Original Article

https://doi.org/10.1590/2317-6431-2021-2558en

Audiology Communication Research
ISSN 2317-6431

Photobiomodulation in the treatment of trismus in patients treated for oral or oropharyngeal cancer: a randomized controlled clinical trial

Fotobiomodulação no tratamento do trismo em pacientes tratados por câncer de boca ou orofaringe: um ensaio clínico controlado randomizado

Anderson Gonçalves Fernandes[1], *Aline Figueiredo de Oliveira*[1], *Renata D'Arc Scarpel*[1]

ABSTRACT

Purpose: to investigate the effectiveness of the association between low-frequency photobiomodulation and traditional speech therapy in the treatment of trismus in patients treated for oral or oropharyngeal cancer. **Methods:** controlled, randomized, longitudinal and prospective clinical trial, carried out in accordance with the norms of the CONSORT 2010 declaration. For data collection, a sociodemographic questionnaire, clinical evaluation, measurement of mouth opening by caliper, the protocol of McGuill pain and the WHOQOL-Bref quality of life protocol. The sample consisted of 30 participants, of both genders, aged between 35-75 years, divided into two groups, control and experimental, in a controlled manner, through an equal draw with regard to the inclusion and exclusion criteria. **Results:** through the analyzed data, it was observed that there was an increase in the vertical amplitude of the mandible in both groups, CG: p0.19, as well as in relation to orofacial pain and quality of life, p= 0.72, both assessments after the speech therapy intervention, however, with better results for the EG, p<0.001. **Conclusion:** It is concluded that the traditional speech therapy intervention and its association with low-frequency photobiomodulation are effective in the treatment of trismus. For orofacial pain and quality of life, associated treatment is more beneficial.

Keywords: Phototherapy; Facial pain; Trismus; Myofunctional therapy; Rehabilitation

RESUMO

Objetivos: investigar a eficácia da associação entre a fotobiomodulação de baixa frequência e a terapia fonoaudiológica tradicional no tratamento do trismo, em pacientes tratados por câncer de boca ou orofaringe. **Métodos**: ensaio clínico controlado, randomizado, longitudinal e prospectivo, realizado de acordo as normas da declaração CONSORT 2010. Para a coleta de dados, foi utilizado o questionário sociodemográfico, a avaliação clínica, a mensuração da abertura de boca por paquímetro, o protocolo de dor McGuill e o protocolo de qualidade de vida WHOQOL-Bref. A amostra foi composta por 30 participantes, de ambos os gêneros na faixa etária de 35-75 anos, divididos em dois grupos, controle e experimental, de forma controlada, mediante sorteio igualitário no que tange aos critérios de inclusão e exclusão. **Resultados**: por meio dos dados analisados, observou-se que houve aumento da amplitude vertical de mandíbula em ambos os grupos, GC: p<0,005 e GE: p<0,001. Não houve correlação estatística entre os grupos na comparação da abertura de boca, p>0,19, assim como em relação à dor orofacial e à qualidade de vida, p= 0,72, ambas as avaliações após a intervenção fonoaudiológica, porém, com melhores resultados para o GE, p<0,001. **Conclusão**: Conclui-se pela eficácia da intervenção fonoaudiológica tradicional e a associação com a fotobiomodulação de baixa frequência no tratamento do trismo. Para a dor orofacial e qualidade de vida, o tratamento associado é mais benéfico.

Palavras-chave: Fototerapia; Dor facial; Trismo; Terapia miofuncional; Reabilitação

Study carried out at Hospital Aristides Maltez – HAM, Liga Bahiana Contra o Câncer – Salvador (BA), Brasil.
[1]Universidade do Estado da Bahia – UNEB – Salvador (BA), Brasil.
Conflict of interest: No.
Authors' contribution: AGF was responsible for the study design and data collection; AFO was responsible for data collection; RDS was responsible for the study design and data collection.
Funding: None.
Corresponding author: Anderson Gonçalves Fernandes. E-mail: andgouveia.fono@gmail.com
Received: August 13, 2021; **Accepted:** June 16, 2023

INTRODUCTION

According to the National Cancer Institute (INCA), 11,200 new cases of cancer (CA) of the oral cavity in men and 4,010 new cases in women were expected for Brazil every year in the triennium 2020-2022[1]. Oral and oropharyngeal cancers are twice as frequent in men than in women, the average age of people with this diagnosis is 60 years old, and it can affect younger people, but only ¼ of them are under 55. These types of tumors usually appear on the tongue, tonsils, oropharynx, gums, and floor of the mouth. However, they can also appear on the lips, minor salivary glands, and other sites, which are less frequently diagnosed[1-3].

Tumors located in the oral cavity, close to the maxilla, mandible, cheek, oropharynx or nasopharynx, salivary glands, or ear, reinforce the presence of orofacial pain, the emergence of temporomandibular joint dysfunctions and increase the patient's risk of developing trismus[3-5]. This alteration often is not the patient's main complaint, and it ends up being underdiagnosed, even with a direct impact on functionality and, consequently, on their quality of life. It is characterized as a limitation in vertical jaw movement and can be acute or delayed. However, it is a condition that can lead to various functional difficulties and thus alter the subject's quality of life[5].

In the treatment of oral and oropharyngeal cancer, radiotherapy (RT) is widely used to control and/or cure cancer since it enables its eradication, with the attempt to preserve the function of the tissues in the affected regions. In more advanced cases, RT associated with chemotherapy (CT) and (or) surgery can be used, depending on the location and type of tumor[4-6]. During RT, non-neoplastic cells may also suffer from irradiation fields due to the treatment[6]. These side effects can be acute or appear after years and are some of the factors that cause trismus in these patients[6-8].

Low intensity photobiomodulation (LIP) is effective in treatments that aim to provide analgesia and muscle relaxation. The literature has shown positive results regarding its use in similar cases, in the area of orofacial motricity, voice, dysphagia, among others[8-12].

Laboratory studies and independent research show that using this technology in living tissue enables restorative effects and increased oxygen and blood flow[1,6,13]. A study[9] reports that patients who receive LIP dosages in the peri temporomandibular joint (TMJ) region improve in terms of muscle, joint, and bone physiological parameters, with consequent improvement in temporomandibular dysfunction (TMD), trismus and orofacial pain[10]. Through a systematic review, authors[14] report that several therapeutic models efficiently treat trismus, especially when more than one therapeutic strategy or a therapeutic resource associated with traditional exercises is inserted[11].

