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Occupational Therapy for Accessory Nerve Palsy after Radical Neck Dissection

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Chida, S., Shimada, Y., Matsunaga, T., Sato, M., Hatakeyama, K. and Mizoi, K. *Occupational Therapy for Accessory Nerve Palsy after Radical Neck Dissection.* Tohoku J. Exp. Med., 2002, **196** (3), 157-165 —— The subjects in this study were ten patients with accessory nerve palsy after radical neck dissection. All the primary diseases that accounted for radical neck dissection were malignant tumors located at the head or neck. Every patient received occupational therapy and underwent evaluations before and after the therapy. The data we collected included the existence of resting pain and motion pain, and the active and passive range of motion during shoulder flexion and abduction. The occupational therapy programs were not adequately effective for resting and motion pain, however, every patient gained independence for activities of daily living and housekeeping activities. The occupational therapy significantly improved the patient's shoulder elevation in all movements; although, the active abduction was always significantly poor compared with flexion. In the meantime, there were no significant differences between passive shoulder flexion and abduction at all times. We can therefore understand that the accessory nerve palsy especially affects active shoulder abduction induced by the trapezius paralysis. Occupational therapy is an effective treatment for the improvement of shoulder function, however, the occupational therapy has limited effectiveness for coping with the pain. ———— occupational therapy; accessory nerve palsy; radical neck dissection; pain; range of motion

Many patients who undergo a radical neck dissection have significant problems. Almost all of them result when the trapezius muscle loses innervations from the accessory nerve after radical neck dissection. Shone and Yardley (1991) investigated the incidence of handicap after radical neck dissection, and described pain, shoulder function, occupation, social and recreational disability and other problems. For example, atrophy of the trapezius and a difficulty to elevate the upper extremity comes from accessory nerve palsy (Fig. 1). The accessory nerve provides the most important and consistent input to the trapezius muscle (Nori et

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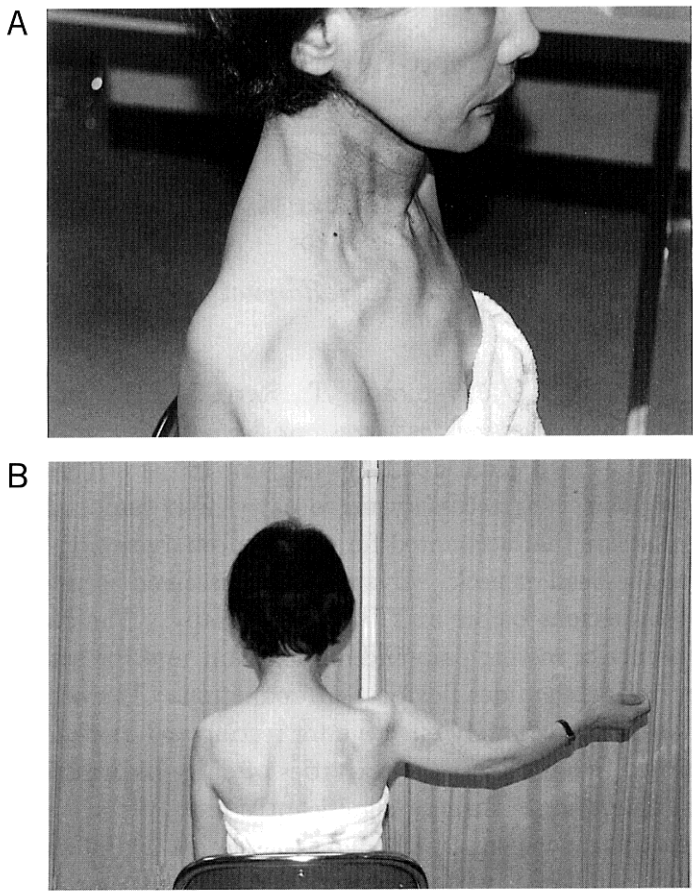

Fig. 1. Functional disorders on right shoulder caused by accessory nerve palsy after radical neck dissection. A: characteristic forward position on shoulder and atrophy of trapezius, B: maximum abduction of shoulder joint.

