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# The effects of orofacial thermal-tactile stimulation on elderly long-term-care facility residents with severe dementia: a case series

## Efeitos da estimulação tátil-térmica orofacial em idosos residentes em instituições de longa permanência com demência grave: uma série de casos

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### ABSTRACT

**Purpose:** To determine the effectiveness of oral sensitivity therapy, on institutionalized elderly patients with severe dementia. **Methods:** A series of eight cases residing in a long-term institution. With the consent of their families, we included elderly residents diagnosed with severe dementia and severe dysphagia. We excluded elderly patients who were already undergoing swallow therapy and those who used only alternative means of feeding. The experimental and the control groups were randomly allocated by drawing lots. A blind assessor carried out pre- and post-therapy tests, using: Northwestern Dysphagia Patient Check Sheet (NDPCS) protocol, Clinical Dementia Rating scale (CDR) and Functional Oral Intake Scale (FOIS). During tests with food, the assessor evaluated swallowing speed and the number of swallows per serving (puréed texture and liquid). The participants in the experimental group underwent five consecutive sessions of tactile-thermal stimulation for 30 minutes each time. **Results:** There were eight participants, six women and two men, between the ages of 68 and 98. No significant difference was found in the items 23 to 28 of the NDPCS instrument for both liquid and puréed consistencies as well as no difference was observed in the number of swallows or the speed of swallowing. Additionally, there was no change in FOIS scale, and neither any significant difference between the experimental and the control group. **Conclusion:** Thermal-tactile stimulation did not change the swallowing patterns of institutionalized elderly patients with severe dementia.

**Keywords:** Swallowing; Swallowing disorders; Aging; Dementia; Geriatrics

### RESUMO

**Objetivo:** Determinar efetividade da terapia de sensibilidade oral em idosos institucionalizados com demência grave. **Métodos:** Uma série de oito casos residentes em instituição de longa permanência. Foram incluídos idosos com diagnóstico de demência grave e disfagia grave, com consentimento da família. Foram excluídos idosos em atendimento fonoaudiológico e com alimentação somente por via alternativa. A divisão entre grupo experimental e grupo controle foi por sorteio. A avaliação pré e pós terapia, realizada por uma fonoaudióloga cega para a intervenção, utilizou protocolo Northwestern Patient Dysphagia Check Sheet (NDPCS), a escala Clinical Dementia Rating (CDR) e a Escala Funcional de Ingestão Oral (FOIS). Durante a oferta a velocidade da deglutição e o número de deglutições (pastoso e líquido) foram avaliados. Os participantes do grupo experimental foram submetidos a cinco sessões consecutivas de estimulação tátil-térmica por 30 minutos. **Resultados:** Oito participantes, com idade entre 68 e 98 anos, fizeram parte da amostra seis mulheres e dois homens. No grupo experimental não observou-se modificação na velocidade da deglutição bem como no número de deglutições nas consistências pastosa e líquida. Não foram encontradas diferenças significativas para os itens 23 a 28 do instrumento NDPCS nas duas consistências, bem como não houve modificação na escala FOIS. Também não houve diferenças estatisticamente significativas entre o grupo experimental e o grupo controle para essas duas consistências. **Conclusão:** A estimulação tátil-térmica não modificou o padrão de deglutição em idosos institucionalizados com demência grave.

**Palavras-chave:** Deglutição; Transtornos de deglutição; Envelhecimento; Demência; Geriatria

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**Conflict of interests:** No.

**Authors' contribution:** MRO was responsible for study conception and design. Also contributed to final review of the manuscript. RSR contributed to the data analysis and the manuscript writing. LAJS performed both manuscript writing and review. AMM was responsible for data collection and manuscript and project writing. VBS was responsible for study conduction, data collection and manuscript final review.

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## INTRODUCTION

The increase in life expectancy has been directly related to the growing prevalence of dementia, a syndrome that compromises activities of daily living (ADLs), and impacts on quality of life (QoL)<sup>(1)</sup>. Advanced dementia is one of the frequent reasons for admitting elderly patients to care institutions<sup>(2,3)</sup>. The prevalence of oropharyngeal dysphagia in institutionalized elderly patients with dementia varies from 45% to 52.7%. However, this estimate may be even greater since this population is affected by many diseases and medications that can cause dysphagia<sup>(4-7)</sup>.

