Arch Health Invest (2024)13(7):2344-2350
http://doi.org/10.21270/archi.v13i7.6334

Original Research

Postural Changes Caused by Antineoplastic Treatment for Head and Neck Neoplasms

Alterações Posturais Causadas pelo Tratamento Antineoplásico para Neoplasias de Cabeça e Pescoço

Cambios Posturales Provocados por el Tratamiento Antineoplásico de las Neoplasias de Cabeza y Cuello

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Abstract

Background: Loss or reduction of muscle function in the cervical and scapular region, causing mobility limits, trismus, and postural abnormalities, are a common musculoskeletal change reported in head and neck cancer (HNC) survivors, with limited information in the scientific literature. Aim: This study aims to describe the patients' overall posture after antineoplastic treatment and verify possible musculoskeletal complications as well as general body posture and its association with temporomandibular disorder (TMD)/orofacial pain (OFP) and quality of life. Methods: The study included patients suffering from head and neck cancer (HNC) after antineoplastic therapy. The following variables were evaluated: body posture photogrammetry, signs and symptoms of TMD and OFP, trismus, and overall quality of life. Results: The study included 60 individuals diagnosed with HNC. Photogrammetry evaluation showed significant differences for shoulder asymmetry (p=0.02), changes between the pelvic waist and knee joint (p=0.04), and changes in the cervical spine (p=0.01). For the variables related to TMD and OFP, were found pain in the masseter muscle, presence of "cracking sound" in the temporomandibular joint, difficulty and limitation for mouth opening, with and without pain, trismus, difficulty for speaking or chewing, and pain surrounding the ears and temples. For quality of life, there were differences for the following dimensions: functional capacity, physical aspects, limitation and pain. Conclusions: Postural evaluation has shown that antineoplastic treatment causes musculoskeletal disorders which alter normal posture, not only in regions directly affected by treatment, but also in several areas of the body, thereby negatively impacting the quality of life.

Descriptors: Head and Neck Neoplasms; Radiotherapy; Postural Balance.

Resumo

Fundamento: A perda ou redução da função muscular na região cervical e escapular, causando limites de mobilidade, trismo e anormalidades posturais, são alterações musculoesqueléticas comuns relatadas em sobreviventes de câncer de cabeça e pescoço (CCP), com informações limitadas na literatura científica. Objetivo: Este estudo tem como objetivo descrever a postura geral dos pacientes após o tratamento antineoplásico e verificar possíveis complicações musculoesqueléticas, bem como a postura corporal geral e sua associação com disfunção temporomandibular (DTM)/dor orofacial (DOF) e qualidade de vida. Métodos: O estudo incluiu pacientes portadores de câncer de cabeça e pescoço (CCP) após terapia antineoplásica. Foram avaliadas as seguintes variáveis: fotogrametria postural corporal, sinais e sintomas de DTM e DOF, trismo e qualidade de vida geral. Resultados: O estudo incluiu 60 indivíduos com diagnóstico de CCP. A avaliação fotogramétrica mostrou diferenças significativas para assimetria de ombros (p=0,02), alterações entre cintura pélvica e articulação do joelho (p=0,04) e alterações na coluna cervical (p=0,01). Para as variáveis relacionadas à DTM e DOF foram encontradas: dor no músculo masseter, presença de "estalo" na articulação temporomandibular, dificuldade e limitação para abertura de boca, com e sem dor, trismo, dificuldade para falar ou mastigar, e dor ao redor das orelhas e têmporas. Para qualidade de vida houve diferenças para as dimensões: capacidade funcional, aspectos físicos, limitação e dor. Conclusões: A avaliação postural demonstrou que o tratamento antineoplásico provoca distúrbios musculoesqueléticos que alteram a postura normal, não apenas nas regiões diretamente afetadas pelo tratamento, mas também em diversas áreas do corpo, impactando negativamente na qualidade de vida.