al. 1997). In fact, Shankar and Means (1990) showed abnormal electro-diagnostic findings in patients with neck dissection, and a number of studies demonstrated that neck dissected patients with their accessory nerve preserved had less pain in their neck and shoulder, less loss of function in their shoulder, and a better quality of life than did those with their accessory nerve sacrificed (Short et al. 1984; Kuntz and Weymuller 1999; Terrell et al. 2000). In the meantime, the C2, C3, and C4 branches of the cervical plexus have input to the trapezius muscles through anastomosis with the accessory nerve also. However, they are either not consistently present or, when they are, do not consistently innervate all parts of the trapezius muscle (Krause 1992; Miyata and Kitamura 1995). Consequently, there is some possibility that the problems investigated by Shone and Yardley (1991) were caused on patients with radical neck dissection who lost their accessory nerve.

Though the radical neck dissection is a procedure for saving the life, there are a number of patients who suffer from some sequelae when the accessory nerve palsy occurs. It cannot be accepted that the problems of the patients who have undergone radical neck dissection are ignored as a minor and allowable side effect of the procedure just because it is a radical operation. However, there are very few reports on rehabilitation for patients who underwent neck dissection, and furthermore only these reports include information about using therapy

(Saunders and Johnson 1975; Herring et al. 1987; Hillel and Patten 1990). The purpose of this study is to introduce occupational therapy to patients with accessory nerve palsy and to discuss roles for rehabilitation of accessory nerve palsy and its outcomes.

METHODS

Subjects

Ten patients (5 men and 5 women) with complete accessory nerve palsy after radical neck dissection who received occupational therapy between June 1997 to August 2001 (Table 1) were evaluated. Their mean age was 56 years (range, 40-66). All the primary diseases that accounted for radical neck dissection were malignant tumors located at the head or neck. The patients tumor sites were distributed as follows: 3 had cancer of the tongue, 2 had tumors of the lower jaw gingiva, 2 had cancer of the floor of mouth, and 1 case each of cancer of the upper jaw, hypopharynx, and larynx. In all patients, the accessory nerve was completely cut off by the radical neck dissection. Their mean period between the radical neck dissection and the initiation of occupational therapy was 49 days (range, 6-93); of the 10 patients, 9 were from 1 to 3 months after. The remaining one case started occupational therapy 6 days postoperation because of a complication of left hemiplegia. Of the 10 patients, 7 had different degrees of resting pain either on their neck or shoulder, alternatively, or on both. Motion pain in the shoulder, limits of scapular elevation, and limits of active shoulder flexion and abduction were observed in all cases. The results of manual muscle testing of scapular elevations were all Zero, and the upper trapezius muscles were completely paralyzed.

Procedure

Every patient received occupational therapy, mentioned below, that was tailored to the patient and was determined after a preliminary evaluation, the patients underwent evaluations before and after occupational therapy. The data we collected included the existence of resting pain and motion pain, the active and passive range of motion (ROM) during shoulder flexion and abduction.

Occupational therapy

Table 2 gives the contents of the occupational therapy. It is unclear at the present time what led to resting pain and severe motion pain, however, it is speculated that the muscle spasm caused by constant muscle contraction may lead to motion pain, also the stretched nerve root caused by the descent of the upper arm may induce resting pain during the early period. In order to avoid motion pain during shoulder elevation, most of the patients exhibited a specific movement pattern depending on excessive contraction of surviving muscles, so we applied some relaxation techniques and some exercises under conditions of decreased impact of gravity as well as massage on the exhausted muscles around the trapezius. The relaxation techniques were instructions for muscle relaxation consisting of the oral indication technique and Jacobson's progressive relaxation technique. Jacobson's technique is a method to facilitate the consciousness of the relaxed sensation by recognizing the tension caused by muscle contraction and the subsequent muscle relaxation. In addition, we gave each patient instructions for personal self-management to maintain a balance of movement and rest. Furthermore, we listened to each patient's complaints with a receptive attitude to provide mental support.

Passive ROM exercise, active-assistive ROM exercise, sanding and wiping exercises were used to improve the ROM in the shoulder, and so the surviving muscles wouldn't contract excessively (Fig. 2). These exercises were combined with the relaxation techniques.