There are few studies in the literature that describe speech-language therapy for patients with severe dementia. There are still debates concerning the most appropriate intervention method to use with this population and there is little scientific evidence. Different studies have suggested changes in feeding dynamics, posture, or food texture<sup>(8-11)</sup>.

Thermal-tactile stimulation (TTS) is a technique used on patients with oropharyngeal dysphagia to increase sensitivity in the oral cavity and trigger a faster swallowing reflex<sup>(12)</sup>. Cold temperatures or ice are used to provide sensory stimulation to the anterior faucial pillars<sup>(13,14)</sup>. This technique has already proven to be effective in reducing the swallowing times of patients diagnosed with Parkinson's disease or recovering from a stroke<sup>(15-17)</sup>. Although the effects of this therapeutic option had not been tested in elderly individuals with severe dementia, our initial hypothesis was that TTS could improve swallowing speed and decrease the presence of clinical signs suggestive of penetration/aspiration.

Thus, the aim of this study was to assess the therapeutic effect of TTS on institutionalized patients with severe dementia and dysphagia.

## METHODS

This is a case series of eight institutionalized male and female individuals residing in a long-term care facility for the elderly, located in southern Brazil. A Clinical Dementia Rating (CDR)<sup>(18,19)</sup> score of 3 or more was used to clinically diagnose the participants with severe dementia. Complaints from family members, caregivers, or health professionals, together with a clinical swallowing assessment, were used to diagnose oropharyngeal dysphagia. We excluded elderly residents who were already in swallow therapy or who were fed only by alternative means. Patient medical histories were also taken.

Informed consent was obtained from a family member or legal guardian. The project was approved by the institution's ethics committee, under approval number 1.213.322.

Participants were randomly divided into two groups: experimental and control. The experimental group received daily TTS-assisted swallowing therapy for five days. The control group received no intervention and was reassessed after the same period.

### Pre-therapy tests

For cognitive assessment, two screening devices were used: the Mini-Mental State Examination (MMSE)<sup>(20)</sup> and the Montreal Cognitive Assessment (MOCA)<sup>(21)</sup>. Both were validated in Brazilian Portuguese.

### Pre- and post-therapy testing

The swallowing assessment was performed using the Northwestern Dysphagia Patient Check Sheet (NDPCS), which consists of a brief clinical and functional swallowing test based on 28 items divided into five categories: a) medical history; b) behavioral aspects; c) motor function; d) an oral motor test; e) a check for signs of swallowing problems<sup>(22)</sup>. Three food textures were tested: 1) puréed (45mL of yogurt) offered with a dessert spoon (5mL); 2) thickened liquid, to be sipped from a drinking glass (100 mL of water mixed with two sachets of 1.2 grams of Thicken Up Clear - Nestlé thickener); and 3) and thin liquid, to be sipped from a drinking glass (100mL of water). In addition to the NDPCS items, the number of swallows performed to consume an entire portion was counted. The duration of the entire swallowing process was similarly measured, in seconds (from the moment the food entered the oral cavity until the end of the laryngeal elevation).

After each swallowing assessment, the degree of dysphagia was established using the Speech-Language Therapy Tool for Dysphagia Risk Assessment (*Protocolo Fonoaudiológico de Avaliação do Risco para Disfagia* - PARD). This tool classifies swallowing and swallowing problems into seven levels: normal, functional, mild, mild to moderate, moderate, moderate to severe, severe<sup>(23)</sup>. Besides this, the participants' oral intake was classified according to the Functional Oral Intake Scale (FOIS)<sup>(24)</sup>. The institution's dietitian carried out a nutritional assessment on each patient, calculating and classifying the Body Mass Index (BMI)<sup>(25)</sup>.

A blind assessor, who was a qualified speech-language therapist, performed pre- and post-test evaluations. This assessor had no contact with the experimental group that received the intervention.

