

# Limitation of mouth opening after radiotherapy for head and neck

## Limitação de abertura bucal pós-radioterapia de cabeça e pescoço

Rafael da Silva CAETANO<sup>1</sup>  
Paula Gabrielle de CASTRO<sup>2</sup>  
Paulo Henrique de Souza CASTRO<sup>2</sup>  
Alexandre Meireles BORBA<sup>1</sup>  
Álvaro Henrique BORGES<sup>1</sup>  
Luiz Evaristo Ricci VOLPATO<sup>1</sup>

### ABSTRACT

#### Objective

To evaluate the ability to open the mouth in patients undergoing radiotherapy for head and neck and the variables related to this limitation.

#### Methods

32 patients were evaluated six months after completion of radiotherapy sessions to treat cancer in the head and neck. The maximum mouth opening was measured using digital calipers and its association with gender, age, smoking, alcohol consumption, tumor location, chemotherapy and surgery were analyzed using the Mann-Whitney and Kruskal-Wallis tests at a level of significance of 95%.

#### Results

The mean age of patients was 60.44 years; 87.5% were male; 81.2% were smokers; 65.6% regularly consumed alcohol. The average mouth opening was 43.17 mm and seven (21.9%) patients had trismus. The most common locations of the tumors were the tongue (31.3%) followed by the larynx and vocal folds with five (15.6%) each. No association was found between limited mouth opening and the other variables.

#### Conclusion

In this sample, 21.9% of patients had trismus six months after completing radiotherapy. The variables gender, age, smoking habits and alcohol consumption, tumor location, previous surgery and adjunctive chemotherapy were not associated with limited mouth opening.

**Indexing terms:** Head and neck neoplasms. Mouth. Radiotherapy.

### RESUMO

#### Objetivo

Avaliar a capacidade de abertura bucal de pacientes submetidos a tratamento radioterápico de cabeça e as variáveis relacionadas à sua limitação.

#### Métodos

Foram analisados 32 pacientes seis meses após o término das sessões de radioterapia para tratamento de câncer em região de cabeça e pescoço. A medida da abertura bucal máxima foi aferida por meio de um paquímetro digital e sua associação com as variáveis sexo, idade, tabagismo, etilismo, localização do tumor, realização de quimioterapia e cirurgia foram analisadas com os testes U de Mann-Whitney e Kruskal-Wallis no nível de significância de 95%.

#### Resultados

A idade média dos pacientes foi de 60,44 anos; 87,5% eram do sexo masculino; 81,2% eram tabagistas; 65,6% eram etilistas. A média de abertura bucal foi de 43,17mm e sete pacientes (21,9%) apresentavam trismo. As localizações mais frequentes dos tumores foi a língua (31,3%), seguida da laringe e da prega vocal com cinco (15,6%) cada uma. Não foi encontrada associação entre a limitação de abertura bucal e as variáveis estudadas.

#### Conclusão

Na amostra estudada, 21,9% dos pacientes apresentaram trismo seis meses após o término do tratamento radioterápico. As variáveis sexo, hábitos de etilismo e tabagismo, localização do tumor, cirurgia prévia e quimioterapia adjuvante não estiveram associados à limitação de abertura bucal.

**Termos de indexação:** Neoplasias de cabeça e pescoço. Boca. Radioterapia.

<sup>1</sup> Universidade de Cuiabá, Faculdade de Odontologia. Av. Beira Rio, 3048, 78025-190, Cuiabá, MT, Brasil. Correspondência para / Correspondence to: RS CAETANO. E-mail: <rafael\_scaetano@hotmail.com>.

<sup>2</sup> Hospital de Câncer de Mato Grosso. Cuiabá, MT, Brasil.

## INTRODUCTION

Amongst the malign neoplasms of the head and neck, tumors occurring in the oral cavity account for 40% of cases, followed by those of the larynx (25%) and pharynx (15%). The remaining neoplasms are located in the saliva and thyroid glands<sup>1</sup>.

Radiotherapy is a mode of treatment that is often used for malign neoplasms of the head and neck and has a significant cure rate, although it is associated with various oral complications<sup>2</sup>.

The chewing muscles or the temporomandibular joint (TMJ), when they are enclosed in a radiation field, may lead to the formation of tissue fibrosis, muscle spasms and restricted mouth opening, or trismus<sup>3</sup>.

Trismus manifests itself slowly and can evolve into an inability to open the mouth and prevent normal function<sup>4</sup>, harming an individual's quality of life as it hampers the proper digestion of food, chewing and oral hygiene. Trismus also makes dental treatment extremely difficult<sup>5-6</sup>.

