/10.55697/tnd.2026.542.

Classic antipsychotic drugs can lead to spasms of the jaw muscles, which can cause an increase in mortality associated with oromandibular dystonia, temporomandibular joint dislocation, impaired vomiting reflex, and obstructive dysphagia.[5] When the side-effects of these pharmacological treatments are taken into consideration, there appears to be several reasons that can lead to dysphagia in patients with schizophrenia (Table 1).[6] The aim of swallowing disorder rehabilitation is to ensure safe and adequate intake of fluid and nutrients.

The use of therapeutic electrical stimulation in the field of physical therapy is well established. Electrical stimulation is used with the aim of analgesia, muscle strengthening, or functionality. In neuromuscular electrical stimulation (NMES), the normal or denervated muscle is stimulated by mimicking nerve impulses, eliciting muscle contraction. In this process, the muscle fibre is directly stimulated, or muscle contraction can be elicited by stimulating the nerve innervating the muscle. When applying nerve stimulation, a lower stimulus is sufficient, and contraction is observed in all the muscles stimulated by that nerve.

There are two mechanisms by which NMES is effective in muscle strengthening. The first is the increase in strength and hypertrophy directly in the muscle fibres, and the second is the sensory awareness and proprioceptive feedback provided by the desired muscle contraction in the patient. Neuromuscular electrical stimulation application in dysphagia is relatively recent compared to other areas, and the results are conflicting. Generally, there is more evidence of the efficacy when swallowing exercises are added. The effect is thought to be on both muscle strengthening and cortical reorganization. Surface NMES is a method in which the stimulation of deep muscles is examined with the placement of electrodes along the neck. In this way, it is attempted to eliminate the reduced hyolaryngeal elevation after treatment. In a review of 11 studies including 2016 patients, no complications were observed following NMES, and clinical improvement was recorded at a rate of 81%.[7]

Dysphagia in psychiatric patients causes morbidity and mortality. Increasing oral awareness, developing sufficient larynx elevation, and reducing salivary issues by training the muscles that form the oral cavity may improve dysphagia. This study aimed to examine the efficacy of swallowing disorders rehabilitation applied to patients with schizophrenia with dysphagia and swallowing issue.

PATIENTS AND METHODS

This quasi-experimental pretest-posttest study evaluated patients who were diagnosed with schizophrenia in the Psychiatry Clinic of Necmettin Erbakan University, Meram Faculty of Medicine, between April 2018 and January 2020 and had dysphagia without comprehension or communication issues (Table 2). Initially, 47 patients diagnosed with schizophrenia were identified as having dysphagia (Eating Assessment Tool [EAT-10] ≥ 3) and were invited to participate. However, 36 of these patients were excluded during the initial stages because they either declined further participation, exhibited significant lack of cooperation, or could not comply with

TABLE 1
Reasons for dysphagia in psychiatric patients[6]

Type	Explanation	Examples
Bradykinetic	Associated with drug-related parkinsonism	Antipsychotic-origin parkinsonism
Dyskinetic	Associated with drug-related dyskinesia	Late dyskinesia related to antipsychotics
Dystonic	Associated with drug-related dystonia	Acute or late dystonia of antipsychotic origin
Rapid feeding	A feeding disorder characterized by poor chewing skills, restlessness, and inattention when feeding	Large bites, rapid food consumption etc.
Iatrogenic	Associated with the drug-related adverse effects other than drug-related movement disorder	Loss of consciousness with the anticholinergic effect of benzodiazepine and anticonvulsants and xerostomia
Stroke-related	Associated with weakness of the oropharyngeal muscle system	Stroke-related dysphagia
Medical	Associated with the existing medical condition	Tachypnea related to pulmonary disease which interferes with feeding

TABLE 2
The inclusion and exclusion criteria of the study

Inclusion criteria	Exclusion criteria
Diagnosed with schizophrenia	No dysphagia problem EAT-10 score < 3
Presence of dysphagia problem EAT-10 score ≥ 3	Receiving medical treatment for saliva problem
Age ≥ 18 years	A history of surgical treatment for saliva problem
Saliva problem severity scale score ≥ 3	A history of physical therapy for saliva problem
Willing to participate in the study	A history of Botox application for saliva problem
Continued participation in the study	The use of an orthosis for oral motor treatment

EAT-10, Eating Assessment Tool-10.