Descritores: Neoplasias de Cabeça e Pescoço; Radioterapia; Equilíbrio Postural**.**

Resumen

Antecedentes: La pérdida o reducción de la función muscular en la región cervical y escapular, causando límites de movilidad, trismo y anormalidades posturales, son cambios musculoesqueléticos comunes reportados en sobrevivientes de cáncer de cabeza y cuello (CCC), con información limitada en la literatura científica. Objetivo: Este estudio pretende describir la postura general de los pacientes tras el tratamiento antineoplásico y verificar las posibles complicaciones musculoesqueléticas, así como la postura corporal general y su asociación con el trastorno temporomandibular (TTM)/dolor orofacial (DPO) y la calidad de vida. Métodos: El estudio incluyó a pacientes que padecían cáncer de cabeza y cuello (CCC) tras una terapia antineoplásica. Se evaluaron las siguientes variables: fotogrametría de la postura corporal, signos y síntomas de TMD y OFP, trismus y calidad de vida general. Resultados: El estudio incluyó a 60 individuos diagnosticados de HNC. La evaluación mediante fotogrametría mostró diferencias significativas para la asimetría de los hombros (p=0,02), los cambios entre la cintura pélvica y la articulación de la rodilla (p=0,04) y los cambios en la columna cervical (p=0,01). Para las variables relacionadas con los TTM y los PFO, se encontraron: dolor en el músculo masetero, presencia de "crujido" en la articulación temporomandibular, dificultad y limitación para abrir la boca, con y sin dolor, trismo, dificultad para hablar o masticar, y dolor alrededor de las orejas y las sienes. En cuanto a la calidad de vida, se observaron diferencias en las siguientes dimensiones: capacidad funcional, aspectos físicos, limitación y el dolor. Conclusiones: La evaluación postural ha demostrado que el tratamiento antineoplásico provoca trastornos musculoesqueléticos que alteran la postura normal, no sólo en las regiones directamente afectadas por el tratamiento, sino también en varias zonas del cuerpo, lo que repercute negativamente en la calidad de vida.

Descriptores: Neoplasias de Cabeza y Cuello; Radioterapia; Equilíbrio Postural.

INTRODUCTION

Currently, the malignant neoplasia of the head and neck has antineoplastic treatments available like surgery, radiotherapy, and/or

chemotherapy[1,2]. Although necessary to cure the disease, treatments may cause adverse effects that negatively impact the survivors' quality of life[3,4]. Within the many acute and late effects of antineoplastic therapy, we observe the musculoskeletal changes mainly caused by surgical procedures and radiotherapy treatment[5-9].

The musculoskeletal changes commonly found include loss or reduction of muscle functions of the cervical and scapular region, causing mobility limitations, trismus, and postural abnormalities[7,10]. Individuals undergoing surgery and radiotherapy develop postural abnormalities induced by tissue fibrosis and contractures, muscular atrophy and generalized weakness. With these progressive postural changes, the chances of developing pathological curvature of the column increase, such as severe kyphosis, and decrease or increase of cervical and lumbar lordosis, changes in the scapular waist and muscles that fall in the acromioclavicular joint, generating several types of pains, aspirative pneumonia, and restrictive pulmonary diseases[7,10]. Some musculoskeletal complications are also found in individuals treated with neck dissection as myofascial pain in upper trapezius muscles, lifts of the scapula and rhomboids, and limitations of movements across the scapular region and upper limbs. Although it occurs with less frequency, the morbidity of the shoulder can also develop itself because of radiotherapy[11,12]. The muscles of the body are arranged in the form of chain, and the mechanical index happens globally and simultaneously; thus, the dynamic relationship between the posture of the head and the dental occlusion justifies the commitment of all the postures when there are craniofacial changes[13,14].

There is lack of data in the literature on the incidence or severity of postural abnormalities from musculoskeletal complications in HNC survivors; therefore, studies that compare the global posture of patients with a normal population are

relevant to check for possible muscle and joint complications as well as the overall body posture and its relationship with the quality of life[7,10]. Hence, the objective of this study was to observe the evolution of individuals with HNC postoperative antineoplastic therapy, symptoms of TMD/OFT including trismus and the impact of quality of life.

MATERIAL AND METHOD

This is a transversal type of observational study where the study group was composed of individuals with HNC and evaluated after antineoplastic treatment. Participants who presented bone and/or muscle diseases which interfered in their normal posture, were excluded. It was a convenience sample.