### Thermal-tactile sensory stimulation

The experimental group received daily TTS-assisted swallowing therapy for five consecutive days, with cryotherapy<sup>(17,26)</sup>. This model of approach was chosen so that patients could be assessed immediately after the end of the last session and to avoid missed days. These daily therapy sessions lasted approximately 30 minutes each (the time of therapy was adapted to each individual's tolerance to the stimulus). Participants were monitored for readiness, cooperation, and signs of fatigue or psychological and motor agitation. The same speech-language therapist conducted all of these sessions.

To perform TTS, a laryngeal mirror was immersed in a disposable cup filled with 50 mL of cold water (approximately 10°C) and ice cubes to achieve the necessary temperature for stimulating oral structures. The anterior faucial pillars (more specifically, the bilateral anterior faucialpillars) and the tongue received stimulation with the cold laryngeal mirror.

Each participant was placed in a 90° sitting position before the cold laryngeal mirror was passed along the anterior faucial pillars three times (five repetitions each time) with medium intensity, from top to bottom, on both sides. Patients were asked to swallow their saliva immediately after the stimulus. Then, with a cold teaspoon, the back of the tongue was stimulated with forward-moving strokes in an attempt to stimulate the automatic elevation of the tip of the tongue. Three strokes of medium intensity were performed on the tongue, followed by a verbal command to swallow saliva.

The teaspoon was used to encourage greater cooperation during TTS-assisted therapy since the use of familiar tools from their daily routine helps these patients to better accept stimuli.

**Table 1.** Experimental and control group: general data and cognitive and swallowing assessments

	Group	Age (years)	Institution time (years:months)	MMSE	MOCA	BMI	FOIS	PARD
Patient 1	Experimental	71	2:9	1	1	18.53	4	Moderate to severe
Patient 2	Experimental	68	3:0	0	0	27.34	4	Moderate to severe
Patient 3	Experimental	97	3:0	9	3	17.77	5	Mild to moderate
Patient 4	Experimental	98	5:0	7	3	18.31	5	Moderate
Patient 1	Control	88	3:0	0	0	28.83	5	Moderate
Patient 2	Control	79	2:7	0	0	21.38	5	Moderate
Patient 3	Control	95	6:0	9	0	26.15	5	Moderate
Patient 4	Control	86	6:0	0	0	26.57	5	Moderate

**Subtitle:** MMSE = Mini Mental State Exam; MOCA = Montreal Cognitive Assessment; BMI = Body Mass Index; FOIS = Functional Oral Intake Scale; PARD = Speech-Language Tool for Dysphagia Risk Assessment

This sequence of TTS was repeated throughout the session. No other swallow-inducing maneuvers were used.

## Statistical analysis

Descriptive analyses presented absolute and relative frequencies (showing the median and interquartile range). To verify the distribution of variables, the Kolmogorov-Smirnov test was used. Due to the rejection of the normality hypothesis, Mann Whitney and Kruskal-Wallis non-parametric tests were performed. The rejection value of the null hypothesis was  $p < 0.05$  (95% CI). The analyses were performed using the Statistical Package for the Social Sciences / SPSS Version v.21 software (Chicago: SPSS).

## RESULTS

The study sample consisted of eight individuals diagnosed with severe dementia: six women (75%) and two men (25%), with an average age of 85.25 years. The mean age in the EG was 83.5 years and 87 years in the CG. The results of the clinical assessments of cognition and swallowing, as well as the BMI of the patients from the experimental and control groups, are shown in Table 1.

After the therapeutic intervention, tests with both puréed texture and thin liquid in the experimental group showed no reduction in the duration of the swallowing reflex or in the number of swallows required for a complete swallow. Patients who presented no gag reflex before therapy showed no improvement upon reassessment. In addition, no significant differences were found for items 23 to 28 of the NDPCS, for puréed texture or thin liquid. There were also no statistically significant differences between the experimental group and the control group for these two consistencies (Table 2).