TABLE 3
The relationships between the parameters evaluated pre and post-treatment according to Wilcoxon Signed-Rank Test

Scale evaluated	n	Mean ± SD	Min-Max	*p*
Pre-treatment EAT-10	7	13.7143 ± 7.76132	4.00-24.00	0.018
Post-treatment EAT-10	7	9.4286 ± 6.29437	2.00-18.00	
Pre-treatment saliva severity	7	3.2857 ± 0.75593	2.00-4.00	0.034
Post-treatment saliva severity	7	2.4286 ± 0.78680	2.00-4.00	
Pre-treatment saliva frequency	7	3.4286 ± 0.78680	2.00-4.00	0.034
Post-treatment saliva frequency	7	2.4286 ± 0.78680	2.00-4.00	
Pre-treatment trismus	7	43.4286 ± 6.90066	33.00-53.00	0.017
Post-treatment trismus	7	46.8571 ± 5.08031	42.00-55.00	

SD, standard deviation; EAT-10, Eating Assessment Tool-10; $p < 0.05$.

the intensive exercise protocol due to cognitive symptoms. During the follow-up period, four additional patients were excluded as they were discharged from the hospital before completing the 12-session swallowing therapy. Consequently, the study was completed with a final sample of 7 patients (4 males, 3 females; mean age: 44.28 ± 21.81 years; range, 19 to 79 years) who successfully adhered to the entire rehabilitation program. A written informed consent was obtained from each patient. The study protocol was approved by the Karatay Technical University Faculty of Medicine Non-Drug and Medical Device Research Ethics Committee (Date: 06.02.2018, No. 2018/014). The study was conducted in accordance with the principles of the Declaration of Helsinki.

A sociodemographic data form was prepared, including age, sex, height, weight, disease history, education level, and level of physical activity. The evaluation of disease history (the time since psychiatric diagnosis) was categorized into four groups: < 2 years, 2 to 5 years, 5 to 10 years, and > 10 years.[8]

The education level was evaluated in seven categories, similar to previous literature:[9] illiterate, primary school, middle school, high school, further education, and university.

The level of physical activity was evaluated with the Turkish version of the International Physical Activity Questionnaire.[10] The validity and reliability of the Turkish version have been established.[11] In this questionnaire, activity in the last seven days was questioned as the level of intense physical activity, the level of moderate physical activity, and the minutes per day of walking and sitting. The time in minutes of intense physical activities (e.g., football, basketball, aerobics, fast cycling, weight lifting, and carrying weights), of moderate physical activities (e.g., carrying light weights, normal tempo cycling, folk dancing, dancing, bowling, and table tennis), and walking was calculated. The total physical activity score was determined by converting the calculated times to MET (metabolic equivalent of task) corresponding to basal metabolic rate (MET-min/week). According to the total physical activity score, the patients

were classified as low level at < 600 MET-min/week, moderate level at 600 to 3000 MET-min/week, and high level at > 3000 MET-min/week.

The swallowing function was evaluated using the EAT-10, which is simple, inexpensive, and can be applied in approximately 8 min. The EAT-10 provides subjective data in the evaluation of dysphagic patients. It measures the level of the swallowing issue with 10 questions scored from 0 (no issue) to 4 (severe issue). Patients with a total score of ≥ 3 were evaluated as dysphagic.[12]

The Saliva Control Problem Severity and Frequency Scale, developed by Stonell and Greenberg,[13] scores severity from 1 to 5 and frequency from 1 to 4. Higher scores indicate a greater impairment. The scale has been validated and is often used in the literature.[14,15] The severity and frequency of issues in saliva control was determined using this scale.

The evaluation of restricted mouth opening (trismus) was made by measuring the maximum mouth opening with calipers of the distance in millimeters between the mesioincisal edge of the right first upper incisor and the mesioincisal edge of the right first lower incisor, with the patient in an upright seated position.[16]

The patients included in the study received a swallowing disorder rehabilitation program as a total of 12 sessions at three sessions per week for four weeks. The swallowing disorder rehabilitation included chewing training, oral motor exercises, larynx mobilization, thermal tactile stimulation, oral phase sensory stimulation, tongue protraction and retraction exercises, and strengthening exercises for the intrinsic and extrinsic tongue muscles with NMES. Electrodes were attached to the masseter and submental muscles in the stimulation, which was applied bilaterally for 40 min.