- *Postural Evaluation*

The postural evaluation was analyzed quantitatively, employing digital photogrammetry to measure the angles, in order to bring more reliable data than using visual observation15. The surface markers used in participants were selected from the main visible bone references found in the human body16-18. As the postural pattern of normality is not defined in the literature, it was employed the geometric normality pattern of 90º to the angles measured in the anterior and posterior positions, and 0º in the lateral position. Measurements are shown in Figure 1

- *Front View*

- Distance from the head and trunk: glabella and manubrium of the external (G-ME)
- Leveling of the shoulders: right and left acromion (AC-RL)
- Alignment of the upper spine (cervical-thoracic) (CT)
- Alignment of the column bottom (thoracolumbar) (TL)
- Leveling of the pelvis: anterosuperior iliac spine: right and left (AIS-RL)
- Knee pierce/valgus: anterosuperior iliac spine, patella, and right talus (AIS-PRT)
- Knee pierce/valgus: anterosuperior iliac spine, patella, and left talus (AIS-PLT)

- *Rear View*

- Alignment of the upper column: vertebrae C7 to T8 (C7-T8)
- Leveling of the upper scapular angle: the scapular region top right and left (STRL)
- Leveling of the scapular region lower angles: bottom right and left scapula (SBRL)
- Alignment of the column bottom: vertebrae T8 to L3 (T8-L3)
- Leveling of the pelvis: posterosuperior iliac spine (PSIS)
- Medial or lateral rotation of the knee: posterosuperior iliac spine, popliteal fossa, and right tendon (PSIS-PF-RT)
- Medial or lateral rotation of the knee: posterosuperior iliac spine, popliteal fossa, and left tendon (PSIS-PF-LT)

- *Side View*

- Protrusion of the head: temporomandibular joint and acromion (TMJ-AC)

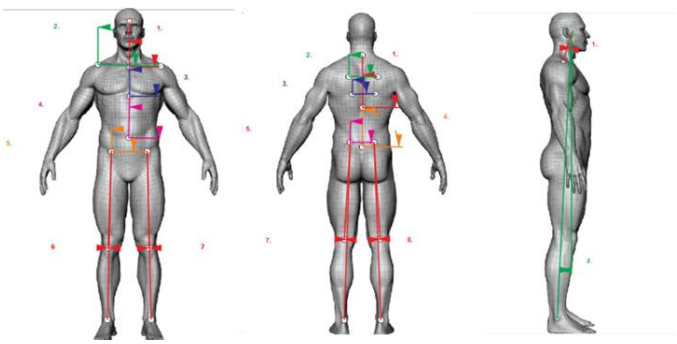

Figure 1: Deviation from the center of gravity: ATM and lateral malleolus (TMJ-LM)

○ *Signs and symptoms of temporomandibular disorder and orofacial pain*

The screening questionnaire was applied for TMD and OFP evaluation. It is composed of 10 sensitive issues for the identification of extracapsular diseases or myogenic disorders. It was also applied in the clinical examination of the Research Diagnostic Criteria for temporomandibular disorder (RDC/TMD)[19]. Measurements from the opening of the mouth were performed using digital pachymeter. It adopted the classification of trismus for mouth opening, smaller than or equal to 35 mm[20].

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○ *Quality of Life*

The participants' quality of life was evaluated by using the Brazilian version of the Short Form-36 (SF-36) questionnaire. Its 36 questions include the following 8 scales: functional capacity, physical aspects, pain, general health status, vitality, social aspects, emotional aspects, and mental health. Its score is graded from 0 to 100, where zero is the worst and 100, the best overall health status21.

○ *Statistical analysis*

Correlations were made with the Spearman, Pearson, Kolmogorov Smirnova, and Shapiro-Wilk tests. For data with normal and abnormal distribution, the Student's t-test and Mann-Whitney test were performed, respectively

RESULTS

A total of 60 individuals participated in the study. There were statistically significant differences for the following variables: age (p=0.01), gender (p=0.01), smoking (p=0.01), alcoholism (p=0.01), sedentary lifestyle (p=0.03), and hypertension (p=0.02).

Regarding the type of antineoplastic therapies applied to individuals with NHC, most of them underwent neck dissection, with prevalence of 44 (73.3%). The histological type of cancer was squamous cell carcinoma, with 48 (80%), and cancer was present in the oral cavity with 22 (37%) prevalence. For tumor staging, only 22 (36.7%) of the participants received information, and the most prevalent staging was T1N0MX with 4 (18.2%). From the 41 patients who underwent chemotherapy, only 19 (46.3%) were informed about the chemotherapeutic drugs used, and the most prevalent was cisplatin with 8 (42.1%)

All the participants in the study group underwent radiotherapy. The average amount of time after radiotherapy treatment was 32 months.