When we analyzed the aspects of signs swallowing problems (23-28 in NPDCS) it was possible to observe that case 1 had an improvement in liquid consistency, with no change in puréed. The same occurred with case 4. Case 3 worsened in the 2 consistencies, whereas in case 2 the improvement was restricted to puréed consistency. The controls group there was no change in the signs and symptoms of swallowing when considering the issues of 23-28 of the NPDCS. Descriptions are found in the table (Table 3 and Table 4).

Regarding the cognitive tests (MMSE and MOCA), they were used to measure cognitive difficulty because even patients with severe dementia may show slightly different levels of performance. However, there was a similar cognitive profile among participants, except for patient 4 who achieved a slightly better score.

**Table 2.** Difference between pre- and post-therapy: experimental x control group.

Variables	p-value
NDPCS - 1 to 4 purée	0.341
NDPCS - 5 to 10 purée	0.346
NDPCS - 11 to 22 purée	0.459
NDPCS - 23 to 28 purée	0.210
NDPCS - 1 to 4 thin liquid	0.198
NDPCS - 5 to 10 thin liquid	0.575
NDPCS - 11 to 22 thin liquid	0.128
NDPCS - 23 to 28 thin liquid	0.290
Number of swallows- purée	0.157
Number of swallows -thin liquid	0.243
Swallowing speed - purée	0.091
Swallowing speed -thin liquid	0.089

**Subtitle:** NDPCS= Northwestern Dysphagia Patient Check Sheet

## DISCUSSION

Results showed that TTS for a short period was not effective in modifying the swallowing patterns of elderly participants with severe dementia in our study. These findings allow us to infer that TTS at the frequency tested in this study did not bring benefit to this group of patients, nor did it seem to reduce the risk of aspiration. Nevertheless, this technique has already been proven effective for other populations, such as stroke patients and a sample of patients diagnosed with Parkinson's disease. These participants obtained statistically significant timing scores in the pharyngeal phase of swallowing<sup>(15-17)</sup>.

Although the results do not point to a change in the swallowing pattern in this population, discussing the scientific evidence of therapy in patients no collaborative is important. This group with dementia has a high prevalence of dysphagia and although outside of Brazil we have studies with this population, socioeconomic characteristics may point to different results<sup>(4)</sup>.

Some studies have divided speech-language therapy into three main types of action: adaptive interventions, compensatory strategies, and rehabilitation with exercises. Facilitating techniques, such as thermal and gustatory stimulation, are included in the third category. In order to choose the best strategies, several factors must be taken into account, including patient diagnosis, quality of life, and economic factors, as well as scientific findings. The literature is still scarce regarding patients with severe dementia and facilitating techniques. However, the modest evidence provided by studies about other degenerative diseases suggests that it is possible to improve the sensitivity and automatic response of triggered swallowing<sup>(9,10)</sup>.

**Table 3.** Pre- and post-therapy: experimental group

Experimental Group	Case 1			Case 2			Case 3			Case 4		
	Pre-therapy	Post-therapy	Difference	Pre-therapy	Post-therapy	Difference	Pre-therapy	Post-therapy	Difference	Pre-therapy	Post-therapy	Difference
NDPCS-1 to 4 purée	0	0	0	2	2	0	0	0	0	0	0	0
NDPCS- 5 to 10 purée	3	3	0	5	5	0	2	2	0	3	3	0
NDPCS - 11 to 22 purée	7	7	0	3	3	0	4	2	2	4	4	0
NDPCS - 23 to 28 purée	3	3	0	4	3	1	0	1	-1	0	0	0
NDPCS -1 to 4 thin liquid	0	0	0	2	2	0	0	0	0	0	0	0
NDPCS - 5 to 10 thin liquid	3	3	0	5	5	0	2	2	0	3	3	0
NDPCS- 11 to 22 thin liquid	7	7	0	3	3	0	4	2	2	4	4	0
NDPCS- 23 to 28 thin liquid	4	3	1	3	4	-1	0	1	-1	3	0	3
Number of swallows - purée	10	11	-1	16	13	3	10	9	1	6	4	2
Number of swallows- thin liquid	2	4	-2	8	7	1	6	6	0	2	4	-2
Swallowing speed <sup>a</sup> - purée	11.69	9.27	2.42	7.72	8.6	-0.88	4.58	3.29	1.29	8.06	6.87	1.19
Swallowing speed <sup>a</sup> -thin liquid	8.47	5.81	2.66	7.67	10.37	-2.7	3	2.78	0.22	2.39	4.97	-2.58