Thus, the aim of the present study was to evaluate, in a subpopulation, the mouth-opening ability of patients subjected to radiotherapy treatment in the area of the head and neck.

## METHODS

In order to carry out this study, a convenience sample was employed consisting of 32 patients subjected to radiotherapy treatment in the area of the head and neck, both with and without associated chemotherapy and surgery, between the months of January and June 2012. The patients were selected by undergoing a pre-radiotherapy oral examination in the Dental Department of the Mato Grosso Cancer Hospital (known locally as the DOHC), all of whom gave their consent by signing a Free and Informed Consent form.

The patient analyses were performed, by a single researcher, six months after the conclusion of the radiotherapy sessions. During the evaluation, data were

collected in respect of age, the social habits of smoking and alcohol consumption, tumor location, performance of adjunctive treatment (chemotherapy and/or surgery) and the measurement of the mouth opening.

The mouth opening capacity was checked using digital calipers (Pantec - São Paulo, Brazil). In those patients who still have their teeth, the distance was measured between the incisal edge of the upper and lower incisors (11, 41); patients with an edentulous lower arch and without the use of a prosthesis, the distance between the incisal edge of tooth 11 and the lower alveolar ridge (region of tooth 41); patients with an edentulous upper arch and without the use of a prosthesis, the distance between the incisal edge of tooth 41 and the alveolar ridge (region of tooth 11); edentulous patients using prostheses, the distance between the upper and lower dentures was measured, or if the patient had no prosthesis, the maximum distance between the two alveolar ridges (location of teeth 11 and 41) was measured, as described by Dijkstra et al.<sup>7</sup> A patient was deemed to be suffering from trismus when his/her maximum mouth opening was less than 35 mm<sup>7</sup>.

The data were stored using Microsoft Excel and the subsequent statistical analysis was conducted using the IBM SPSS 20.0 software application. The Mann-Whitney U test was used to analyze two independent samples. For the analysis of more than two samples, the Kruskal-Wallis test was applied. The level of significance employed was 95%.

The research project was approved by the Research Ethics Committee at the University of Cuiabá (UNIC), Cuiabá, Mato Grosso, Brazil, opinion no. 378.314.

## RESULTS

The mean age of the volunteers was 60.44 years ( $\pm 10.84$ ), the minimum age being 43 and maximum 82 years. Of the volunteers, 28 (87.5%) were male, 26 (81.3%) were smokers and 21 (65.6%) were regular consumers of alcohol. Seven (21.9%) of the 32 patients analyzed presented with trismus (Table 1).

**Table 1.** Distribution of patients evaluated according to the variables of sex, alcohol and smoking habits and the presence of trismus. Cuiabá (MT), 2014.

Variables	n (%)
<b>Sex</b>	
Female	4 (12.5)
Male	28 (87.5)
<b>Variables</b>	
<b>Alcohol Consumption</b>	
Yes	21 (65.6)
No	11 (34.4)
<b>Smoking</b>	
Yes	26 (81.2)
No	6 (18.8)
<b>Trismus</b>	
Yes	7 (21.9)
No	25 (78.1)

With regard to the location of the tumor, the region most affected was the tongue, with 10 cases (31.3%), followed by the larynx and the vocal fold, each with 5 (15.6%) (Table 2).

**Table 2.** Distribution of patients according to tumor location. Cuiabá (MT), 2014.

Tumor location	n (%)
Floor of mouth	1 (3.1)
Pharynx	2 (6.3)
Larynx	5 (15.6)
Tongue	10 (31.3)
Ear	2 (6.3)
Palate	2 (6.3)
Tonsillar pillar	1 (3.1)
Vocal fold	5 (15.6)
Gingival margin	1 (3.1)
Thyroid	1 (3.1)
Not identified	2 (6.3)
<b>Total</b>	<b>32 (100)</b>

The average mouth opening of the patients was 43.17 mm ( $\pm 12.17$ ). In a comparison of the mouth opening of the patients by sex, alcohol and smoking habits, tumor location and adjunctive treatment with surgery or chemotherapy, no statistical difference was found between the groups (Table 3).

**Table 3.** Analysis of the mouth opening of patients by sex, alcohol and smoking habits and tumor location. Cuiabá (MT), 2014.