Therefore, the need for further studies on the subject is evident, comparing the effects of LIP with what is already used as the gold standard in orofacial myofunctional rehabilitation, kinesiotherapy[5,14]. However, the present study aimed to investigate the efficacy of the association between low intensity photobiomodulation and conventional speech therapy intervention in treating trismus in patients with oral or oropharyngeal cancer.

METHODS

A randomized controlled clinical trial was developed following the CONSORT 2010 (Consolidated Standards of Reporting Trials)[15] statement, approved by the Human Research Ethics Committee of Hospital Aristides Maltez - CEP/HAM - Liga Bahiana Contra o Câncer, under CAEE number: 04083518.0.0000.0050 and opinion 3.291.270. The sample consisted of two groups: the control group - GC, which received only traditional therapy, and the experimental group - GE, which underwent the conventional therapy process associated with LIP.

For the GE, the sample was calculated according to the prevalence of patients with oral and oropharyngeal cancer at the HAM, as follows: p = 300; 10% of p = N = 30 patients. The diagnosis of trismus occurred in stages, consisting of a screening during cancer treatment, followed by a multi-professional evaluation with the head and neck surgeon, dental surgeon, and speech therapist one day after the end of the treatment of cancer therapeutic modalities.

Considering that this is a randomized, controlled, superiority trial, a 95% confidence interval (IC) was estimated for both groups, a power of 80%, a sample size ratio of the group to 1, and a between-group difference of 0.4.

Thirty individuals aged between 34 and 75 participated, 19 males and 11 females. Among the participants, six of the CG and five of the EG died. For these, the lowest satisfactory performance value of the group to which the participant belonged was considered, as he did not complete the rehabilitation program. Figure 1 shows the study flowchart.

The inclusion criteria applied were: patients undergoing treatment at HAM for oral or oropharyngeal cancer, followed up by the Head and Neck and Speech Therapy Services of the institution during the years 2018-2019; diagnosed with trismus post-immediately at the end of the therapeutic modalities for cancer treatment; over 18 years of age; signed the Informed Consent Form (ICF). Patients with a history of other diseases that could be associated with trismus, such as neurological impairment and TMD, and patients with a history of cancer from other regions of the head and neck who had undergone radiotherapy were excluded.

Data were collected from January 9 to December 11, 2019. Before inclusion, the pre-selected people were invited to participate in the study and sign the ICF. Subsequently, anamnesis was collected, collecting personal and demographic data and applying the McGill pain questionnaire, Brazilian version[10]. The clinical evaluation protocol was applied, consisting of measuring the vertical movement of the mandible, using a plastic analog caliper, to evaluate and monitor the amplitude of mouth opening in the participants, before and after speech therapy, of the extremities, of the upper central incisor dental element and the lower central incisor. When this was not possible due to the lack of a dental element, the upper and lower lateral incisors or the alveolar ridge in the central incisor position were used.

To assess the quality of life and orofacial pain, the WHOQOL-bref (World Health Organization Quality of Life-bref) and McGuill[13,16] protocols were used, applied in the form of an interview, to standardize the evaluation due to the limited literacy of some participants. One of the researchers conducted the entire evaluation process before and after the speech therapy intervention, which did not allow for blindness due to the limitation of professionals participating in the research.

