

Brief Communication  
Comunicação Breve

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Speech-language therapy program for  
mouth opening in patients with oral and  
oropharyngeal cancer undergoing adjuvant  
radiotherapy: a pilot study

*Programa terapêutico fonoaudiológico para  
abertura de boca em pacientes com câncer de  
boca e orofaringe em radioterapia adjuvante:  
estudo piloto*

Keywords

Trismus  
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Descritores

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ABSTRACT

**Purpose:** Assess the effectiveness of an orofacial myofunctional therapeutic program in patients with oral or oropharyngeal cancer submitted to adjuvant radiotherapy through pre- and post-program comparison of maximum mandibular opening. **Methods:** Prospective study involving five adult patients and five elderly patients postoperatively to oral cavity/oropharynx surgery who were awaiting the beginning of radiotherapy or had undergone fewer than five treatment sessions. The study participants had their maximum jaw opening measured using a sliding caliper at the beginning and end of the program. Two mobility exercises and three mandibular traction exercises were selected and weekly monitored presentially for 10 weeks. Descriptive data and pre- and post-therapy comparative measures were statistically analyzed using the Wilcoxon test. **Results:** Ten patients (two women and eight men) with mean age of 58.4 years, median of 57.0 years, completed the therapeutic program. They presented mean maximum mandibular opening of  $31.6 \pm 11.7$  and  $36.4 \pm 8.0$  mm pre- and post-therapy, respectively ( $p=0.021$ ). **Conclusion:** The proposed orofacial myofunctional therapeutic program increased the maximum jaw opening of patients referred to adjuvant radiotherapy for oral cavity or oropharynx cancer treatment.

RESUMO

**Objetivo:** Analisar, por meio da comparação entre a abertura máxima mandibular, a efetividade de programa terapêutico miofuncional oral em pacientes com câncer de boca ou orofaringe submetidos à radioterapia adjuvante. **Método:** Estudo prospectivo envolvendo cinco pacientes adultos e cinco idosos em pós-operatório de cirurgia de boca/orofaringe que aguardavam início da radioterapia ou até a quinta sessão. No início e no final do programa, os participantes tiveram suas medidas de abertura máxima mandibular mensuradas por meio de paquímetro e foram selecionados cinco exercícios – dois de mobilidade e três de tração mandibular – com controle presencial durante oito semanas, perfazendo um total de dez semanas. Dados descritivos e a comparação das medidas pré e pós-fonoterapia por meio do teste de Wilcoxon foram considerados na análise dos dados. **Resultados:** Dez pacientes finalizaram o programa terapêutico (duas mulheres e oito homens), com média de idade de 58,4 anos, mediana de 57,0 anos. Apresentaram média de abertura máxima mandibular de  $31,6 \pm 11,7$  mm antes do tratamento e  $36,4 \pm 8,0$  mm no pós-terapia ( $p=0,021$ ). **Conclusão:** O programa terapêutico miofuncional oral proposto promoveu aumento da abertura máxima vertical da mandíbula de pacientes submetidos à radioterapia e/ou quimioterapia adjuvante para tratamento de câncer de boca e orofaringe.

Study carried out at the Hospital das Clínicas, Faculdade de Medicina, Universidade de São Paulo and at the Instituto do Câncer do Estado de São Paulo - São Paulo (SP), Brasil.

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## INTRODUCTION

Patients with head and neck (HN) cancer undergoing postoperative adjuvant radiotherapy (RT) or radiochemotherapy (RT/QT) often suffer from acute or long-term reactions<sup>(1)</sup>.

RT may result in injury to the salivary glands, mucosa, and oral and alveolar bone musculature. These lesions, directly or indirectly, lead to clinical consequences that include xerostomia, caries, mucositis, loss of taste, osteoradionecrosis, infection, stomatitis, and trismus<sup>(2)</sup>.

Trismus - restriction to the opening of the mouth - can be caused by infiltration of the tumor in the masticatory muscles and/or temporomandibular joint, involvement of these muscles in the irradiation field, or a combination of both. Large tumors and high-dose RT are also considered risk factors for developing trismus in this population<sup>(3)</sup>. The prevalence rate of trismus after RT ranges from 5 to 30%<sup>(4)</sup>, and a negative influence on patients' quality of life is observed<sup>(3,5)</sup> because it affects feeding, speech, voice, swallowing, and oral hygiene, and causes pain<sup>(3,6)</sup>. A study conducted in Brazil found prevalence of trismus of 27% in patients with HN malignant tumors, with tumor stage and longer use of feeding tube as associated factors<sup>(4)</sup>.

