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MISCELLANEOUS

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A new shoulder orthosis for paralysis of the trapezius muscle after radical neck dissection: a preliminary report

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Abstract Despite recent advances using more conservative approaches, standard classical radical neck dissection is still one of the most frequently performed procedures in head and neck cancer patients who have advanced metastatic neck disease. The trapezius muscle paralysis following division of the spinal accessory nerve results in severe pain and cosmetic disturbance related to malalignment of the shoulder joint. The objective of this study is to report our results with a newly developed orthosis to prevent and correct shoulder dysfunction following standard radical neck dissection. Thirty-four patients who underwent standard radical neck dissection as a part of their surgical treatment from 1997–2002 were rehabilitated by the shoulder orthosis. Beginning 2 weeks after surgery, the patients were allowed to use their orthosis. By using a standard questionnaire, the pain and activity scores were recorded at the 1st, 3rd, 6th and 12th months postoperatively. Six patients were excluded from the study, of whom two succumbed to their disease and four discontinued the use of the orthosis. Of 28 patients included in the study, 20 (72%) were completely pain free within 3 months following the surgery. Four patients (14%) noted their pain level as tolerable, and four patients (14%) reported no considerable gain in the pain threshold and/or physical activity levels. Despite the fact that the active abduction range increased only 5 to 20°, the relief of pain and improved malalignment of the scapula and consequently clavicle and humerus led to functional gains, which increased the patients' endurance. At the end of the study, 23 patients (82%) were able to return to their previous jobs or activity levels. Current preliminary reports suggest that this orthosis can be recommended to prevent significant disability in patients with trapezius palsy due to ablative cancer surgery or other reasons.

Keywords Paralysis · Spinal accessory nerve · Radical neck dissection · Shoulder orthosis

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Introduction

After classical radical neck dissection for metastatic lymph nodes in head and neck cancer patients, shoulder dysfunction due to the division of the spinal accessory nerve supplying the trapezius muscle is a well-recognized complication [1, 4]. Paralysis of the trapezius muscle eventually results in malalignment of the shoulder joint, which causes pain and dysfunction as well as cosmetic disturbance. The clinical picture was first defined by Ewing and Martin [2] as 'shoulder syndrome' consisting of ipsilateral shoulder drop, reduced lateral abduction and forward flexion, a marked rhomboid and levator scapula muscles profile, stiffness, pain and abnormal electromyographic findings on the affected side.

The trapezius muscle is the main stabilizer of the scapula. Paralysis of this muscle causes inferolateral displacement of the scapula and shoulder protraction. In some patients, compensatory activities of the levator scapulae, rhomboids and upper parts of the serratus anterior muscles may decrease the degree of shoulder disability, but cosmetic disappearance and pain are invariably present in all cases [1, 9]. Additionally, in some patients postoperative pain may also limit extreme shoulder movements that cause a specific condition, called 'scapulohumeral joint periarthritis' or 'adhesive capsulitis' [9]. While varying degrees of these findings are

constantly seen following radical neck dissections, there are also several studies reporting that approximately 30–40% of patients who underwent so-called functional neck dissections with anatomical preservation of accessory nerves was also found to develop some degree of shoulder disability [6, 8]. Salerno et al. [8] concluded that not only denervation of the trapezius muscle, but also weakness of the scapulohumeral muscles and postoperative voluntary shoulder immobility are also important factors that may lead to shoulder drop syndrome in cases with an anatomically intact accessory nerve.

In today's era of head and neck oncologic surgery, the quality of life is one of the most important factors to be considered in the removal of the cancerous tissues and preventing its spread. Postoperative rehabilitation of shoulder dysfunction following standard radical neck dissection has a key role in comprehensive head and neck cancer treatment programs. If left untreated, this condition produces significant patient disability because of severe pain, shoulder dysfunction and cosmetic disturbance.

The purpose of this study is to evaluate the efficacy of a new shoulder orthosis that was developed for the correction of shoulder malalignment and pain relief in patients who underwent classic radical neck dissections.