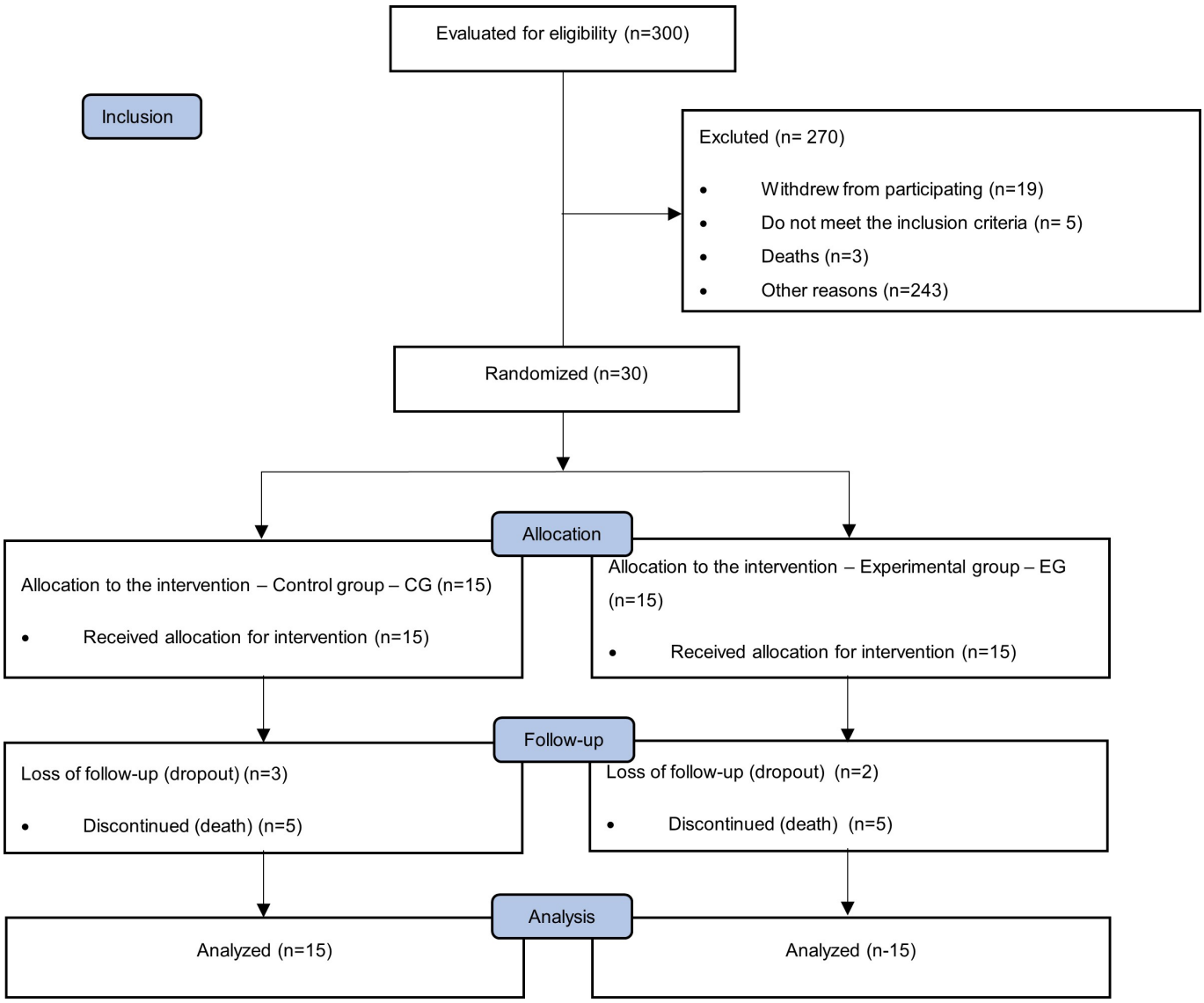

Figure 1. Flowchart of study participants
Source: own authorship

The McGuill pain protocol consists of seven questions, separated into modules: social impairment; activities of daily living; perception of the other; pain tolerance; feeling of illness; feeling of usefulness; satisfaction with life[13]. The WHOQOL-bref quality of life protocol[16], on the other hand, is an instrument in questionnaire format, with 26 questions, divided into five modules: social support; feeling and capacity for resourcefulness; activities performed in the last two weeks; personal fulfillment or satisfaction on aspects and frequency of mood; questions that can be self-assessing or require an interlocutor, in specific cases of illiteracy, motor or cognitive difficulties. The data are scored using categorical variables, and soon after, the average of the scores is calculated for the items evaluated to obtain the final result.

Only after the evaluation process were the participants randomized to the CG - N=15 or EG - N=15, using a random block draw. In the CG, the conventional speech therapy intervention was carried out with isotonic and isometric exercises, starting with mouth opening, protrusion, retraction, and lateralization of the mandible, in three series of ten repetitions for each exercise, and isometry in two 20 s holds, and three 30 s holds[5]. The exercises were prescribed verbally and in writing, with language accessible to both the patient and the companion, and for daily performance.

In the EG, a conventional speech therapy intervention was performed, the same as in the CG, associated with the LIP protocol, adapted by the authors, based on previously published clinical dental protocols[12]. The treatment applied was muscle relaxation, analgesia, and reduction of local edema. Thus, low-intensity LIP was programmed with the following protocol: 1) muscle relaxation in the masseter, temporal, lateral pterygoid muscles - red wavelength (660 nm), applied on facial muscles - with a dose of 2 J (40 mW for 20 seconds) per point; 2) local pain relief - infrared wavelength (780 or 808 nm) - with a dose of 3 J (70 mW for 30 seconds) per point, applied on the regions of the masseter, temporal muscles and around the condyle of the mandible and intra-articular; 3) lymphatic drainage - application points in the pre-auricular, mandibular

and cervical regions - infrared wavelength (780 or 808 nm), applied over the lymph nodes involved in the process, with a dose of 9 J (70 mW/s). All LIP applications were performed with a distance between the application points of approximately one centimeter, both applications using the perpendicular "contact" mode of laser application (Figure 2) [10,12].

For each group, ten appointments were performed twice a week, lasting approximately 40 to 50 minutes each, with a time interval between two and three days and a prescription for performing orofacial myofunctional exercises daily, a series of ten repetitions, and maintaining maximum mouth opening for ten seconds, three times a day.

The orofacial myofunctional exercise protocol was characterized by the following exercises: vertical movement of the mandible up to the maximum limit - ten repetitions; maintaining maximum mouth opening for ten seconds; maximum lateralization of the mandible to each side - ten repetitions; anteriorization of the mandible - ten repetitions; both exercises concerning the maximum tolerance of movement without the sensation of pain in the orofacial region. In the EG, the exercises were performed combined with the application of LIP.

The process of evaluating vertical mandibular movement was performed at the beginning and end of each session. As no agreement was found in the literature between the final evaluation day and the reassessment day, it was defined that the final evaluation would be performed after the last day of the session, with reassessment after seven days, to confirm the findings.

A team of six people carried out the rehabilitation program, two principal investigators - a Ph.D. speech therapist and another resident in oncology - and four speech therapy academic monitors - (under the supervision of the speech therapist). Both principal investigators were duly calibrated beforehand by the professional for the evaluation of the vertical movement of the mandible, performance of the exercises, with precision in the entire execution process, the time of execution and rest, timed, as well as the accuracy of the place for the application of LIP, dosimetry, and biosafety.

The LIP equipment used was the Laser Therapy XT DMC®, which emits 1 joule (J) every ten seconds. The equipment emits red and infrared light for anti-inflammatory, analgesic, and healing purposes. It has a red laser wavelength of 660 nm +-10 nm; useful red laser emitter power of 100 mW = +-20%; infrared laser wavelength of 808 nm+- 10 nm and useful infrared laser emitter power of 100 mW+- 20%; fiber diameter 600 um - data list adapted from the manufacturer's manual.

For biosafety, the measures and protocols of care were used, such as hand hygiene, the environment and the equipment of use, disposable gloves, protective glasses for the therapist and the patient, and disposable plastic film for covering the LIP equipment.

The SPSS statistical package was used for data analysis, with descriptive statistics through the values of mean and standard deviation. The results obtained had normal distribution; however, the analytical statistics were performed using absolute and relative frequency, with the parametric Student's T-test and non-parametric Mann-Whitney U test. Data imputation was conducted through an intention-to-treat protocol for patients who did not complete the intervention process for some reason, such as death or withdrawal.

RESULTS

Thirty volunteers of both genders were randomized into CG and EG (Figure 1). Of the 15 participants in the CG, nine were female, and six were male, with a mean age of 58 ±10 years. Among the participants in this group, 14 reported being former alcoholics and former smokers, 2 self-declared as belonging to socioeconomic class "D" - two to four minimum wages of family income - and 14 self-declared as belonging to socioeconomic class "E" - up to two minimum wages of family income. Of the 15 participants in the EG, 4 were female, and 11 were male, with a mean age of 55 years and a standard deviation of ±10. Eleven reported being former alcoholics and former smokers, and 1 reported that he is still both an alcoholic and a smoker. Three reported themselves as belonging to socioeconomic class "D," and 12 reported themselves as belonging to socioeconomic class "E".