Incidence of trismus may vary according to the time of treatment the patient is in. In Sweden, a study conducted with HN patients found incidence of trismus of 9% during pre-treatment, 38% six months post-treatment, and 28% one year post-treatment<sup>(3)</sup>.

Several interventions for this impairment have been described in the literature: application of botulinum toxin, use of medicines, surgical procedures, and direct therapy with the use of commercial devices or through programs with orofacial myofunctional exercises<sup>(7-14)</sup>. In addition to possible difficulties associated with cost and access, cancer patients may present limitations to certain types of intervention because of the characteristics of disease evolution and the effects of cancer treatment<sup>(2,5,8,9)</sup>.

Botulinum toxin has been indicated when the effects of RT on patients with HN cancer include muscle spasms and oromandibular dystonia. Improvement in pain and spasm rates in the masticatory muscles has been observed, but direct improvement of trismus has not<sup>(7)</sup>.

A preliminary study using medication found limited therapeutic effect on cancer patients with radiation-induced trismus<sup>(8)</sup>.

Surgeries aiming to obtain greater mouth opening are more indicated in cases resistant to therapy<sup>(9)</sup>. The use of commercial devices has proven to be effective<sup>(11)</sup>, but because of their high cost and, especially, of the evidence of increased mouth opening with conventional exercise programs<sup>(10,12)</sup>, they would not be suitable for all patients<sup>(14)</sup>. Muscle exercise programs have not yet proven to be effective as a preventive measure<sup>(13)</sup>.

A recent literature review found increased mouth opening in patients with trismus secondary to HN cancer after exercise therapy; however, wide methodological variation was observed, including type, duration, and repetition of the techniques. It is worth noting that several of the studies surveyed in this

review reported mandibular opening <35 mm after the exercise program, showing that patients might continue to suffer from trismus. The early beginning and correct compliance with the sequence of proposed exercises were important for the good results observed<sup>(14)</sup>.

Due to the incidence of trismus resulting from HN cancer, its functional impact, and the painful states that it causes, and based on these evidences regarding exercise therapy, speech-language pathology (SLP) intervention structured as a therapeutic program can be interesting. If applied early for control of the adverse effects of RT, the SLP program can present promising results that assist with improving the quality of life in this period, emphasizing that these patients may present disease evolution and reserved prognoses.

The objective of this study was to evaluate the efficacy of an orofacial myofunctional therapeutic program in patients with oral and oropharyngeal cancer undergoing adjuvant RT.

## METHODS

This prospective longitudinal study was approved by the Research Ethics Committee of the Institution under process no. 488.448. Study participants were patients undergoing oral cavity/oropharynx cancer treatment with reference to adjuvant radiotherapy (RT) or radiochemotherapy (RT/QT) in a high complexity hospital. Three-dimensional RT was performed according to institutional protocol. Inclusion criteria comprised adult or elderly patients postoperatively to oral cavity/oropharynx surgery, with or without cervical emptying, who were awaiting the beginning of RT or had undergone fewer than five treatment sessions. Patients who did not sign the Informed Consent Form; were absent in two or more treatment sessions and/or were hospitalized during speech-language therapy; had RT suspended; had total resection of the mandible; presented diseases associated with functional impact on phonoarticulatory organs and/or difficulties in oral comprehension of simple orders were excluded from the research. All patients operated in the two years previously to the study commencement were invited. The assessments and application of the therapeutic program were conducted by the same professional.

In the initial (Session 1) and final (Session 10) sessions, the maximum jaw opening of dentate patients was assessed by measuring the maximal interincisal distance (MID) - the distance between the edges of the incisors of the mandible and the maxilla, and in case of edentulous patients or patients wearing dental prosthesis, it was evaluated in the midline of the face, considering the distance to the alveolar ridge or the lips, depending on the patient's oral condition. Classification was conducted according to severity of restriction, with values  $\leq 35$  mm considered as trismus. All participants were instructed to remain with the neck in a neutral position and open the mouth as much as possible, avoiding excessive pain<sup>(6,15)</sup>. An analog, Starfer manufactured, 6" (150 mm), plastic caliper was used to take the measures.