Results demonstrated that the intensity-modulated radiotherapy (IMRT), was the most commonly used modality (30, 50%). The anatomical sites which received radiation were the tumor region, cervical and tumor region, cervical spine and subclavicular fossa (SCF), cervical tumor region and SCF. The region that presented the highest prevalence of irradiation was the tumor site, with 34 patients (56.7%), and the dose of radiotherapy ranged from 6000 to 7020 cGy 48 (80%).

Table 1 - Results of variables related to neoplastic disease in the study group.

	n	%
Antineoplastic Therapies		
Surgery	36	60
Neck dissection	44	73,3
Chemotherapy	41	68,3
Radiotherapy	60	100
Histological types of tumors		
Squamous Cell Carcinoma	48	80
Mucoepidermoid carcinoma	4	6,7
Lymphoma	2	3,3
Microcystic adnexal carcinoma	1	1,7
Adenocarcinoma	1	1,7
Alveolar Sarcoma	1	1,7
Papillary carcinoma	1	1,7
Adenoid cystic carcinoma	1	1,7
Schwannoma	1	1,7
Anatomical tumor location		
Oral cavity	22	36,7
Oropharynx	21	35
Larynx	8	13,3
Cervical	5	8,3
Nasopharynx	4	6,7
Tumor staging information		
TXN3MX	1	4,5
T1N0MX	4	18,2
T1N1MX	1	4,5
T2NXMX	1	4,5
T2N0M0	3	13,6
T2N1M0	1	4,5
T2N3	1	4,5
T3NXMX	1	4,5
T3N0M0	3	13,6
T3N2MX	2	9,1
T3N3MX	1	4,5
T4N0M0	1	4,5
T4N2M0	1	4,5
T4N3M0	1	4,5
Total	**22**	**100**
Information about chemotherapy applied		
Cisplatin	8	42,1
Nivolumab	1	5,3
Cyclophosphamide	1	5,3
Doxorubicin	1	5,3
Vincristine	1	5,3
Rituximab	1	5,3
Paclitaxel	4	21,1
Carboplatin	2	10,5
Total	**19**	**100**

The postural evaluation by photogrammetry showed statistically significant differences among

the groups for the acromion right-left regions (p=0.02); posterosuperior iliac crest, popliteal fossa, left tendon (p=0.04); temporomandibular joint, acromion (p=0.01); and temporomandibular joint, lateral malleolus (p=0.01) (Table 2).

The posture of the study group showed significant correlations among the angles of the posture in the following anteroposition: glabella manubrium sternum, upper column (cervical-thoracic), lower spine (the thoracolumbar), anterosuperior iliac spine right and left, and anterosuperior iliac spine (patella-talus right and left) and the following secondary variables: dose of radiotherapy, free of pain mouth opening, pain in the masseter, type of radiotherapy, TMD/OFP, and quality of life (Table 3, p<0,05).

Table 2 - Correlations between the posture variables in the previous view and the secondary variables in the study group.