Patients and methods

Thirty-four (30 male and 4 female) patients who underwent standard radical neck dissection as a part of their surgical treatment from 1997–2002 at the Inonu University Medical Faculty Department of Otolaryngology were rehabilitated by employing the Akman-Sari orthosis [5]. This orthosis consists of two pieces (Fig. 1): a rectangular piece of polyethylene covered with 6-mm-thick plasthosode inside and a 4-cm-wide non-elastic band, 120 cm in length, which is attached to the other piece with metal rivets. The polyethylene piece, when placed on the axillary region on the affected side, covers the inferior angle and lateral edge of the scapula and has a cleft on its posterior edge. The band is connected to a 15-cm belt-like piece made of durable leather, which has multiple holes in order to adjust the tightness of the orthosis. A buckle is fixed on the anterior part of the band, and a piece of plasthosode is attached in order to relieve discomfort due to pressure on the soft tissues. When the patients wear the orthosis, the band should be tightened till the scapulae and shoulders become symmetrical before buckling so that the polyethylene piece acts as a retractor and stabilizer of the scapula (Fig. 2a, b).

The beneficial effects of the orthosis were investigated by using a standard questionnaire regarding the pain intensity, analgesic requirements and improvement in daily activities before the trial and at the 1st, 3rd, 6th and 12th months postoperatively.

Results

Six patients who stopped using the orthosis were excluded from the study. The pain and activity scores showed a significant improvement in the majority of the patients. Twenty patients (72%) were completely pain free within 3 months following surgery. With the relief of pain and improved malalignment of the scapula and consequently clavicle and humerus, the patients' remaining shoulder girdle muscle functions were also improved, although the active abduction range increased only 5 to 20°. Functional gains and pain relief increased the patients' endurance. Twenty-three patients (82%) were able to return to their previous jobs or activity levels.