**Subtittle:** NDPCS = Northwestern Dysphagia Patient Check Sheet; <sup>a</sup>= in seconds

**Table 4.** Pre- and post-therapy: control group

Control Group	Case 1			Case 2			Case 3			Case 4		
	Pre-therapy	Post-therapy	Difference	Pre-therapy	Post-therapy	Difference	Pre-therapy	Post-therapy	Difference	Pre-therapy	Post-therapy	Difference
NDPCS -1 to 4 purée	0	0	0	0	0	0	0	0	0	2	2	0
NDPCS - 5 to 10 purée	3	3	0	4	4	0	4	4	0	3	3	0
NDPCS - 11 to 22 purée	1	1	0	2	2	0	2	2	0	2	2	0
NDPCS - 23 to 28 purée	3	3	0	3	3	0	3	3	0	3	3	0
NDPCS -1 to 4 thin liquid	0	0	0	0	0	0	0	0	0	2	2	0
NDPCS - 5 to 10 thin liquid	3	3	0	4	5	-1	4	2	2	3	3	0
NDPCS - 11 to 22 thin liquid	1	1	0	2	2	0	2	2	0	2	2	0
NDPCS - 23 to 28 thin liquid	1	1	0	3	3	0	5	5	0	2	2	0
Number of swallows- purée	16	9	7	10	12	-2	10	5	5	8	6	2
Number of swallows –thin liquid	6	6	0	8	7	1	3	3	0	6	4	2
Swallowing speed - purée <sup>a</sup>	7.72	5.76	1.96	7.38	6.91	0.47	11.54	4.06	7.48	8.11	6.38	1.73
Swallowing speed –thin liquid <sup>a</sup>	1.92	2.04	-0.12	6.27	4.42	1.85	25.24	4.75	20.49	6.94	7.54	-0.6

**Subtittle:** NDPCS= Northwestern Dysphagia Patient Check Sheet; <sup>a</sup>= in seconds

Rather than the simple repetition of movements or learned behavior, evidence on neuroplasticity states that plastic and dynamic changes in the central nervous system only occur when motor learning is able to promote neurogenesis, synaptogenesis, angiogenesis, and pre- and post-synaptic modulation. Thus, our hypothesis is that the lack of therapeutic results in this study is related to the intensity and duration of the intervention, as well as the complexity of the process, since the new synapses necessary for showing clinical improvement may not be formed in cases of advanced dementia. In addition, the progress of the disease and neuronal degeneration may prevent the creation of new nerve connections and contribute to the poor effect of TTS on this population<sup>(27)</sup>.

Bearing in mind that the technique employed in this sample did not stimulate clinical improvement, we suggest that speech-language therapy for this population should give priority to swallowing management. Published literature has highlighted strategies for patients in palliative care: identifying and diagnosing difficulties; sorting the complaints, symptoms, and difficulties that affect or bother patients and family members the most; using compensation strategies, symptom relief, and management and control. Moreover, one must question the decision-making process if the risk of aspiration exceeds the benefit of maintaining any kind of oral feeding<sup>(28)</sup>.

The sample size of our study was a limiting factor, as well as its design which places it close to the base of the evidence



pyramid. In addition, other limiting factor was the assessment of swallowing pattern, which was not performed using an instrument to measure swallowing speed or the number of swallowing, which would increase the chance to find differences in times. Despite this, due to the present lack of intervention studies, our research may serve as a point of reference for researchers and clinicians. We believe that further controlled studies are needed to properly address swallowing rehabilitation in elderly patients with severe dementia.

## CONCLUSION

The results of this study suggest that TTS did not promote any benefit for the studied group. Death due to aspiration pneumonia is frequent among this population and justifies continuing the search for new therapeutic methods.

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