The speech-language pathology (SLP) therapeutic program, described ahead (Chart 1), consisted of ten sessions, and the

exercises were based on literature review<sup>(6-13)</sup>, considering positive results and easy execution. Three mobility exercises and two mandibular traction exercises were selected and performed three times a day<sup>(11-13)</sup>.

Participants returned weekly for adjustments, monitoring of evolution and clinical conditions, and control of daily record sheets (sessions 2 to 9). The daily record sheet should

be completed by the patient or literate family member during the week; it contained information on the level of difficulty in performing the exercises, number of repetitions per day, and weekly frequency.

The MID values were described and the Wilcoxon test applied for pre- and post-program comparison at statistical significance level of 5%.

**Chart 1.** Description of the therapeutic program

<b>OROFACIAL MYOFUNCTIONAL THERAPEUTIC PROGRAM FOR MOUTH OPENING INCREASE</b>	
<b>Session 1.</b> Questioning about possible difficulty in opening the mouth, assessment of the maximal mouth opening capacity, execution of the program exercises, hand in of the daily record sheet and presentation of directions on how to fill it in.	
<b>Exercises and respective execution directions:</b>	
1) Maximum mandibular opening: Open your mouth to comfort limit with the palms of your hands on the side of the face, hold it in this position, count to three, and then slowly return to the initial position. Repeat it five times.	
2) Mandibular lateralization: Press your chin to the right with the palm of your hand on the cheek running the teeth on the spatula in the same direction. Hold in position for three times and then return to the initial position slowly. Repeat it five times. Do the same on the left side. Note: for edentulous patients the spatula was not used, and the exercise was performed without support.	
3) Mandibular Protrusion: Move your chin forward, hold it in this position, count to three, and return to the initial position. Repeat it five times.	
4) Traction with fingers: Place the index finger and the middle finger on the lower central incisors and open your mouth to the maximum, inhale deeply and look up, hold in position, count to three, and then release. Repeat it five times. Note: the alveolar ridge or flap was used as support for edentulous patients.	
5) Traction with spatulas: Place the stacked spatulas at mouth opening comfort limit. Divide them in half, hold each part with one hand, and force it vertically to open the mouth until you feel discomfort, hold in position, count to three. Join the spatulas, remove them, and close the mouth slowly. Repeat it five times.	
<b>Sessions 2 to 9.</b> Questioning about possible difficulty in opening the mouth, hand in of the daily record sheet, execution of the exercises without help of the therapist to verify possible inadequacies. Directions to family members if needed.	
<b>Session 10.</b> Questioning about possible difficulty in opening the mouth, hand in of the daily record sheet, and reassessment of maximal mouth opening capacity.	
<b>Home exercises (as of Session 1):</b> Repetition of the complete sequence three times a day.	

## RESULTS

Of the 23 individuals included in the study, 13 were excluded from the sample due to absence/withdrawal, clinical interferences and/or death. Of the 10 participants that remained in the study, eight were men and two were women, five adults and five elderly, with mean age of  $58.4 \pm 9.8$ , median of 57.0 years. Seven individuals had tumors in the oral cavity and three in the oropharynx; four presented T2 tumors and six

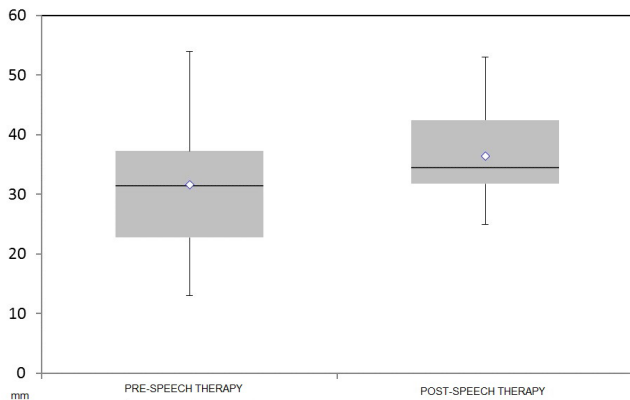
had T3 or T4 tumors. The participating patients underwent the following surgeries: three, partial glossectomy; three, segmental pelveglossomandibulectomy; two, bucopharyngectomy; one, pelveglossectomy; one, maxillectomy. Eight participants were submitted to adjuvant radiotherapy (RT) and two to adjuvant radiochemotherapy (RT/QT) (Table 1).