All the patients were evaluated before and after the swallowing disorder rehabilitation with the EAT-10, the Saliva Control Problem Severity and Frequency Scale, and trismus measurements.

Statistical analysis

Statistical analysis was performed using the IBM SPSS version 22.0 software (IBM Corp., Armonk, NY, USA). Descriptive data were expressed as mean ± standard deviation (SD), median (min-max), frequency, and percentage values where appropriate. Due to the small sample size and the non-normal distribution of the study variables, non-parametric statistical methods were used. Changes in swallowing function (EAT-10), saliva control severity and frequency scores, and trismus measurements before and after the swallowing disorder rehabilitation program were analyzed using the Wilcoxon Signed-Rank Test. The effects of disease duration, education level, and physical activity level on treatment outcomes were evaluated using the Kruskal-Wallis test. Comparisons were performed separately for pre-treatment and post-treatment measurements. Statistical significance was accepted as $p < 0.05$.

RESULTS

The education level of the patients was determined as primary school in two, middle school in one, high school in two, further education in one, and university in one. Disease activity was of 2 to 5 years duration in three cases, 5 to 10 years in three, and > 10 years in one. When the physical activity levels were examined, a low level of physical activity was determined in four cases, and a moderate level was observed in three. None of the patients had a high level of physical activity.

The level of significance between the pre- and posttreatment EAT-10, saliva severity, saliva frequency, and trismus evaluations was examined using the nonparametric Wilcoxon Signed-Rank Test ($p < 0.05$). As a result of these comparisons, all data reached significant results (Table 3).

The disease activity, education level, and physical activity level were evaluated separately before and after treatment, and relationships between the significance of these data were examined with the Kruskal-Wallis test. As a result of the statistical analyses of these three parameters, no significant relationship was determined between the physical activity level and pre- and posttreatment EAT-10 scores, saliva severity score, saliva frequency score, and trismus measurement ($p > 0.05$).

DISCUSSION

Antipsychotic drugs were proven to cause dysphagia in recent studies.[17,18] In a study of 60 patients diagnosed with schizophrenia, Regan et al.[19] reported the rate of dysphagia to be 23%. Corcoran and Walsh[20] reported a mortality rate of 85/100,000 for asphyxia (probably due to choking on food) in psychiatric patients in Ireland, and this rate was 100-fold greater than for the general population. More recently,

Wu et al.[21] reported mortality related to choking on food in schizophrenia at a rate of 7.92 to 12.80 (95%) compared to the general population. These issues are much more evident in schizophrenia than in other severe mental diseases.[2]

Antipsychotic drugs are known to affect the oral and pharyngeal phases of swallowing.[22,23] Changes in the pharyngeal phase of swallowing are the most important cause of aspiration. As a result of this change in the pharyngeal phase, laryngeal elevation is delayed, and the airway cannot be protected. Although there may be several neurological and physiological disorders that cause this, antipsychotics are known to affect pharyngeal muscles and cause a delay by decreasing laryngeal elevation. Sedation and immune system disorders have been shown to be related to pneumonia in patients with schizophrenia.[24] However, drug-induced parkinsonism is thought to be the leading cause of dysphagia.[18,25]

Drug-induced parkinsonism is the most important mechanism leading to aspiration but is not the only one.[21,26] Dystonic reactions and late dyskinesia may affect swallowing and may lead to aspiration. Drug-induced xerostomia (dry mouth) can lead to swallowing difficulties and, ultimately, aspiration. In contrast, sialorrhea with clozapine is a risk factor for aspiration pneumonia.[27] It has also been reported that abnormal eating and swallowing habits, particularly rapid eating and swallowing inappropriate large bolus, and insufficient chewing can lead to choking, acute asphyxia, and aspiration pneumonia in patients with schizophrenia.[26]

When previous studies are examined, interventions for swallowing disorders in patients with schizophrenia include strategies such as diet modification, thickening support, feeding in an upright position, jaw repositioning maneuvers during chewing, reducing distracting elements, prolonging eating time with verbal and written tips, and chewing for a specified time before swallowing.[6,21] However, there are no studies in literature of swallowing disorder rehabilitation approaches applied to patients with schizophrenia.