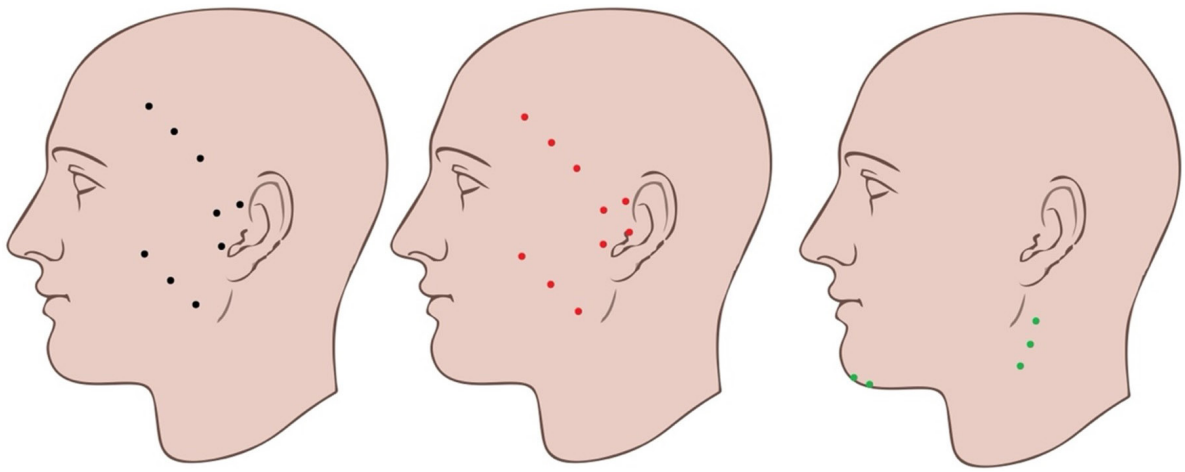

Figure 2. Models with low intensity photobiomodulation application points
Note: from left to right: local analgesia (model i); muscle relaxation (model ii); local edema (model iii).
Source: own authorship (2020)

One participant had surgery only, 6 were associated with RT and CT, and 23 combined RT and CT. The mean number of RT sessions was 37.90 ± 3.809, and CT was four cycles. All participants started therapy one day after the end of cancer treatment. Table 1 shows the types of treatment, tumor site, and TNM (Classification of Malignant Tumors) staging.

In the GC, the mean pre-treatment vertical jaw movement was 19 mm, with a minimum of 0.1 mm and a maximum of 28 mm. Post-treatment, the mean value was 25 mm, with a minimum of 0.3 and a maximum of 42 mm post-treatment, $p<0.004$. In the EG, the mean pre-treatment mandibular vertical movement measurement by pachymeter was 16 mm, with a minimum of 10 mm and a maximum of 20 mm. Post-treatment, the mean was 21 mm, with a minimum of 14 mm and a maximum of 31 mm, $p<0.001$. The comparison of these data regarding the measurement of vertical mandibular movement pre- and post-treatment between the groups is shown in Table 2, $p>0.05$.

All participants reported orofacial pain in the masseter region and difficulty opening the mouth as their main complaints. The data from the responses to the McGuill pain questionnaire are shown in Figure 3, about each sub-item of the protocol, using absolute frequencies, in which the presence of dissatisfaction was observed in most of the responses to the items evaluated in the pre-treatment and in both groups. Comparing the post-treatment, both in the CG and in the EG, it was verified that, in the EG, there was a reduction of these dissatisfactions, with more satisfactory indexes from the qualitative point of view. Still, in this regard, Figure 4 shows the analysis of section II of the McGill pain protocol - "how much pain influences activities of daily living" -referring to orofacial pain due to trismus, pre, and post-intervention, in both groups.

Table 1. Tumor site, staging and oncological treatment performed

Control Group - CG			Experimental Group - EG		
Câncer site	**Staging**	**Câncer treatment**	**Câncer site**	**Staging**	**Câncer treatment**
Left tonsil	T3N0M0	Chemotherapy and radiotherapy	Right tonsil	T3N2M0	Chemotherapy and radiotherapy
Tongue	T2N1M0	Chemotherapy and radiotherapy	Right tonsil	T2N3M0	Chemotherapy and radiotherapy
Tongue	T4N2M0	Chemotherapy and radiotherapy	Tongue	T4N2Mx	Chemotherapy and radiotherapy
Maxilla	T1N0M0	Surgery	Tongue	T3N1M0	Chemotherapy and radiotherapy
Nasophryngeal	T3N2M0	Surgery/Radiotherapy/Chemotherapy	Maxilla	T4N0M0	Chemotherapy and radiotherapy
Nasophryngeal	T4N2M0	Chemotherapy and radiotherapy	Maxilla	T4N0M0	Chemotherapy and radiotherapy
Oropharyngeal	T4AN2AM0	Chemotherapy and radiotherapy	Maxilla	T4N2M0	Surgery/Radiotherapy/Chemotherapy
Oropharyngeal	T2N1M0	Chemotherapy and radiotherapy	Nasophryngeal	T3N2M0	Chemotherapy and radiotherapy
Oropharyngeal	T3N2M0	Chemotherapy and radiotherapy	Oropharyngeal	T3N1M0	Chemotherapy and radiotherapy
Oropharyngeal	T4N2M0	Chemotherapy and radiotherapy	Oropharyngeal	T4N2M0	Chemotherapy and radiotherapy
Oropharyngeal	T3N2M0	Chemotherapy and radiotherapy	Oropharyngeal	T4N2M0	Chemotherapy and radiotherapy
Oropharyngeal	T3N2M0	Surgery/Radiotherapy/Chemotherapy	Oropharyngeal	T4N2M0	Surgery/Radiotherapy/Chemotherapy
Oropharyngeal	T3N0M0	Surgery/Radiotherapy/Chemotherapy	Oropharyngeal	T4N2M0	Surgery/Radiotherapy/Chemotherapy
Oropharyngeal	T3N0M0	Chemotherapy and radiotherapy	Rhinopharyngeal	T4N0M0	Chemotherapy and radiotherapy
Oropharyngeal	T3NxMx	Chemotherapy and radiotherapy	Rhinopharyngeal	T4N2M0	Chemotherapy and radiotherapy