Radiation Therapy Dose	0,332	**0,01**	-0,133	0,30	-0,111	0,39	0,093	0,48	-0,261	**0,04**	-0,250	0,05
Type of Radiotherapy												
IMRT	0,975	0,67	0,975	0,69	0,989	0,98	0,942	0,10	0,957	0,25	0,939	0,08
3DCRT	0,920	0,47	0,943	0,67	0,879	0,22	0,947	0,69	0,859	0,15	0,912	0,40
Cobalt therapy	0,893	**0,01**	0,974	0,77	0,972	0,74	0,934	0,13	0,878	**0,01**	0,884	**0,01**
Temporomandibular dysfunction assessment questionnaire and orofacial pain (TMD/OFP)												
Difficulty opening your mouth	-0,198	0,13	0,256	**0,04**	-0,020	0,88	0,031	0,81	0,122	0,35	0,010	0,94
Locked jaw	-0,066	0,61	0,128	0,33	-0,106	0,42	-0,132	0,31	-0,007	0,95	0,120	0,36
Difficulty speaking or chewing	0,067	0,60	0,037	0,78	0,155	0,23	-0,077	0,55	0,192	0,14	0,153	0,24
Temporomandibular joint (TMJ) noise	0,058	0,66	0,178	0,17	0,039	0,77	-0,091	0,49	-0,061	0,64	-0,119	0,37
Stiff or tired jaws	0,056	0,67	0,065	0,62	0,006	0,96	0,040	0,75	0,182	0,16	0,038	0,77
Pain around the ears, seasons or cheeks	0,024	0,85	0,119	0,36	0,233	0,07	-0,005	0,97	0,023	0,86	-0,053	0,68
Headache, neck or teeth pain	0,095	0,47	0,110	0,40	0,159	0,22	-0,042	0,75	0,036	0,78	-0,181	0,16
Suffered recent head / neck / jaw trauma	-0,039	0,76	0,038	0,77	0,084	0,52	0,029	0,82	0,044	0,73	0,134	0,30
Notices recent bite change	-0,076	0,56	-0,211	0,10	-0,058	0,65	0,028	0,83	0,075	0,56	0,149	0,25
Recent TMJ Treatment	0,083	0,53	0,055	0,67	-0,206	0,11	0,106	0,42	0,140	0,28	0,099	0,45
Quality of Life Assessment - SF 36												
Functional capacity	-0,076	0,56	0,117	0,37	-0,129	0,32	-0,092	0,48	-0,031	0,81	0,082	0,53
Physical limitation	-0,052	0,69	0,017	0,89	-0,098	0,45	0,127	0,33	-0,024	0,85	0,061	0,64
Pain	0,046	0,72	-0,002	0,98	0,105	0,42	0,084	0,52	-0,206	0,11	-0,208	0,11
General health	0,021	0,30	0,099	0,45	0,241	0,06	-0,071	0,59	0,002	0,98	0,062	0,63
Vitality	0,136	0,30	0,041	0,75	-0,065	0,62	0,009	0,94	-0,323	**0,01**	-0,248	0,05
Social aspects	-0,099	0,45	-0,074	0,57	0,045	0,73	0,068	0,60	0,055	0,67	0,184	0,15
Emotional limitation	0,189	0,14	-0,127	0,33	-0,007	0,95	0,153	0,24	0,061	0,64	0,159	0,22
Mental health	0,007	0,96	-0,230	0,07	-0,079	0,54	0,189	0,14	-0,151	0,25	0,028	0,83

Table 3 - Correlations between the posture variables in the rear and side view and the secondary variables in the study group.

	(STRL)	p	(SBRL)	p	(C7 -T8)	p	(T8 - L3)	p	(PIS-PFRT)	p	(TMJ-AC)	P	(TMJ-LM)	p
Neck dissection	0,237	0,06	-0,050	0,70	0,259	**0,04**	0,041	0,75	0,097	0,45	0,191	0,14	0,076	0,56
Pain free opening	-0,198	0,12	-0,040	0,76	0,274	**0,03**	0,252	0,05	0,079	054	0,019	0,88	0,012	0,93
Opening with pain -	-0,240	0,06	0,002	0,98	0,253	0,05	0,265	**0,04**	-	**0,04**	0,024	0,85	-0,003	0,98
TMJ pain	-0,101	0,44	0,007	0,96	0,186	0,15	0,266	**0,04**	-	0,20	0,223	0,08	0,316	**0,01**
Pain - masseter origin	0,089	0,50	0,028	0,82	0,055	0,67	0,025	0,84	-	0,50	-0,203	0,12	-0,086	0,51
Pain - body masseter	0,029	0,82	-0,121	0,35	0,272	**0,03**	-0,141	0,28	-	**0,03**	-0,032	0,80	0,133	0,31
Pain - masseter insertion	0,171	0,19	0,103	0,43	0,033	0,80	0,046	0,72	-	0,69	0,031	0,81	0,042	0,74
Temporomandibular dysfunction assessment questionnaire and orofacial pain (TMD/OFP)														
Difficulty opening your mouth	0,134	0,30	0,094	0,47	0,198	0,13	-0,017	0,89	-	0,19	0,129	0,32	0,259	**0,04**
Locked jaw	0,187	0,15	0,196	0,13	0,094	0,47	0,037	0,78	-	0,54	0,126	0,33	0,429	**0,01**
Difficulty speaking or chewing	0,042	0,75	0,049	0,70	0,113	0,39	0,058	0,65	-	0,72	0,016	0,90	-0,021	0,87
Temporomandibular joint noise	0,123	0,35	-0,010	0,93	0,083	053	-0,093	0,48	-	0,97	-0,039	0,77	0,252	0,05
Stiff or tired jaws	0,263	**0,04**	0,153	0,24	0,076	0,56	0,021	0,87	-	0,68	0,133	0,31	0,146	0,26
Pain around the ears/seasons/ cheeks	0,042	0,75	0,032	0,80	0,044	0,73	0,169	0,19	-	0,37	0,221	0,09	0,022	0,86
Headache, neck or teeth pain	-0,055	0,67	-0,018	0,89	0,230	0,07	-0,008	0,95	-	0,07	-0,057	0,66	0,117	0,37
Suffered recent head / neck / jaw trauma	0,114	0,38	-0,127	0,33	-0,014	0,91	-0,070	0,59	-	0,15	0,136	0,30	0,060	0,64
Notices recent bite change	-0,136	0,30	-0,035	0,79	0,050	0,70	0,089	0,49	-	0,19	0,258	**0,04**	0,081	0,53
Recent TMJ Treatment	0,093	0,48	0,195	013	-0,130	0,32	0,036	0,78	-	0,67	-0,090	0,49	-0,081	0,53

