

A mobilization regimen to prevent mandibular hypomobility in irradiated patients: An analysis and comparison of two techniques

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ABSTRACT

Radiotherapy, when used in head and neck cancer treatment, can produce side effects in the patients, such as decreased salivary production, xerostomia, opportunistic infections, radiation caries, dysphagia, local discomfort and the limitation of mouth opening. The aim of this study was to evaluate the amplitude of mouth opening in patients before and immediately after the completion of radiotherapy, comparing the effectiveness of two physiotherapy exercises. The irradiated sites included the masticatory muscles. The results demonstrated that there were no statistically significant differences between the two instituted exercises; however there was a trend towards better clinical results in group 2. The amplitude of mouth opening showed a trend towards reduction, but this was not statistically significant. When the pterygoid and sternocleidomastoid muscles were included in the irradiated field, patients were observed to have more morbidity. This indicates the great importance of these muscles in mouth opening. Based on the results obtained within this study, it is not possible to conclude that physiotherapy exercises are efficacious in preventing trismus. Future longitudinal studies are required to verify the onset of trismus in radiotherapy patients.

Key words: Radiotherapy, trismus, physiotherapy.

INTRODUCTION

Cancer is a disease with a high morbidity rate, and it represents the second largest cause of death in Brazil. The oral cancer statistics in the world show an incidence lesser than 5%, from that 90% of oral carcinoma are squamous cell carcinoma. The typical oral carcinoma patient is a Caucasian male, in the 6th or 7th decade of life (1). Oral and oropharyngeal carcinomas represent 3% of all cancers in men and 2% in women (2). A study performed in a dental school in Porto Alegre-RS, Brazil, showed that malignant oral tumors represent 17.81% of all diagnosed tumors. Squamous cell carcinoma was the predominant diagnosis with the gingiva as the most common site of occurrence (3).

Surgery, radiotherapy and chemotherapy are therapeutic modalities used in the treatment of oral cancer. They can be used in isolation or in combination (1). The therapeutic regimen chosen is based upon the anatomic site, diagnosis, histology, clinical staging and the patient's physical condition (4-6).

The tumors that show a better response to radiotherapy are the small ones, exophytic lesions, and the ones with good vascularization and oxygenation (7). The appropriate radiation dose for cancer therapy is based on localization and the specific type of malignancy. It can be used alone or in combination with other therapies.

Complications due to radiotherapy are related to dose,

frequency, and the site exposed to radiation. Intraosseous lesions are more radioresistant. The larger the volume irradiated tissue, the greater the number of complications. These complications also increase as the dose increases; it is for this reason that dose fragmentations used, submitting the patient to smaller doses for a longer treatment period (8). In tissues where cellular proliferation is slow, the effect of dose fragmentation is smaller than in tissues where it doesn't occur. Thus, using fractionated radiation it's possible to magnify the differences between the response in normal and tumoral tissue (9).

The damage to normal tissue within the irradiated field presents a unique challenge in the head and neck region, because of the anatomic complexity formed by many tissues that react differently to radiation. Acute complications are observed in the oral mucosa, salivary glands, taste buds and skin, late complications can occur in all tissues (10).

Trismus, or limited mouth opening, can be caused by tumor infiltration into the masticatory muscles and/or temporo-mandibular joint dysfunction (TMD). It also can be a result of radiotherapy treatment where the masticatory muscles or temporo-mandibular joint (TMJ) are in the field of radiation. It can be a combination of both situations (10,11).

Following radiotherapy it is estimated that 17 to 41% of patients will present with significantly limited mouth opening (12). According Dijkstra (13), the prevalence of trismus after head and neck radiotherapy ranges from 5% to 38%.

To Ichimura (14), the frequency and the seriousness of this condition is dubiety, usually happening, from 3 to 6 months after the ending of radiotherapy, became a problem for the patient's rest of life. Engelmeier (7) and Whitmyer (15) support the idea that the opening mouth limitation may occur in the course of radiotherapy and, maybe this movement restriction is due to stiffening of the epidermal and dermal layers.