Table 2. Measurements of the range of vertical movement of the mandible pre and post-intervention in both groups studied

Control Group – CG (p value 0,004)		Experimental Group – EG (p value 0,001)	
Measurement with caliper (mm)			
Pre-treatment	**After-treatment**	**Pre-treatment**	**After-treatment**
20	36	10	22
18	18	20	20
0.1	0.3	0.9	14
28	42	15	23
0.1	0.3	0.9	23
28	40	0.9	20
0.1	0.3	14	21
10	10	10	14
12	12	20	31
20	23	19	22
0.1	0.3	0.9	22
20	23	0.9	31
0.1	0.3	14	22
25	32	30	22
28	32	0.9	22

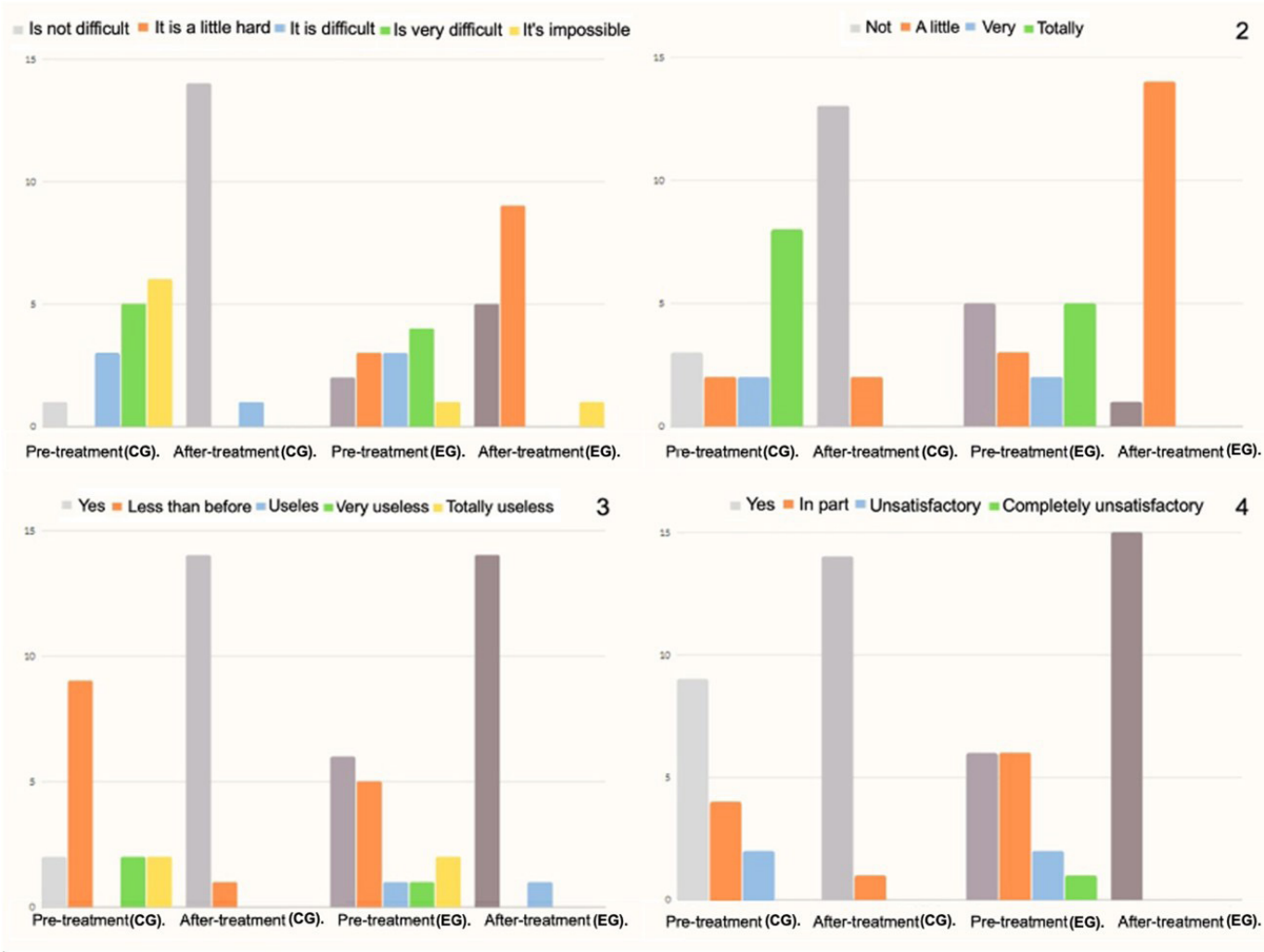

Figure 3. Absolute frequency responses to the sub-items of the McGuill pain protocol between the control group and the experimental group
Legend: Image 1 = item "Tolerate pain"; 2 = "Do you feel sick?"; 3 = "Do you feel useful?" 4 = "Is your life satisfying?" CG = control group; EG = experimental group

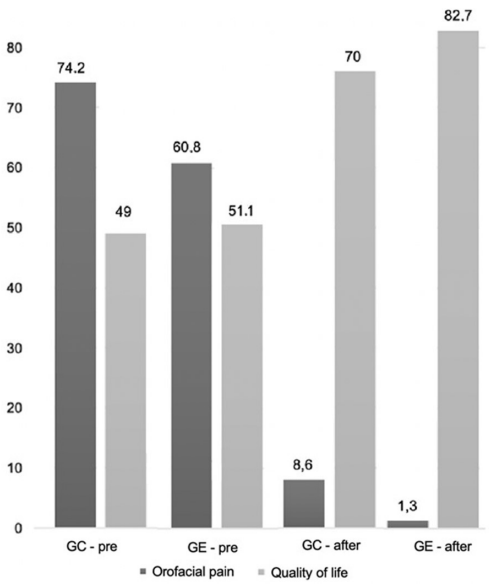

Figure 4. Distribution of data in relative frequency on orofacial pain and quality of life, during the pre- and post-treatment performed, by group
Legend: CG = control group; EG = experimental group

Table 3 shows the results regarding quality of life investigated by the WHOQOL-bref protocol - domains I, II, III, and IV, pre- and post-intervention, in both groups. When analyzing the post-intervention between the groups, there were better results for the orofacial pain factor for the EG, with a p value of 0.023. In the post-intervention analysis. In comparing the items related to pain and quality of life, the value of $p>0.05$ was found without statistical significance; however, with positive clinical results in both groups and better in the EG. In the CG, the Mann-Whitney test showed that there was a difference between orofacial pain and quality of life, $U= 6405.5$; $p<0.001$.