The posture angles in posterior position (scapular region top and bottom right-left, vertebrae C7 to T8, vertebrae T8 to L3, and posterosuperior iliac spine/popliteal fossa/right tendon, and position profile (temporomandibular-acromion and temporomandibular-lateral malleolus) showed statistically significant correlations with the following secondary variables: neck dissection, mouth opening, with or without pain.

As For TMD/OFP and trismus, results showed significant differences, in terms of pain in the masseter muscle (p=0.02), presence of “click” on the TMJ (p=0.02); pain for opening

the mouth (p=0.01); difficulty to speak, chew, or using the jaws (p=0.01); and pain around the ears or cheeks (p=0.04). For the study group, the evaluation of the TMD/OFP demonstrated statistically significant correlation with the following variables types of antineoplastic therapy: surgery and presence of crepitation (p=0.04); difficulty to open the mouth (p=0.05); neck dissection and difficulty to speak or chew (p=0.04); sensation of blocked jaw (p=0.05); and pain around the ears or cheeks (p=0.04). The variable for mouth opening, employed to evaluate trismus, showed statistically significant correlation with the following dimensions of quality of life: functional capacity (p=0.04), physical limitation (p=0.04), pain (p=0.01), vitality (p=0.03), and social aspects (p=0.01).

For quality-of-life evaluation, results showed that in the study group, the worst impact occurred for the size limitation by physical aspects, presenting an average of 49.68. There were statistically significant differences for the following dimensions: functional capacity (p=0.01), limited by physical aspects (p=0.01), and pain (p=0.03).

DISCUSSION

Participants of the study group underwent antineoplastic treatment, surgery, radiotherapy, and chemotherapy. There were chemotherapeutic agents which caused adverse effects and may have contributed to possible postural abnormalities, such as muscle weakness and fatigue. Here, no statistically significant correlations were found to consolidate this fact; therefore, it was assumed that postural abnormalities found in this study were consequences from surgical treatment and radiotherapy. In addition, only 3 (5%) patients underwent radiotherapy as well, to treat cancer.

- *Postural evaluation*

Clinically, it was observed that HNC survivors were highly likely to develop postural abnormalities[7,10]. The individuals in the study group showed higher postural changes, when compared to normal population. This fact can be justified by tissue fibrosis and contracture caused by dissection of the neck and radiation. Results showed that postural changes occur not only in the region which has received direct treatment, but also in the whole body.

- *Postural abnormalities and antineoplastic therapies*

For this type of antineoplastic therapy, postural changes in the cervical thoracic region were related to neck dissection. Neck dissection can result into loss of active range of motion in the shoulder and neck, in addition to loss of sensation and strength[18,22]. All these effects of neck dissection actively contribute to the development of postural abnormalities, which explain the correlation found in this study. As all patients who underwent neck dissection were also submitted to radiotherapy, it was assumed that the combination of surgery with treatment and radiotherapy increased fibrosis in the region, generating changes in the individual’s normal body posture.

- *Postural abnormalities and TMD/OFP*

For the relationship between postural abnormalities and the TMD/OFP variable, the greater the abnormality in the thoracolumbar region,

the greater the pain in the temporomandibular joint and the greater the abnormalities in the cervical and thoracic regions. The angular abnormalities that demonstrated the protrusion of the head were related to the difficulty of opening the mouth, sensation of blocked jaw, and sensation of recent changes in the bite. Results can be justified because of the intimate connection of the posture with the stomatognathic system[23-25]. Changes in the temporomandibular complex may reflect adjustments in the entire muscular system, interfering with the position of the shoulder girdle and head and triggering postural changes[26]. Evidence shows that diseases are not treated in the stomatognathic system and are at risk of developing postural disorders[18]. These literature findings explain the correlations between posture and the variables associated with TMD/OFP found in this study. However, as it is a transversal type observational study, it is not possible to reach conclusions about the relationship cause-and-effect.