The research on dysphagic patients with Parkinson's disease has focused one the efficacy of swallowing disorder rehabilitation. Several studies demonstrated that the application of NMES and the teaching of exercises for swallowing rehabilitation improved breathing-swallowing coordination and reduced the risk of aspiration in patients with Parkinson's disease.[28-30] Moreover, studies reported that long-term swallowing rehabilitation was more effective than short-term therapy.[31-33] Therefore, we also believe that approaches applied with longer sessions may yield stronger results in patients with schizophrenia.

The majority of the mechanisms used in swallowing function are also valid for saliva control.[34] Sialorrhea and sedation are frequently observed side-effects associated with clozapine treatment.[35] Noninvasive methods include oral sense motor exercise protocols, pharmacological treatments, and electrical stimulation.[36] Güzel and Tuncer[37] reported that NMES applied to children with cerebral palsy and salivary issues was not effective. In the current study, the treatment was found to provide a statistically significant positive result in saliva severity and frequency in patients with schizophrenia ($p < 0.05$). This difference in results may be due to the presence of primitive reflexes in the tongue and mouth in children.

Based on current information, NMES is used in support of exercise treatment programs due to its simple and risk-free application and sensory stimulation to the pharyngeal region, which may improve swallowing and saliva control.

Treating dysphagia in patients with schizophrenia presents unique clinical hurdles. While literature suggests diet modifications or compensatory techniques, our study is one of the rare attempts to apply an intensive, 12-session active rehabilitation protocol including NMES. The high dropout rate (85%) underscores the difficulty of maintaining treatment compliance in this group. Given these challenges, this work should be considered a pilot study. Despite the small final sample (n = 7), the statistically significant improvements in EAT-10, saliva control, and trismus provide a crucial foundation for future interventions in psychiatric care.

There were several limitations to this study. The first and most significant limitation was the final sample size (n = 7). Although the study initially screened 47 patients, the high attrition rate (85%) due to cognitive impairment, lack of cooperation, and hospital discharges highlights the immense difficulty of conducting intensive physical rehabilitation in a population with chronic schizophrenia. Consequently, the findings of this research should be interpreted as a pilot study, and the statistical significance observed may not

be generalized to the entire patient population with schizophrenia. Second, while there was a statistically significant reduction in EAT-10 scores, the majority of patients remained above the clinical threshold (≥ 3) for dysphagia after treatment. This suggests that while a 12-session intensive rehabilitation program provides clinical improvement and functional gains (as supported by increased Trismus measurements), it may not be sufficient to eliminate dysphagia in patients with long-term antipsychotic use. Finally, the lack of a long-term follow-up prevents us from determining the permanence of these improvements. Future large-scale studies with longer intervention periods and control groups are necessary to establish the long-term efficacy and sustainability of swallowing rehabilitation in psychiatric care.

In conclusion, the results demonstrated that the rehabilitation of swallowing disorders applied to patients with schizophrenia and swallowing difficulties provided statistically significant improvements in the EAT-10, saliva severity and frequency, and trismus measurements. Disease history and levels of physical activity were not seen to have any effect on the efficacy of swallowing rehabilitation treatment, suggesting that disease history and physical activity level are not a priority when selecting treatment for patients with schizophrenia with swallowing and salivary issues. Similarly, the education level of the patient had no effect on the result of swallowing rehabilitation. However, in this study, the swallowing rehabilitation was individually applied to the patients under the supervision of a specialist, and whether the exercise program would be as effective when it is given as a home-based program remains uncertain. Evaluation of oral control and swallowing functions from the early stage onwards, irrespective of the disease history, physical activity level, or education level, is recommended for patients diagnosed with schizophrenia and with dysphagia and salivary issues in respect of involving these patients in the necessary protective and therapeutic rehabilitation programs.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions: N.A.Y.: Conceptualization, data curation, writing, original draft, writing, review & editing; A.A.: Conceptualization, data curation; M.S.: Original draft, writing, review & editing; A.M.T.: Original draft, writing, review & editing; G.Y.: Original draft, writing.

Conflict of Interest: The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding: The authors received no financial support for the research and/or authorship of this article.

AI Disclosure: The authors declare that artificial intelligence (AI) tools were not used, or were used solely for language editing, and had no role in data analysis, interpretation, or the formulation of conclusions. All scientific content, data interpretation, and conclusions are the sole responsibility of the authors. The authors further confirm that AI tools were not used to generate, fabricate, or 'hallucinate' references, and that all references have been carefully verified for accuracy.

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