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Original research

Comparative study on the maximum mouth opening between dynamic and static jaw exercise in irradiated head and neck cancer patients: A randomized control trial

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ABSTRACT

Objective: To compare the effects of dynamic and static jaw exercises on maximum mouth opening distance (MMOD) in irradiated head and neck cancer patients.
Materials and methods: Forty-three head and neck cancer patients who received radiotherapy were divided into two groups, dynamic jaw exercise group (n = 20) or static jaw exercise group (n = 23). The MMOD of the patients in each group, measured by Therabite range of motion scale, revealed excellent validity and reliability pre-radiotherapy, every two weeks during radiotherapy, the last day of radiotherapy, and the 1, 3, 6 and 12 months after treatment. The percentage of MMOD change in the groups pre-treatment and 1 year post-treatment were compared using the independent *t*-test ($\alpha = 0.05$).
Result: The average reduction in MMOD in the static group was $7.17\% \pm 21.34$, and in the dynamic group was $9.42\% \pm 16.91$. The independent *t*-test analysis revealed no significant difference between the groups ($p = 0.706$).
Conclusion: There was no significant difference in MMOD between head and neck radiotherapy patients using dynamic or static jaw exercises.

1. Introduction

Trismus, defined as a reduced normal mouth opening range,[1] is a complication resulting from radiotherapy in head and neck cancer patients. However, this condition is not well investigated. Dijkstra et al. indicated that a maximum mouth opening distance (MMOD) <35 mm is a functional cut-off point for a diagnosis of trismus.[2] Head and neck cancer radiotherapy induces fibrosis in the masticatory muscles and oral soft tissues in the radiation field, resulting in reduced MMOD.[3,4] Trismus commonly occurs when the muscles received a radiation dose up to 40 Gy and the prevalence increases at higher doses.[5] For every additional 10 Gy applied, trismus will increase by an additional 24%.[6]

The prevalence of trismus in irradiated head and neck cancer patients is high (38–47%)[4,7,8] and can lead to several complications, such as difficulty in eating, talking, maintaining oral hygiene and oral care, wearing a dental prosthesis, and malnutrition; leading to poor quality of life.[3,4,7,9,10] Treating trismus that occurs after radiotherapy is extremely difficult with unsatisfactory results. Therefore, preventing and alleviating trismus during radiotherapy and early post-radiotherapy will reduce the severity of trismus and improve the patients' quality of life.[11]

The most convenient and widely used technique to improve trismus is jaw exercise. There are 2 techniques, dynamic and static jaw exercises. Dynamic jaw exercises activate jaw opening and closing more than 1 cycle per exercise session, while the static technique uses only 1 cycle per session. However, there have been no clear clinical guidelines for the prevention or management of trismus and no reports comparing the efficacy of trismus prevention between dynamic and static jaw exercises in irradiated head and neck cancer patients. Therefore, the aim of this study was to compare the efficacy between dynamic and static jaw exercises on MMOD in irradiated head and neck cancer patients.

☆ AsianAOMS: Asian Association of Oral and Maxillofacial Surgeons; ASOMP: Asian Society of Oral and Maxillofacial Pathology; JSOP: Japanese Society of Oral Pathology; JSOMS: Japanese Society of Oral and Maxillofacial Surgeons; JSOM: Japanese Society of Oral Medicine; JAMI: Japanese Academy of Maxillofacial Implants.