- *Postural abnormalities and quality of life*

Concerning the relationship between abnormal posture and quality of life, there was a correlation with the worsening of vitality. The assessment of vitality evaluated the levels of energy and fatigue. Results regarding the worst levels of vitality related to body posture were congruent, because of the intimate connection between fatigue and reconditioning and severe muscle weakness generated by the antineoplastic treatment and that consequently generated postural changes[7,10]. Individuals with HNC showed worse scores in the domains of physical health, role limitations because of physical problems, and role limitations because of emotional problems, compared with an Iranian population free of the disease. However, their scores in the domains of pain, social function, and vitality were not significantly different, which was similar to other results found in the literature[27-31]. Here, it was observed a significant difference in vitality dimension, but this difference was found in comparison with postural assessment, a variable which had not yet been studied in the literature, which demonstrated the importance of unpublished findings of this research.

The overall quality of life of individuals with HNC who underwent antineoplastic treatment was commonly affected physically and emotionally; before, during, and after the treatment, mainly because of the effects from the therapy[32]. Here, quality of life demonstrated statistically significant differences between populations for the dimensions of functional capacity and limitations because of physical aspects and pain. The differences found were expected since both, the disease itself and the treatment led to negative side effects that influenced the activities of daily living, decreased the physical and emotional capacity for work, and caused pain in making activities unfeasible[8]. The needs related to cancer were extensive and included physical and psychosocial needs and practices in addition to health system and information needs. Therefore, the evaluation of quality of life in this population is of extreme importance to provide better patient care and social support through the interdisciplinary team, aiming at a survival with quality[33,34].

All individuals in the study group underwent radiotherapy treatment, with a large number combined with surgical removal of the tumor, neck dissection, and chemotherapy. The postural abnormalities found in distant regions from the focus of treatment, with higher prevalence occurred because of body muscles to be organized in the form of string. When a group of muscles is affected by any reason, the global body mechanics is also affected. These changes present in distant regions were potentially derived from surgical treatment, since its effects were mutilating, bringing immediate consequences to more severe global bodily changes. The radiotherapy also caused muscle deformities, but the radiation fibrosis was a consequence of late treatment, which demanded time to submit their signals on the global body posture. Hence, the abnormalities found in regions close to the treatment site, were certainly from radiotherapy. While no treatment can cause impact on the attitude of the survivors, the results, objectively and quantitatively showed that antineoplastic treatment, as a whole, caused musculoskeletal changes and consequently postural abnormalities, not only in the regions which were the focus of the treatments but also in the whole body, thereby negatively impacting the quality of life of this population.

- *Limitations of the study*

The analysis of postural evaluation by photogrammetry is a relatively recent instrument and lacks parameters of normality and with different methodologies in literature. Regarding the need for objective assessments to verify the postural complications arising from the antineoplastic treatment, photogrammetry is still the best evaluation option, up to present time. Due to lack of parameters of normality, it would be ideal to elaborate the comparison assessment before and after the antineoplastic treatment, in order to verify, accurately, the differences found in the individuals' posture. However, conducting this type of method was not effective because the participants took part during the oncologic treatment, or after its completion.

CONCLUSION

Postural evaluation showed that head and neck surgery, with and without ganglionar emptying,

associated with radiotherapy, causes musculoskeletal changes which alter the normal posture, not just in the regions directly affected by the treatment, but also in several areas of the body, negatively interfering in the quality of life. Objective studies aiming to improve postural assessments are necessary to obtain accurate results assisting in the quantitative physiotherapeutic diagnosis and, consequently, in best decision-making on prevention and specific treatment for this population.

FUNDING STATEMENT

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), Brazil (Finance Code 001).

ACKNOWLEDGEMENTS

We would like to thank Mr. Anderson Prestes for supporting us with technical services.

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CONFLICT OF INTERESTS

The authors declare no conflict of interest.

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Received 03/01/2024
Accepted 17/07/2024