We gave instructions on self-assistive ROM exercises within the patient's pain limits as a personal self-exercise program. We periodi-

TABLE 1. *Patient demographics*

Patient (No.)	Age	Sex	Tumor location	Operation side	Extent of nerve injury	Post-operation days	Resting pain	Motion pain	MMT of trapezius (upper portion)	Active shoulder flexion	Active shoulder abduction
1	61	F	Upper jaw	L	Complete	93	+	+	Z	95°	60°
2	48	F	Tongue	R	Complete	34	−	+	Z	145°	55°
3	64	M	Tongue	L	Complete	92	−	+	Z	80°	35°
4	65	M	Floor of mouth	R	Complete	73	−	+	Z	105°	55°
5	51	F	Tongue	L	Complete	57	+	+	Z	100°	80°
6	40	F	Lower jaw gingiva	L	Complete	28	+	+	Z	90°	50°
7	56	F	Lower jaw gingiva	R	Complete	41	+	+	Z	140°	60°
8	62	M	Hypopharynx	R	Complete	6	+	+	Z	65°	60°
9	66	M	Larynx	R	Complete	49	+	+	Z	105°	55°
10	47	M	Floor of mouth	R	Complete	21	+	+	Z	145°	80°

F, female; M, male; R, right; L, left; MMT, manual muscle testing.

TABLE 2. *Occupational therapy programs*

1. For resting pain and motion pain
— instructions for muscle relaxation
— relearning of shoulder movements
— massage on the exhausted muscles around trapezius
— instructions for personal self-management (to keep a balance of movement and rest)
2. For the limitation of shoulder elevation
— instructions for muscle relaxation
— active and passive ROM exercises
— sanding, wiping exercises
— muscle strengthening with isometric contraction
— instructions for a personal self-exercise program
3. For disability of ADL and APDL
— instructions and exercises for ADL and APDL
4. For mental support
— to listen to patient's complaints with a receptive attitude

ROM, range of motion; ADL, activities of daily living; APDL, activities parallel to daily living.

cally checked the patient's progress and advised them on changes to the program.

The patients with accessory nerve palsy often complain of difficulty in dressing. In this instance, we taught them some ways, for example, of putting on a jacket from the affected side and taking off it from the healthy side. On the other hand, in the case of a housewife who suffered severe neck pain caused by the motion of an affected upper arm, we sought the amount and extent of the actions that would not induce pain, and showed her some methods with a low likelihood of pain in order to gradually improve her housekeeping ability.

The intensity of the occupational therapy and personal self-exercises were adjusted to the degree in which the aggravation of the pain by the therapy did not remain until the following day. Therefore, most exercises were carried out in the range with less pain. All patients received the occupational therapy 5 times every week when they were under hospitalization. Three patients continued to receive the occupational therapy once or twice every week after they became outpatients. The duration of each occupational therapy was about 40 minutes.

The period of occupational therapy

The mean period of occupational therapy was 91 days. However, there was a large dispersion due to three patients who received occupational therapy for over 150 days. This prolongation was caused by complications of severe pain, trigger finger and left hemiplegia. In the remaining seven cases, the mean period of occupational therapy was 29 days and the longest period was 68 days. There was no significant correlation between the period of occupational therapy and the degree of improvement of pain and ROM.

Data analysis

An unpaired t-test was applied to compare the two shoulder movements, flexion and abduction. A paired t-test was used to evaluate the improvement of shoulder elevation. For all statistical tests, a 0.05 level of probability was required for significance.

RESULTS

The changes of shoulder pain

Table 3 shows the existence of the resting pain and the motion pain at the initial and final evaluation of occupational therapy. The resting pain was observed in seven patients. In two of the seven patients, the resting pain disappeared; however, there was no change in the remaining five patients. The resting pain of these two patients was already light at the initial evaluations, and there were no obvious reasons for it.