Fig. 1 The Akman-Sari orthosis

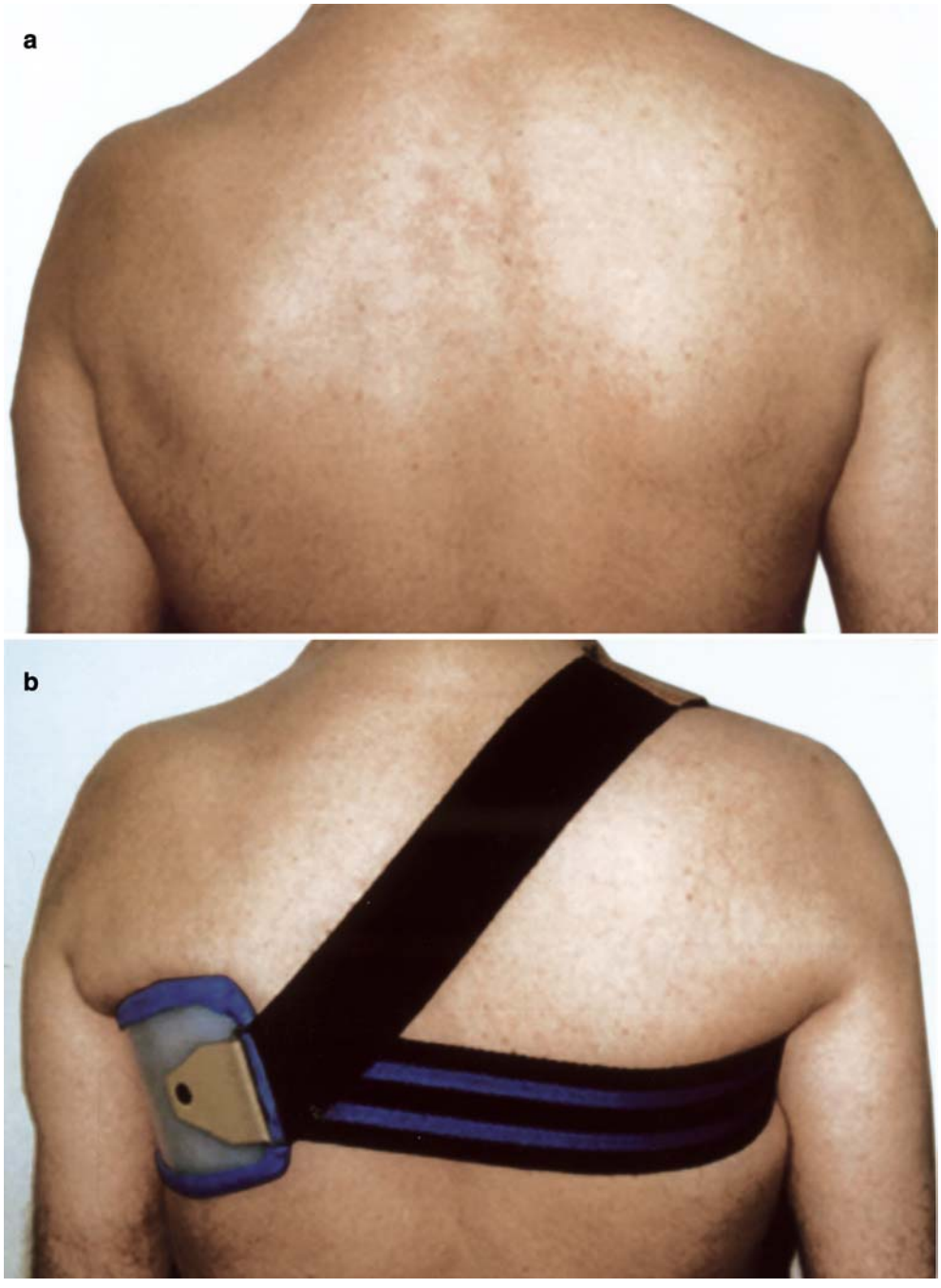

Fig. 2 a Shoulder malalignment on the left side due to loss of spinal accessory nerve function. **b** With the orthosis on, note the almost complete re-alignment of shoulder positions. The polyethylene piece acts as a retractor and stabilizer of the scapula

Discussion

After classical radical neck dissection with excision of the sternocleidomastoid muscle and division of the spinal accessory nerve supplying the trapezius muscle, severe shoulder pain, impaired shoulder joint function as well as cosmetic disturbance and shoulder atrophy are expected permanent complications [3, 9]. Ewing and Martin [2] defined this situation as shoulder syndrome. The degree of muscle atrophy correlates with clinical parameters such as abduction of the shoulder, downward rotation and, with regard to dislocation of the shoulder girdle, lateral and upward displacement of the scapula [3, 10]. The increased tension on the levator scapula muscle and rhomboid muscles due to the drop of the trapezius muscle and ipsilateral shoulder drop results in severe shoulder and back pain, which progressively deteriorates the quality of life parameters. As classical techniques, the use of non-steroid anti-inflammatory drugs (NSAID) and trans-cutaneous electrical nerve stimulation (TENS) are proposed to control the pain and shoulder disability resulting from this pathologic process [7]. Despite the

varying degree of efficacy, possible drug side effects and the development of a tolerance problem make the results unsatisfactory on the long-term basis for these techniques. Nerve blockages with local anesthetic injections are found to be effective; nonetheless, the main drawback of these procedures is the need for repeated injections within short periods of time. To impede the mechanical tension on the scapula and shoulder girdle by using a specially designed orthosis is another option allowing to hold off drugs or other invasive techniques for intractable pain situations. The elevation and medialization of the scapula may also help to decrease the level of functional deficiency of the trapezius muscle. In a search of the literature, we could find only one study describing an orthosis specifically designed to help postoperative shoulder drop syndrome [10].

In this preliminary study, we used a newly developed orthosis to prevent and to correct shoulder dysfunction following standard radical neck dissection. The orthosis described in this study consisted of two parts: a pelvic part as a point of support and two shoulder loops to align both sides in the correct position. These two parts are connected with two rigid bars, which make the use of this orthosis nearly impossible while driving or in lower sitting positions. For our orthosis, the opposite shoulder is used as a supporting point, so a connection part crossing the body is not needed, allowing us to design a more practical, easy to use and cosmetically acceptable instrument. The lightweight material used in the device skeleton makes this orthosis very easy to wear or take off for most of the patients. Improved malalignment and a better force of action obtained with the remaining muscle groups also alleviate the pain caused by the excessive stretch of the rhomboids and levator scapula muscles and provide a better physical appearance. (Fig. 2a ,b) With improved patient endurance, psychological problems can also be minimized or overcome easily [5, 10].

We conclude that this new orthosis may be recommended to prevent significant disability in many of the patients with trapezius palsy due to ablative cancer surgery or other reasons. However, we suggest new randomized trials to assess the efficacy of this shoulder orthosis.

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