MID measures varied from 13 to 54 mm and from 25 to 54 mm, pre- and post-program, respectively. Eight patients presented measures compatible with the presence of trismus in the pre-program

**Table 1.** Characterization of patients assessed pre- and post-intervention program

Patient	Gender	Age	Tumor	Stage	Surgery	Adjuvant treatment	MID (mm)	
							pre	post
1	M	50	Oropharynx	T4aN2cM0	Bucopharyngectomy	RT/QT	30	31
2	M	70	Oropharynx	T2N1M0	Bucopharyngectomy	RT	54	53
3	F	50	Oral cavity	T4aN0M0	Maxillectomy	RT	19	25
4	M	62	Oral cavity	T3N0M0	Partial glossectomy	RT	44	44
5	M	68	Oral cavity	T3N0M0	Partial glossectomy	RT	33	36
6	M	63	Oral cavity	T2N1M0	Segmental pelveglossomandibulectomy	RT	24	32
7	M	47	Oral cavity	T3N1M0	Partial glossectomy	RT	34	42
8	F	52	Oropharynx	T4aN2cM0	Segmental pelveglossomandibulectomy	RT/QT	30	34
9	M	49	Oral cavity	T2N0M0	Segmental pelveglossomandibulectomy	RT	13	32
10	M	73	Oral cavity	T2N2bM0	Pelveglossectomy	RT	35	35

Caption: M = male; F = female; RT/QT = radiochemotherapy; RT = radiotherapy; MID = maximal interincisal distance



**Figure 1.** Maximum mandibular opening measures pre- and post-intervention program (means of 31.6 mm and 36.4 mm, respectively;  $p=0.021$ , Wilcoxon test)

period, and six of them remained in this classification after the SLP program but with increased measures; only one patient kept the same initial measure (35 mm) (Table 1).

The mean pre-program MID was  $31.6 \pm 11.7$  mm, whereas the mean post-program MID was  $36.4 \pm 8.0$  mm - an increment of 13.2% ( $p=0.021$ ) (Figure 1).

Despite the higher mean values presented by the sample after the intervention program, one patient showed a decrease in the MID value (patient 2, decrease of 1 mm) and two patients maintained the initial MID measures (patients 4 and 10). Patient 1 presented the smallest post-program increase (1 mm), whereas patient 9 had the greatest post-program increase (19 mm).

Very few daily record sheets were filled in; consequently, the patients were verbally questioned by the speech-language therapist about their home exercises every week. It was possible to observe that most of the participants performed the exercises correctly, but they did not do them at the requested frequency.

## DISCUSSION

Patients undergoing oral and/or oropharyngeal surgery present imminent risk of trismus, which is enhanced by adjuvant radiotherapy (RT)<sup>(6)</sup>. Intervention in oral complications is possible, but its effectiveness requires further studies<sup>(6,14,15)</sup>, including with respect to the best time to begin<sup>(5)</sup>.

The therapeutic programs or exercises proposed in the literature are difficult to reproduce because they lack details such as mode of execution, number of series, and daily frequency, in addition to considering the use of costly commercial devices<sup>(10)</sup> infeasible for the population in this study. The program applied to this preliminary sample<sup>(11-13)</sup> proved to be feasible, easy to implement and conduct, inexpensive, and of short duration.

Most of the sample consisted of men, with mean age of 60 years, corroborating the literature<sup>(4)</sup>.

Results showed an increase in the mean maximal interincisal distance (MID) after SLP intervention, reaching a mean value above the threshold considered for trismus<sup>(6,15)</sup>. Among the patients who remained with trismus after the program, only one

had the same initial measures, the others presented increased maximum jaw opening. The literature reports that it is common for patients to continue with trismus after intervention, but with improved maximum mandibular opening and functionality<sup>(14)</sup>.