Variable	Mouth opening (mm)		P
	Average	Standard deviation	
<b>Sex</b>			0.120
Male	44.09	12.45	
Female	36.75	8.54	
<b>Alcohol Consumption</b>			0.907
Yes	43.43	12.44	
No	42.68	12.23	
<b>Smoking</b>			0.285
Yes	42.30	13.01	
No	46.94	7.18	
<b>Tumor location</b>			0.381
Floor of mouth	46.00	-	
Pharynx	20.00	18.38	
Larynx	46.30	10.34	
Tongue	42.00	12.83	
Ear	52.75	2.47	
Palate	39.25	2.47	
Tonsillar pillar	46.00	-	
Vocal fold	49.38	11.77	
Gingival margin	34.00	-	
Thyroid	52.15	-	
Not identified	40.50	6.36	
<b>Chemotherapy</b>			0.063
Yes	40.95	12.49	
No	49.79	10.55	
<b>Surgery</b>			0.373
Yes	41.28	13.13	
No	46.75	10.66	

NB. The Mann-Whitney U test was used to analyze the variables of sex, alcohol consumption and smoking. The Kruskal-Wallis test was used for the location of the tumor.

## DISCUSSION

As found in other studies, the mean age of the sample was over 60 years<sup>5,8-10</sup>, the dominant sex is male and the location most affected by tumors is the tongue<sup>5,7-8</sup>.

With regard to social habits, around 81.3% of patients declared themselves to be smokers while 65.6% were regular alcohol drinkers. The study conducted by Bragante et al.<sup>9</sup> obtained a sample of 26 volunteers in which 100% were smokers and 73.1% stated they were regular alcohol drinkers, with results close to those obtained in this study.

The average mouth opening of the patients analyzed was 43.17 mm ( $\pm 12.17$ ), close to that observed by Jager-Wittenaar et al.<sup>5</sup>, in a study that analyzed the mouth opening of 120 patients (40.1 mm  $\pm 11.5$ ), and far higher than that found by Scott et al.<sup>10</sup>, in a study which analyzed the mouth opening of 100 patients, observing an average mouth opening of 32 mm.

Seven (21.9%) of the thirty-two participants in this study presented with trismus. This percentage is considered high, more than one fifth of the patients, although it is less than that found by Lee et al.<sup>11</sup>, where 79% of patients had trismus six months after the conclusion of radiotherapy, and

by Pauli et al.<sup>12</sup>, where 38% of the 75 patients presented with trismus.

In the study by Lee et al.<sup>11</sup> it was noted that patients who were regular consumers of alcohol have a lower chance of the occurrence of restricted mouth opening, possibly due to the intoxication which could reduce the sensation of pain during movement of the jaw, leading to a wider opening of the mouth than amongst those who do not use alcohol. In the present study, there was no statistical difference between mouth opening patients who were drinkers compared with those who did not drink.

In this study, the adjunctive treatments, such as chemotherapy and surgery, had no influence on the mouth opening of the volunteers, just as with the study by Lindblom et al.<sup>13</sup> which showed no connection between surgery and mouth opening limitations. With regard to chemotherapy, Bragante et al.<sup>9</sup> noted no variation in mouth opening measurements.

Despite the fact that this study did not find any statistical differences in patients with and without trismus, it is important to stress that more than one fifth of patients who underwent radiotherapy in the region of the head and neck still presented with limited mouth opening six months after the conclusion of treatment, similar to the study by Jager-Wittenaar et al.<sup>5</sup> who found no significant difference in the maximum mouth opening in patients with or without trismus.

Santos et al.<sup>14</sup> underline the importance of the dental surgeon in minimizing or even avoiding these alterations, thereby providing the individual with a better quality of life, given that not only trismus but also other reactions caused by radiotherapy may be prejudicial to the patient.

Epstein et al.<sup>15</sup> stress that active/passive exercises should be commenced after surgery and radiotherapy in the region of the head and neck, when the muscles responsible for the movement of the lower jaw lie within the radiation field, as once a limitation on mouth opening is

established, mobility is impaired. According to Ren et al.<sup>16</sup>, the TheraBite®, a tool used for mouth opening exercises, may be employed, or even other simple devices such as tongue depressors and corkscrews that are used in clinical practice to help with mouth opening.

## **CONCLUSION**

In the sample studied, 21.9% of patients presented with a maximum mouth opening of less than 35 mm six months after the conclusion of radiotherapy treatment. The variables of sex, drinking and smoking habits, tumor location, previous surgery and adjunctive chemotherapy were not associated with mouth opening limitations.

## **Acknowledgements**

We would like to thank the Mato Grosso State Research Foundation (FAPEMAT) for the financial assistance given to the project under Process no. 156662/2014.

## **Collaborators**

RS CAETANO took part in the collection of research data, the bibliographical survey and composition of the manuscript. PG CASTRO took part in the patient selection, collection of research data, the bibliographical survey and the composition of the manuscript. PHS CASTRO coordinated and participated in the performance of the study, the bibliographical survey, critical intelligence review of the manuscript and composition of the article. AM BORBA participated in the data analysis and interpretation, critical intelligence review of the manuscript and composition of the article. AH Borges took part in the study's conception and operational planning, critical intelligence review of the manuscript and the composition of the article. LER VOLPATO took part in the study's conception, planning and data interpretation as well as the composition of the article.