Overall, orofacial pain had a more significant impact than quality of life, with a median of orofacial pain: 45 and quality of life: 70.8. In the EG, the Mann-Whitney test also showed that there was a difference between orofacial pain and quality of life, $U= 7902.5$ and $p<0.001$. In this group, orofacial pain had less impact than the quality of life, with a median of orofacial pain: 20 and quality of life: 70. Comparing the medians, it was observed that, in the CG, orofacial pain had a more significant impact than in the EG and the quality of life presented similar values, $p>0.05$.

Table 3. Distribution of data, by domain, of the WHOQOL-bref quality of life protocol, pre- and post-treatment performed, by treatment group

	Average	Standard deviation	Minimum	Maximum	Percentiles - 25%	50%	75%	100%
Pre-treatment	50.33	12.06	31.6	50.33	41.5	48.5	54.3	71.6
After-treatment	78.92	13.04	43	78.92	77.2	77.2	80.1	100
Pre-treatment	69.01	16.2	43.4	69.01	58.4	73.4	77	96.8
After-treatment	86.28	5.92	83.4	86.28	83.4	83.4	83.4	100
Pre-treatment	58.26	23.8	20	58.26	46.8	60	73.4	100
After-treatment	73.34	17.05	60	73.34	60	60	90.1	100
Pre-treatment	63.41	10.51	35	63.4	58.7	65	70.8	77.4
After-treatment	70.36	17.4	55	70.36	55	55	85.1	100
Pre-treatment	51.1	13.9	31.6	74.4	40	48.6	58.6	74.4
After-treatment	76.66	12.52	40	100	76	76	76.6	100
Pre-treatment	65.17	17.32	33.4	93.4	54.2	66.8	78.4	93.4
After-treatment	78.68	11.54	70	100	70	70	88.4	100
Pre-treatment	64.93	17.62	33.4	100	56.7	60	76.7	100
After-treatment	84.01	8	73.4	100	80	80	86.7	100
Pre-treatment	64.16	15.69	35	87.6	51.2	65	77.4	87.6
After-treatment	68.9	16.4	57.6	100	57.6	57.6	81.3	100

DISCUSSION

The results of this research showed that the tumor site, staging, and treatment performed are factors that may impact in different ways the values of the amplitude of vertical movement of the mandible; authors[11,17,18] correlate these findings in patients with oral and oropharyngeal cancer with the risk of developing trismus associated with factors such as pain and quality of life[11,16-21].

It was noted that the treatment modality through surgery with facial reconstruction presented, as a sequel, limitation in orofacial movements, such as the transfer of soft tissues, which impacted on hypomimia, even though it was the treatment modality with less aggression to cells without tumor. Even so, these patients presented limitations in the vertical mandibular range of motion. A study[22] found that of the 15 patients who developed trismus, 14 had received free flap reconstruction, which suggests that undergoing this process may increase the risk of trismus.

Statistical significance was observed pre and post-intervention when comparing the patients in each group. However, in terms of vertical jaw movement, the measurement in the EG obtained better scores, a factor that can be linked to issues such as non-reliable adherence to the proposed rehabilitation program, with the execution of the exercises as prescribed by the speech therapist; psychosocial relationship involved in the illness process, such as issues that go beyond the limits of speech therapy follow-up[3,18-21].

In terms of quality of life, it was found that the EG obtained better indices in the control of the impact of orofacial pain associated with factors that boost the quality of life in the evaluated aspects, data that can be linked to what the literature already describes about the benefits of LIP, which provides analgesia, edema reduction, anti-inflammatory and antibacterial effect[4,8,9,23]. In the comparison between the groups, it was evident that both improved the aspects of orofacial pain and quality of life. It is noteworthy that the difference between the values of these aspects showed greater efficacy in the EG, that is, the patients had a better performance in the analgesia process and in the quality of life compared to the CG[10-12,21].

It was noticed that the highest prevalence of trismus was among patients who received RT with or without CT, as compared with patients undergoing surgery. A study[20] has found the same findings and added that, generally, this result is due to a larger and more extensive field of fibrosis, due to prolonged inflammatory responses, angiogenesis, and prolonged and increased expression of extracellular matrix components, which is in agreement with the data of the present study[20].

Authors[24,25] associate trismus with alterations in stomatognathic functions, considering that once one or more functions are compromised, there is disharmony in the whole system, such as difficulty in chewing and speaking, besides the impossibility of appropriate oral hygiene. It should be emphasized that, depending on the limitation in the mouth opening, the head and neck surgeon or dentist's follow-up to detect a possible cancer recurrence is impaired[21].

Studies have reported that changes in dental conditions and difficulty in chewing can lead to malnutrition and lack of energy, chronic periodontal disease, and even damage to dental integrity, with a risk of osteoradionecrosis of the jaw, which affects the patient's quality of life. These clinical and psychosocial factors, associated with others, were evident in the responses to the orofacial pain and quality of life questionnaires[12,16,17,19-21]. These patients also suffered from a lack of intimacy due to limited orofacial muscle movements, low self-esteem, and depression, as well as reported altered body image, generating seclusion and stigma due to post-treatment physical appearance. Other authors also found increased social isolation and reduced quality of life due to communication difficulties[18,21].

It is worth noting that the incidence of cancer was higher in male patients, and this data was in line with those referred to by INCA for the 2020-2022 triennium[1]. Other data presented by INCA, related to the subjects' lifestyle, were also in line with the findings of this research, in which almost all participants are or have been alcoholics and smokers, two significant factors in the cause of cancers around the world. Notably, the low-income population is more vulnerable to practicing this type of drug use, either as a recreational form or as an addiction [1,2,4,5].