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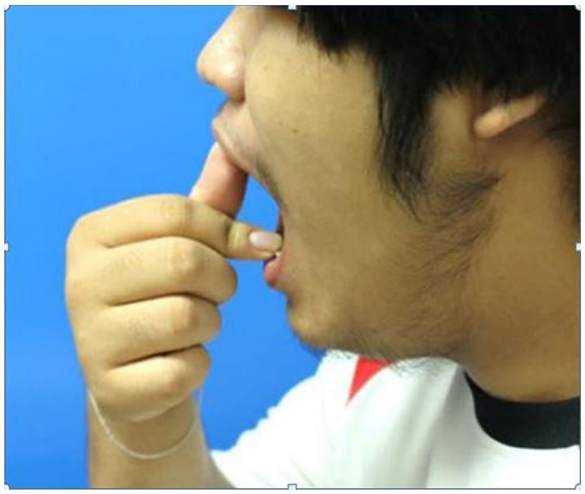

Fig. 1. Demonstrate jaw exercise with fingers (dynamic group).

Fig. 2. Demonstrate jaw exercise with tongue blade stack (static group).

Fig. 3. Demonstrate the measurement of maximum mouth opening distance (MMOD) by the Therabite™ range of motion scale.

2. Materials and methods

Seventy head and neck cancer patients who received radiotherapy for the first time with or without chemotherapy at the Chonburi Cancer Hospital from July 2013–June 2014 were enrolled in the study. The total radiation dose ranged from 50 to 70 Gy, delivered 1.8–2.0 Gy per day for five days a week. No surgical procedures involving the masticatory muscles were performed pre- or post-radiation. The study protocol was approved by the Ethics Committee of the Chonburi Cancer Hospital. Written informed consent was obtained from each patient participating in this study. Patients who could not perform jaw exercise as directed, non-compliant patients, or could not participate throughout the study were excluded.

The patients were divided into 2 groups by simple random sampling by a well-trained physical therapist. The patients in group A were assigned to perform static jaw-exercises (tongue blade stack) and the patients in group B were assigned to perform dynamic jaw-exercises (finger stretching).

The patients in the dynamic group were instructed to perform their jaw exercises by placing their thumbs against the upper anterior teeth or alveolar ridge and index fingers against the lower anterior teeth or alveolar ridge. The patients then forcefully separated their upper and lower arches until the MMOD was obtained. The patients held the stretched muscles for 30 s, and then relaxed for 30 s (1 cycle) (Fig. 1). The patients repeated the exercise for 4 cycles per session for 5 sessions per day.

The static group patients were instructed to insert a stack of tongue blade sticks between their upper and lower posterior teeth on one side until they reached their MMOD for 2 min and then remove the blades. This exercise was performed 5 times daily (Fig. 2).

The MMOD of the active group was measured using the Therabite range of motion scale with an intraclass correlation coefficient of 0.92 and excellent validity with Pearson's ratio ranging from 0.86–0.90 ($p < 0.0001$).[12] The patient's MMOD was measured before receiving the first dose of radiotherapy. The distance from the incisal edge of the upper central incisors to the incisal edge of the opposing lower central incisors was measured. This distance plus any overbite distance was recorded. In patients without both upper and lower central incisors, the measurement was made between the opposing upper and lower lateral incisors. In patients without their upper central incisors, the distance between the maxillary alveolar ridge and the opposing incisal edge of their lower central incisors was measured. In patients without lower central incisors, the distance between the incisal edge of the upper central incisors and the opposing mandibular alveolar ridge was recorded. In patients without both upper and lower anterior teeth, the measurement was made between the midline of the upper and lower alveolar ridge. The edge of the lower incisor or the crest of the mandibular midline was placed at the notch of the Therabite range of motion scale, and the distance at the incisal edge of the upper incisors or the crest of the maxillary midline plus the overbite distance was recorded as the MMOD. The measurement was carried out by one physical therapist that was blinded to which method the patients were assigned (Fig. 3). The patients' MMOD was measured every two weeks during radiotherapy (week 2, 4, and 6) and on the last day of radiotherapy. After radiotherapy, the patients were instructed to continue their jaw exercise and their MMOD was measured 1 month, 3 months, 6 months, and 1 year post-radiotherapy.

2.1. Statistical analysis

The percentages of MMOD change between pre-radiotherapy and 1 year post-radiotherapy was calculated and shown as

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