The severe motion pain was observed in every patient at the initial evaluation. Although the motion pain disappeared in one case, there were small palliations in the remaining nine patients. The impact on pain was not effective; however, every patient procured in-

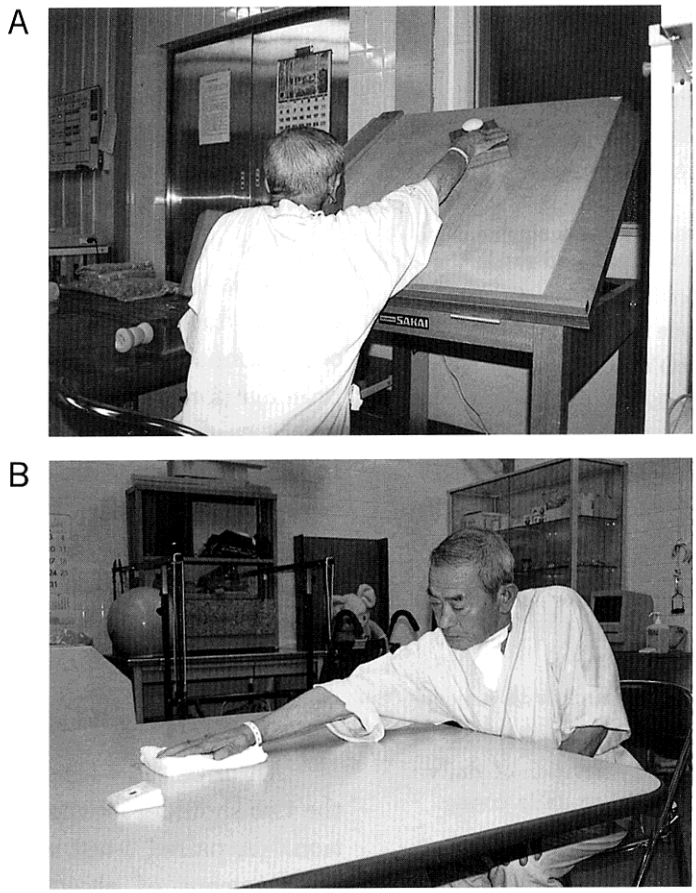

Fig. 2. Sanding exercise (A) and wiping exercise (B) are applicable for achieving variety goals.

TABLE 3. *The change of shoulder pain*

Patient	Resting pain Initial/Final	Motion pain Initial/Final
1	+/−	+/+
2	−/−	+/+
3	−/−	+/+
4	−/−	+/+
5	+/−	+/+
6	+/+	+/+
7	+/+	+/−
8	+/+	+/+
9	+/+	+/+
10	+/+	+/+

dependence for activities of daily living (ADL) and housekeeping activities.

The differences in ROM between shoulder flexion and abduction

The mean ROM of active shoulder elevation at the initial evaluation was 107 ± 28 degrees on flexion and 59 ± 13 degrees on abduction, and the mean ROM at the final evaluation was 135 ± 19 degrees on flexion and 78 ± 19 degrees on abduction (Fig. 3A). The active abduction ability was always significantly poor compared with flexion. In the meantime, there were no significant differences between passive shoulder flexion and abduction at all times (Fig. 3B). The accessory nerve palsy especially affected active shoulder abduction induced by a paralysis of the trapezius muscle.