Most participants had tumor staging between T3 and T4, and evidence indicates that patients with such stage are more likely to develop trismus[19,26]. A study[26] highlights more significant functional impacts in patients with higher tumor staging. Other authors have also reported that, in cases of advanced tumors, the treatment tends to be more aggressive, involving combined therapeutic modalities, the most recurrent being postoperative RT and (or) associated with CT, which can compromise the quality of life[21]. Patients with T4 staging are candidates only for palliative care and not for treatments aimed at tumor remission. In clinical practice, with the increasing advancement of technology, it is already noticeable that these patients have lived longer and with better quality of life after oncologic treatment[2,5,7,21,25].

Authors of a study[27] have found that the masseter and medial pterygoid muscles, when submitted to high doses of RT, suffer from toxicity and are strongly associated with mouth opening < 35 mm. They found that from 40 Gy there was already a 10% risk of trismus for the masseter muscle and 64 Gy for the medial pterygoid. The authors suggest trying to limit the maximum dose, which could reduce the chance of developing toxicity, but any potential impact on tumor control should be carefully evaluated. The mean number of radiotherapy sessions was equivalent to what is already described in the literature, being a standard protocol in radiotherapy services[2,5]. Another study[7] emphasizes that the gold standard oncological treatment is the combination of two or more interventions, as in the case of RT and CT.

All the participants in the present study complained of orofacial pain and limitation in opening the oral cavity. A study[28] highlights that tumor sequelae, or those resulting from the treatment itself, remain a challenge for the entire multidisciplinary team in search of better health conditions for the patient[21]. Trismus is a sequela of the treatment and has significant repercussions on the lives of those who live with the comorbidity[2-5]. In the present study, it was observed that, in the treatment for trismus, both groups had satisfactory improvement, both with the increase in mouth opening and in aspects related to quality of life, with statistical significance.

In relation to physical issues, it was statistically significant that the greater the influence of pain, possibly the lower the quality of life of the subject. A study[18] relates the influence of orofacial pain to direct interference in the individual's quality of life[21]. Another study[8] describes that these findings do not change the fact that kinesiotherapy is the gold standard of speech rehabilitation. However, it opens possibilities to evaluate when it is necessary to add other adjuvant technologies to the treatment of patients. It is important to note that it is essential to assess each case and that the results of this study cannot be generalized to all patients undergoing treatment for trismus[5,8,18,21].

Limitations of the study include the number of participants in the sample, the lack of precision of the measurements obtained due to the use of a plastic analog caliper, and the lack of access to objective tests, such as surface electromyography, infrared thermography, among other aspects, as well as the absence of validated LIP protocols for use in the rehabilitation of trismus after CA treatment, in addition to the comparison between radiotherapy doses. Also noteworthy is the fact that the treatment was performed by several therapists, and blinding of the evaluator was not possible. It is evident the importance of further studies in the area so that the data can be compared to achieve new scientific discoveries and to promote the best possible treatment for each patient, respecting their individualities.

CONCLUSION

Both LIP and conventional speech therapy effectively improve aspects of trismus. The associated treatment is more beneficial for orofacial pain and quality of life, as it provides muscle relaxation and analgesia and facilitates lymphatic drainage.

ACKNOWLEDGEMENTS

To the Universidade do Estado da Bahia - UNEB and, in particular, to the Hospital Aristides Maltes - HAM - Liga Bahiana Contra o Câncer, and to everyone who participated directly or indirectly in this process.

REFERENCES

1. Instituto Nacional do Câncer. Estimate/2020 – Cancer Incidence in Brazil. Rio de Janeiro: Inca; 2020.
2. American Cancer Society. What are oral cavity and oropharyngeal cancers? [Internet] 2014 [citado em 2021 Ago 13]. Disponível em: https://www.cancer.org/cancer/types/oral-cavity-and-oropharyngeal-cancer/about/what-is-oral-cavity-cancer.html#:~:text=Oral%20cavity%20cancer%20starts%20in,to%20grow%20out%20of%20control.
3. Kluthcovsky ACGC, Kluthcovsky FA. O WHOQOL-bref, um instrumento para avaliar qualidade de vida: uma revisão sistemática. Rev Psiquiatr Rio Gd Sul. 2009;31(3, Suppl.):1-12. http://dx.doi.org/10.1590/S0101-81082009000400007.
4. Gonnelli FAS, Palma LF, Giordani AJ, Deboni AL, Dias RS, Segreto RA, et al. Low-level laser for mitigation of low salivary flow rate in head and neck cancer patients undergoing radiochemotherapy: a prospective longitudinal study. Photomed Laser Surg. 2016;34(8):326-30. http://dx.doi.org/10.1089/pho.2016.4104. PMid:27196626.
5. Marrafon CS, Matos LL, Simões-Zenari M, Cernea CR, Nemr K. Speech-language therapy program for mouth opening in patients with oral and oropharyngeal cancer undergoing adjuvant radiotherapy: a pilot study. CoDAS. 2018;30(2):e20160221. PMid:29694489.
6. Lima AASD, Figueiredo MAZD, Krapf SMR, Souza FRD. Salivary flow rate and pH after radiotherapy of the head and neck region. Rev Bras Cancerol. 2004;50(4):287-93. http://dx.doi.org/10.32635/2176-9745.RBC.2004v50n4.2005.
7. Rubira CMF, Devides NJ, Úbeda LT, Bortolucci AG Jr, Lauris JR, Rubira-Bullen IRF, et al. Evaluation of some oral post radiotherapy sequele in patients treated for head and neck tumors TT. Braz Oral Res. 2007;21(3):272-7. http://dx.doi.org/10.1590/S1806-83242007000300014 PMid:17710295.
8. Lisboa MV, Pinheiro ALB, dos Santos MAV, Baptista AF, de Sousa APC, Pires Valença Neto AA, et al. Influence of laser therapy and muscle relaxant on the masseter muscle under occlusal wear: an ultrastructural study. Int J Morphol. 2012;30(3):999-1006. http://dx.doi.org/10.4067/S0717-95022012000300038.
9. Elgohary HM, Elad IHM, Soliman AH, Soliman ES. Effects of ultrasound, laser and exercises on temporomandibular joint pain and trismus following head and neck cancer. annals of rehabilitation medicine. Med. 2018;42(6):846-53. PMid:30613078.
10. De Santana Santos T, Piva MR, Ribeiro MH, Antunes AA, Melo AR, Dias De Oliveira E, et al. Lasertherapy efficacy in temporomandibulardisorders: controlstudy. Rev Bras Otorrinolaringol (Engl Ed). 2010;76(3):294-9.