## **REFERENCES**

1. Dobrossy L. Epidemiology of head and neck cancer: magnitude of the problem. *Cancer Metastasis Rev.* 2005;24(1):9-17.
2. Tolentino ES, Centurion BS, Ferreira LHC, Souza AP, Damante JH, Rubira-Bullen IRF. Oral adverse effects of head and neck radiotherapy: literature review and suggestion of a clinical oral care guideline for irradiated patients. *J Appl Oral Sci.* 2011;19(5):448-54. doi: 10.1590/S1678-77572011000500003
3. Goldstein M, Maxymiw WG, Cummings BJ, Wood RE. The effects of antitumor irradiation on mandibular opening and mobility: a prospective study of 58 patients. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 1999;88(3):365-73. doi: 10.1016/S1079-2104(99)70044-2
4. Sciubba JJ, Goldenberg D. Oral complications of radiotherapy. *Lancet Oncol.* 2006;7(2):175-83.
5. Jager-Wittenaar H, Dijkstra PU, Vissink A, van Oort RP, Roodenburg JL. Variation in repeated mouth-opening measurements in head and neck cancer patients with and

- without trismus. *Int J Oral Maxillofac Surg.* 2009;38(1):26-30. doi: 10.1016/j.ijom.2008.10.001
6. Flores JA, Machado E, Machado P, Flores FW, Mezomo MB. Avaliação da presença de trismo em pacientes submetidos à exodontias de terceiros molares. *RGO, Rev Gaúch Odontol.* 2007;55(1):17-22.
  7. Dijkstra PU, Huisman PM, Roodenburg JL. Criteria for trismus in head and neck oncology. *Int J Oral Maxillofac Surg.* 2006;35(4):337-42. doi: 10.1016/j.ijom.2005.08.001.
  8. Wetzels JW, Merckx MA, de Haan AF, Koole R, Speksnijder CM. Maximum mouth opening and trismus in 143 patients treated for oral cancer: A 1-year prospective study. *Head Neck.* 2014;36(12):1754-62. doi: 10.1002/hed.23534
  9. Bragante KC, Nascimento DM, Motta NW. Avaliação dos efeitos agudos da radioterapia sobre os movimentos mandibulares de pacientes com câncer de cabeça e pescoço. *Rev Bras Fisioter.* 2012;16(2):141-7.
  10. Scott B, Butterworth C, Lowe D, Rogers SN. Factors associated with restricted mouth opening and its relationship to health-related quality of life in patients attending a maxillofacial oncology clinic. *Oral Oncol.* 2008;44(5):430-8. doi: 10.1016/j.oraloncology.2007.06.015
  11. Lee R, Slevin N, Musgrove B, Swindell R, Molassiotis A. Prediction of post-treatment trismus in head and neck cancer patients. *Br J Oral Maxillofac Surg.* 2012;50(4):328-32. doi: 10.1016/j.bjoms.2011.06.009
  12. Pauli N, Johnson J, Finizia C, Andréll P. The incidence of trismus and long-term impact on health-related quality of life in patients with head and neck cancer. *Acta Oncol.* 2013;52(6):1137-45. doi: 10.3109/0284186X.2012.744466
  13. Lindblom U, Gärskog O, Kjellén E, Laurell G, Levring Jäghagen E, Wahlberg P, et al. Radiation-induced trismus in the ARTSCAN head and neck trial. *Acta Oncol.* 2014;53(5):620-7. doi: 10.3109/0284186X.2014.892209
  14. Santos MG, Silva LCF, Lins CA, Passos DD, Oliveira Neto JN, Santos TS. Fatores de risco em radioterapia de cabeça e pescoço. *RGO, Rev Gaucha Odontol.* 2010;58(2):191-6.
  15. Epstein JB, Thariat J, Bensadoun R, Barasch A, Murphy BA, Kolnick L, et al. Oral complications of cancer and cancer therapy: from cancer treatment to survivorship. *CA Cancer J Clin.* 2012;62(6):400-22. doi: 10.3322/caac.21157
  16. Ren WG, Ao HW, Lin Q, Xu ZG, Zhang B. Efficacy of mouth opening exercises in treating trismus after maxillectomy. *Chin Med J (Engl).* 2013;126(14):2666-9.

Received on: 19/11/2014

Final version resubmitted on: 23/9/2015

Approved on: 18/11/2015