Regarding the three patients who did not improve with the program, it is worth noting that they were the ones who had the highest means of pre-program MID measures, and similarly to the patient who presented an increase of only one millimeter, they did not present trismus or were at the limit of the classification, which may suggest that they were on a plateau with maximum jaw opening. They could also have had less motivation for home exercises because their limitations were not as comprehensive. Of these three patients, two maintained their pre-program measures and only one showed reduction. This patient presented the highest initial mean, was the oldest in the group, and the observed reduction was only one millimeter. It is important to note that the patient who presented the smallest evolution was one of the most severe cases in the sample.

These data suggest that the SLP program is more effective in patients with oral/oropharyngeal cancer who present trismus referred to adjuvant RT or RT/QT, and that it should be applied to larger samples for verification.

The proposed therapeutic program, conducted pre- and intra-radiotherapy, provided significant increase in the maximum mandibular opening of most patients. This early intervention is considered essential in cases where the masticatory muscles or soft tissues around the temporomandibular joint are included in the radiation field, with indication of practice of the exercises concurrently with the beginning of RT<sup>(10)</sup>. Such procedures optimize the conditions of swallowing and communication, contributing to better survival in these patients<sup>(3,12)</sup>. Comparison with other studies is limited by the different methodologies employed, but this program focused on orofacial myofunctional exercises, as observed in other similar proposals<sup>(10,12,14)</sup>, was able to improve the maximum jaw opening of most patients - although trismus remained for more than half of the sample, and it is necessary to verify the impact of this improvement in the quality of life of patients.

Clinical practice demonstrates that the effects of adjuvant treatment may be observed late, and are more severe and last longer, compromising the therapeutic results<sup>(3,6,15)</sup>. In this context, SLP intervention during adjuvant radiotherapy enables early identification of eventual reduction in mandibular opening. This fact corroborates the proposal of the present study and justifies the indication of a SLP program for trismus, regardless of the presence of complaint.

Although all the patients who met the eligibility criteria assisted at the institution in the period were included in this preliminary study, its main limitation was the small sample size. Therefore, it was not possible, at that time, to classify the patients according to degree of trismus, nor to separate the group based on other factors such as radiation dose and tumor stage, which have been shown to be relevant for the onset of trismus<sup>(3,4)</sup>.

Late diagnoses and deaths hindered the longitudinal monitoring. A study with follow-up after four weeks, ten weeks, and three months of a program that combined exercises with and without commercial devices reported 74% of patients free of

trismus compared with 32% of patients in the control group<sup>(3)</sup>. The patients reported greater comfort when eating together with other people, the possibility of following an unrestricted diet, as well as improvements at work and in communication, and reduction of facial pain, demonstrating great influence on their quality of life<sup>(3)</sup>.

Few daily record sheets filled in, home exercises done less often than required, and absence and/or withdrawal of part of the final sample reinforce that attention should be given to this population in order to understand the limitations of adherence to the program - an aspect little discussed in the literature probably because of differences in patient profiles. The literature also highlights the practice of home exercises as relevant to good results<sup>(14)</sup>. Thus, it is believed that the benefits gained from this program can be increased.

Permanent multiprofessional discussion, the basis of practice in head and neck (HN) cancer, contributes to the definition of therapy, as well as its continuity, modification, or even interruption. This interrelationship, which is part of an evidence-based practice, aims to improve the patients' functions with consequent improvement in their quality of life.

As there is no direct correlation between duration of orofacial myofunctional therapy and increase in mandibular opening<sup>(14)</sup>, other formats of therapeutic programs can be tested and compared with that of the present study. We believe that a limitation to this study is that the assessments and application of the therapeutic program were conducted by the same professional.

Multicenter studies, as well as surveys with larger samples, may provide expanded information aiming at the improvement of SLP clinical practice.

## CONCLUSION

The proposed orofacial myofunctional therapeutic program provided increased maximum mandibular opening in patients with oral and oropharyngeal cancer undergoing adjuvant radiotherapy or radiochemotherapy. The program is feasible and inexpensive.

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## Author contributions

*CSM participated in the design and scheduling of the study, literature search, collection and analysis of data, and writing of the manuscript; LLM contributed to data analysis and review of the manuscript; MSZ contributed to the study design, data analysis, and review of the manuscript; CRC was in charge of the review and final approval of the manuscript; KN was the study advisor, responsible for its design and coordination of execution stages, and data analysis.*