MATERIALS AND METHODS

In this investigation, the study population consisted of both male and female adults with a diagnosis of head and neck malignancy and treated with radiotherapy at the Radiotherapy Service at Santa Rita Hospital from Santa Casa de Misericórdia of Porto Alegre.

To be included in this study, the patient must have had one or more masticatory muscles in the irradiated field. Patients with clinical conditions that may have confounded results were identified and excluded. These consisted of previous radiotherapy, previous surgery to remove the tumor, physical incapacity to endure the treatment and refusal to join the research.

The patient was submitted to interview. A standard medical history was taken which included their general health, familiar health history and lesional history. The mouth opening of each patient was quantified by a method reported by Goldstein (16). A Boley gauge was used to measure the mouth opening in millimeters. The patients were then classified into groups according to their mandibular mobility, temporo-mandibular joint function, and presence of pain during opening, both laterally and protrusively; the presen-

ce of pain during palpation in one or more masticatory muscles, and the presence of pain in the temporo-mandibular joint using digital pressure. The patients were classified in group zero (no alteration), 1 (light alteration), 2 (moderate alteration) and 3 (severe alteration).

The measurement were always made by the same examiner. The first measurement was made one day prior to radiotherapy and the second measurement was taken on the day of the final radiotherapy session. The patients were asked to open their mouth maximally and then the measurement was taken with a Boley gauge.

The patients were systematically distributed into 3 groups; with 18 patients per group. This number was previously established by statistical analysis. One group served as a control (no exercise) and the other groups were all instructed to perform mandibular exercises to prevent trismus. One of these techniques was described by Buchbinder (17) (annex 1) and the other one is its adaptation described by Santos (18) (annex 2).

Annex 1: exercises orientation to patients (Buchbinder,1993).

Instructions - exercises buccal opening recommendations:

The exercises will have to be made 6 times to the day, looking for to always make each session in the same schedules;

- To open mouth maximum that to obtain, to count 3 seconds with open mouth and to close - to make this 10 times;

- Chin for the right side, to count 3 seconds in this position and to come back ploughs the normal position - to make this 10 times;

- chin for the left side, to count 3 seconds in this position and to come back ploughs the normal position - to make this 10 times;

- Onward chin, to count 3 seconds in this position and to come back toward the normal position - to make this 10 times.

These exercises have to be made every day while you are having radiotherapy.

Annex 2: exercises orientation to patients (Santos, 2003) (18).

Instructions - exercises buccal opening recommendations:

The exercises will always have to be carried through in the same schedule, 3 times per day, after breakfast, lunch and dinner.

- To open mouth maximum that to obtain, to count 3 seconds with open mouth and to close - to make this 5 times

- Chin for the right side, to count 3 seconds in this position and to come back toward the normal position - to make this 5 times

- Chin for the left side, to count 3 seconds in this position and to come back toward the normal position - to make this 5 times

- Onward chin, to count 3 seconds in this position and to come back toward the normal position - to make this 5 times.

Immediately after to make the exercises, chews 2 tablets of gum to chew (trydent) per 15 minutes.

These exercises have to be made every day while you are having radiotherapy.

Table 1. Clinical evolution.

Group	Mean reduction of mouth opening quantity (mm)	Clinical alterations (classification according to Goldstein) (%)			
		normal	light	moderate	severe
Control	4,94	36,8	36,8	15,8	10,5
1	3,80	16,7	50	27,8	6,8
2	1,38	44,4	50	5,6	0

Santa Rita Hospital. Porto Alegre, 2005.