11. Assis TO, Soares MS, Victor MM. O uso do laser na reabilitação das desordens temporomandibulares. Fisioter Mov. 2012;25(2):453-9. http://dx.doi.org/10.1590/S0103-51502012000200023.

12. Lizarelli RFZ. Protocolos Clínicos Odontológicos: uso do laser de baixa intensidade. 2. ed. São Paulo: MMO Equipamentos Opto-eletrônicos; 2005.

13. Pimenta CA, Teixeiro MJ. Questionário de dor McGill: proposta de adaptação para a língua Portuguesa. Rev Esc Enferm USP. 1996;30(3):473-83. PMid:9016160.

14. Chee S, Byrnes YM, Chorath KT, Rajasekaran K, Deng J. Interventions for trismus in head and neck cancer patients: a systematic review of randomized controlled trials. Integr Cancer Ther. 2021;20:1-12. http://dx.doi.org/10.1177/15347354211006474. PMid:34014116.

15. Schulz KF, Altman DG, Moher D. CONSORT 2010 Statement: updated guidelines for reporting parallel group randomised trials. Ann Intern Med. 2010;152(11):726-32. http://dx.doi.org/10.7326/0003-4819-152-11-201006010-00232. PMid:20335313.

16. The Whoqol Group. The World Health Organization Quality of Life Assessment (WHOQOL): development and general psychometric properties. Soc Sci Med. 1998;46(12):1569-85. http://dx.doi.org/10.1016/S0277-9536(98)00009-4 PMid:9672396.

17. Kluthcovsky ACGC, Kluthcovsky FA. O WHOQOL-bref, um instrumento para avaliar qualidade de vida: uma revisão sistemática. Rev Psiquiatr Rio Gd Sul. 2009;31(3, Suppl.):1-12. http://dx.doi.org/10.1590/S0101-81082009000400007.

18. Kamstra JI, Dijkstra PU, Van Leeuwen M, Roodenburg JLN, Langendijk JA. Mouth opening in patients irradiated for head and neck cancer: a prospective repeated measures study. Oral Oncol. 2015;51(5):548-55. http://dx.doi.org/10.1016/j.oraloncology.2015.01.016. PMid:25703798.

19. van der Geer SJ, van Rijn PV, Kamstra JI, Langendijk JA, van der Laan BFAM, Roodenburg JLN, et al. Prevalence and prediction of trismus in patients with head and neck cancer: a cross-sectional study. Head Neck. 2019;41(1):64-71. http://dx.doi.org/10.1002/hed.25369. PMid:30561067.

20. Rao SD, Saleh ZH, Setton J, Tam M, McBride SM, Riaz N, et al. Dose-volume factors correlating with trismus following chemoradiation for head and neck cancer. Acta Oncol. 2016;55(1):99-104. http://dx.doi.org/10.3109/0284186X.2015.1037864. PMid:25920361.

21. Fernandes AG, Chiacchiaretta JM, Scarpel RDA. Impacto da dor orofacial na qualidade de vida de portadores de câncer de boca e orofaringe. Audiol Commun Res. 2022;27:e2583. http://dx.doi.org/10.1590/2317-6431-2021-2583.

22. Scott B, D'Souza J, Perinparajah N, Lowe D, Rogers SN. Longitudinal evaluation of restricted mouth opening (trismus) in patients following primary surgery for oral and oropharyngeal squamous cell carcinoma. Br J Oral Maxillofac Surg. 2011;49(2):106-11. http://dx.doi.org/10.1016/j.bjoms.2010.02.008. PMid:20236743.

23. Borges LS, Cerqueira MS, Santos Rocha JA, Conrado LA, Machado M, Pereira R, et al. Light-emitting diode phototherapy improves muscle recovery after a damaging exercise. Lasers Med Sci. 2014;29(3):1139-44. PMid:24258312.

24. van Der Molen L, Heemsbergen WD, de Jong R, van Rossum MA, Smeele LE, Rasch CR, et al. Dysphagia after chemoradiotherapy Dysphagia and trismus after concomitant chemo-Intensity-Modulated Radiation Therapy (chemo-IMRT) in advanced head and neck cancer; Dose-effect relationships for swallowing and mastication structures. Radiother Oncol. 2013;106(3):364-9. http://dx.doi.org/10.1016/j.radonc.2013.03.005. PMid:23540551.

25. Van den Broek LJ, van der Veer WM, de Jong EH, Gibbs S, Niessen FB. Suppressed inflammatory gene expression during human hypertrophic scar compared to normotrophic scar formation. Exp Dermatol. 2015;24(8):623-9. http://dx.doi.org/10.1111/exd.12739. PMid:25939875.

26. Owosho AA, Pedreira Ramalho LM, Rosenberg HI, Yom SK, Drill E, Riedel E, et al. Objective assessment of trismus in oral and oropharyngeal cancer patients treated with intensity-modulated radiation therapy (IMRT). J Craniomaxillofac Surg. 2016;44(9):1408-13. http://dx.doi.org/10.1016/j.jcms.2016.06.008. PMid:27377999.

27. Gebre-Medhin M, Haghanegi M, Robért L, Kjellén E, Nilsson P. Dose-volume analysis of radiation-induced trismus in head and neck cancer patients. Acta Oncol. 2016;55(11):1313-7. http://dx.doi.org/10.1080/0284186X.2016.1221129. PMid:27595312.

28. van den Broek LJ, van der Veer WM, Jong EH, Gibbs S, Niessen FB. Suppressed inflammatory gene expression during human hypertrophic scar compared to normotrophic scar formation. Exp Dermatol. 2015;24(8):623-9. http://dx.doi.org/10.1111/exd.12739. PMid:25939875.