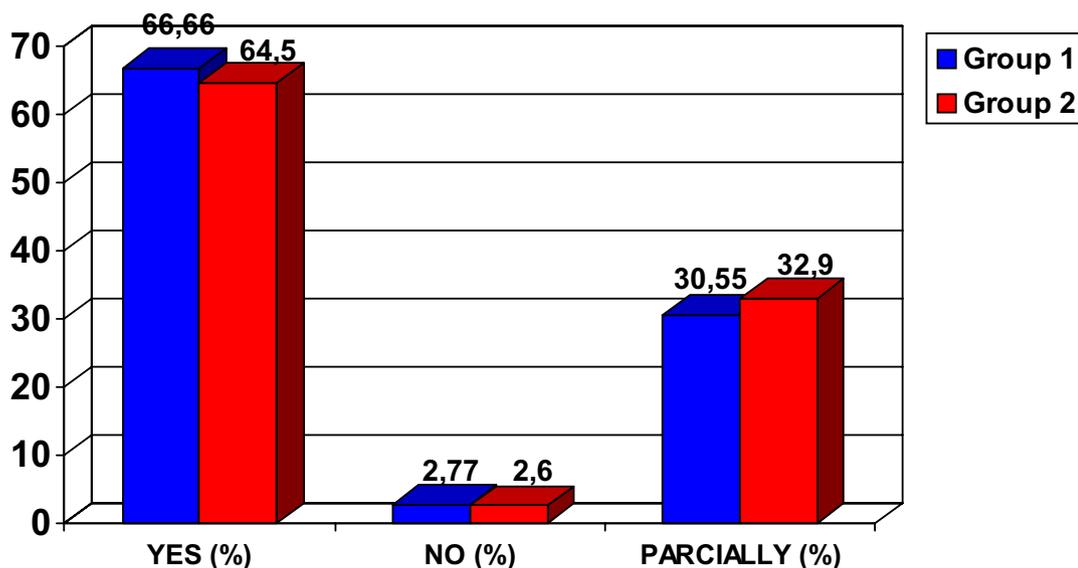


Fig. 1. Patients engagement rate for exercises. Santa Rita Hospital. Porto Alegre, 2005.

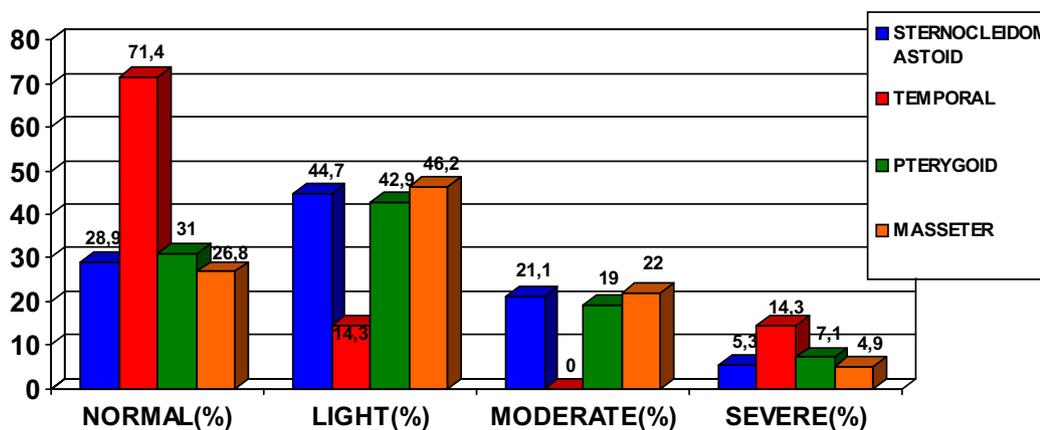


Fig. 2. Relation between clinical alteration and irradiated musculature. Santa Rita Hospital. Porto Alegre, 2005.

The results were analyzed using means, modes and median, followed by standard and punctual deviation. The Pearson test of co-relation, t-student test, analysis of variance with repeated measures, variance analysis and multiple linear regression were all performed on the data collected. The exact Fisher test was also used to cross categorical variables. Variance analysis (ANOVA) was used when it was crossed categorical and quantitative variables.

RESULTS

Patients examined in this study were divided in accordance the intention of the treatment, so 9,4% had been submitting the palliative treatment, receiving doses of 1,8 or 2 Gy/day in intervals of 20 days; and 90.6% received cure treatment, with doses of 1,8 or 2 Gy/day, that was given during a period of 35 days. The group of cure treatment had the biggest average of clinical worsen.

The patients presented with different head and neck tumors. According to their diagnoses, 61.8% were squamous cell carcinoma. The mean patient age was 57.91 years old; the youngest 15 years old and the oldest were 80 years old. Gender distribution was 76.4% men and 23.6% women. Demographically, 85.5% were Caucasian, 1.8% were Black and 12.7%, were mulatto.

The patients were also questioned about a possible family history of cancer. It was found that 56.4% had some familiar history while 43.6% were uncertain or denied any family history.

With respect to social habits, 76.4% of patients were smokers (mean: 10 cigarettes per day / 27 years). When asked about alcohol, 52.7% admitted to regular use, most of these patients drank sugar cane brandy (68.9%). Other habits such as drugs use, mate ingestion, onicophagia and bruxism were present in 65.5% of patients.

Of all the patients, 32.7% were edentulous, 23.6% were partially dentate, and 43.6% had all their natural teeth.

Table I shows the mean reduction of mouth opening and the clinical alteration of each groups of patients.

These clinical alterations are: mobility rate, temporo-mandibular joint function, pain during mandibular movement, muscular and temporo-mandibular joint pain (quantified by the method reported by Goldstein).

The patients were asked about their compliance to the prescribed exercises. The rate of compliance is shown in figure 1.

There were no statistically significant differences among the groups. No difference was detected among the groups when musculature was analysed. Figure 2 shows the relationship between clinical alterations observed and the muscles present in the radiation field.

In addition to trismus, other clinical complications due to head and neck radiotherapy were also observed. These alterations were not measured, they were noted qualitatively during physical examination. Mucositis was present in 16.4% of patients; 47.3% reported hyposalivation or xerostomia; 40% reported complete loss or reduction in taste and 9.1% presented with candidiasis.

DISCUSSION

Squamous cell carcinoma was the most frequent diagnosis among patients observed in this study, totaling 61.8% of the cases. This data is supported by INCA - Institut Nacional of Cancer (1) statistics and by others reports in the literature (2, 3, 11, 19).

The results obtained in this study, show that Caucasian men are most commonly affected by this condition. This data is corroborated by the literature (2, 3, 11, 19) and also INCA – Institut Nacional of Cancer (1). The population in the south of Brazil is mainly composed of people from European descent, which explains this observation.

Approximately 17 to 41% is an expect rate of limitation in mouth opening for patients undergoing radiotherapy (12). According to Dijkstra (13), the prevalence of trismus following radiotherapy varied between 5 to 38%. Teo (20) analyzed 159 patients that received radiotherapy to treat nasopharyngeal carcinoma and 6 months after treatment, 17 patients (10.69%) presented with trismus. This study did not obtain statistically significant results; however there was a trend suggesting that trismus was mainly present in the control group, the group that had no physiotherapy exercises. In this group there was a mean mouth opening of 4.94mm.

Trismus may not be caused only by radiation. According to Vissink (10), trismus, a limitation in mouth opening, may occur due to tumor infiltration into masticatory muscles and/or the temporo-mandibular joint, or it may be the result of radiotherapy treatment that includes masticatory muscles or temporo-mandibular joint in the radiation field or it may a combination. Other reasons leading to difficulty in mouth opening could be due to a deficiency in mucosa lubrication, leading to pain and discomfort.

This study shows that 16.4% of cases presented with mucositis, and 47.3% with hyposalivation. These conditions may give a falsely represent the real capacity of mouth opening; and thus, more investigation is necessary.

With regards to muscles in the field of radiation, there was a trend to suggest that there is a greater amount of limitation in mouth opening when the sternocleidomastoid and pterygoid muscle are involved.

According to Ichimura (14), trismus is developed only after high dose radiation in the temporo-mandibular joint and pterygoid muscles. Goldstein (16) proposed that patients may present with altered mandibular movements even if the temporo-mandibular joint and pterygoid muscles were not included in the radiation field.

This present study compared the exercises described by Buchbinder (17) and Santos (18). It was not observed statistically significant differences when it was compared the two groups of exercise or when they were compared with control group. A tendency was seen, which was not of statistical significance, to suggest that the exercises suggested by Santos (18) presented better results. The patients subjected to these exercises presented with a lower mean rate of diminished mouth opening as compared to the exercises proposed by Buchbinder (17). It is important to remember, that these exercises were not supervised and therefore were not controlled by the examiner.

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