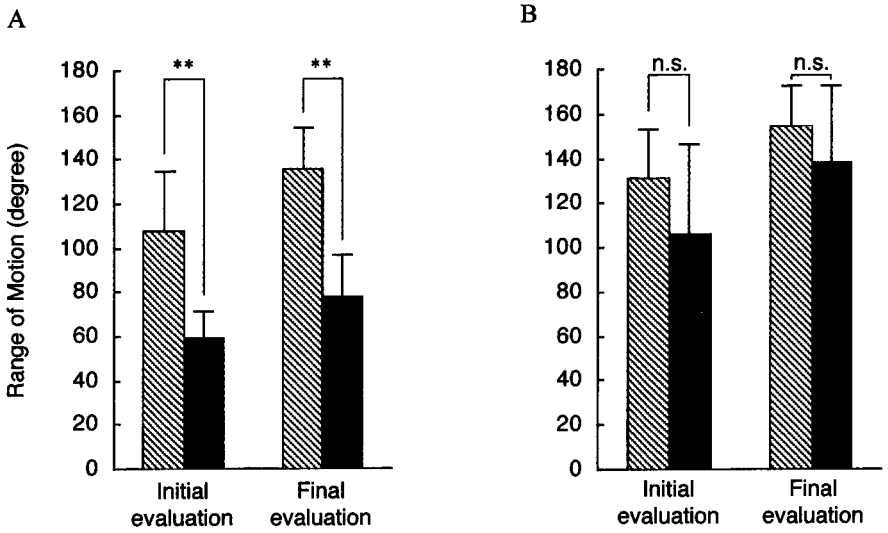

Fig. 3. The differences in ROM between shoulder flexion and abduction.
A: active range of motion, B: passive range of motion.
$^{**}p<0.01$; n.s., not significant; mean±S.D.; ▨, flexion; ■, abduction.

The improvement in ROM by occupational therapy

The improvement of shoulder ROM was 28±19 degrees on active flexion, 24±11 degrees on active abduction (Fig. 4A), 19±14 degrees on passive flexion and 33±23 degrees on passive abduction (Fig. 4B), so occupational therapy significantly improved the patient's shoulder elevation at all movements.

DISCUSSION

Pain is one of major problems for patients with accessory nerve palsy after radical neck dissection. The descriptions of incidence for pain are divided into two groups; one is approximately 80% (Short et al. 1984; Hillel et al. 1989; Shone and Yardley 1991) and another is approximately 50% (Ewing and Martin 1952;

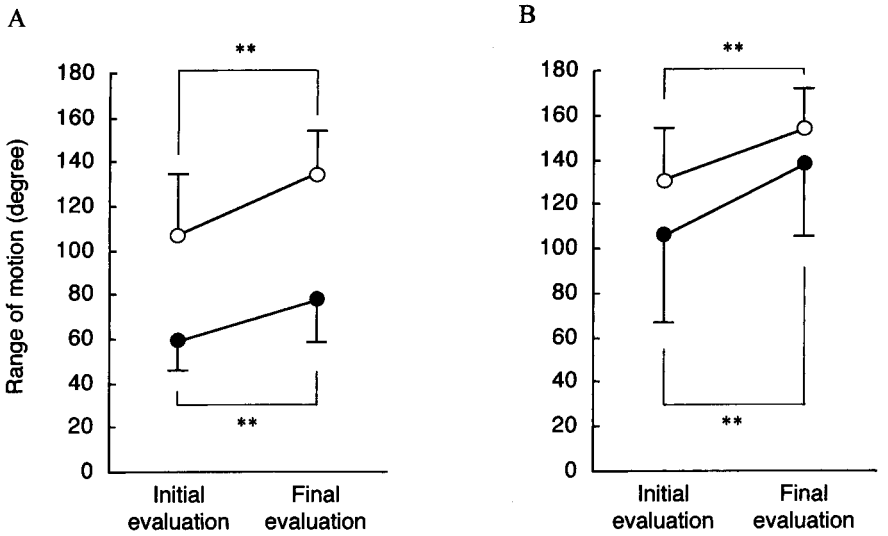

Fig. 4. The improvement in ROM by occupational therapy.
A: active range of motion, B: passive range of motion.
$^{**}p<0.01$; mean±S.D.; ○, flexion; ●, abduction.

Okinaga et al. 1992). In this study, the resting pain was observed in seven (out of ten) patients at the initial evaluation and five (out of ten) patients at the final evaluation. This result seems to support the above-mentioned incidences of pain, and so we can recognize the higher incidence and the importance of coping with the pain. However, the occupational therapy programs were not adequately effective for resting and motion pain. In two patients the resting pain disappeared, however, we couldn't find any obvious reasons except that the resting pain was already light at the initial evaluations. We considered that the occupational therapy has limited effectiveness for coping with the pain. It is unclear what led to resting pain and severe motion pain, and there have been few reports written about conservative therapies for the pain caused by radical neck dissection. On these points, further research is desired.

In the meantime, improvements in motor function and pain were reported when using the surgical remedy (Edward and Raleigh 1987; Krause 1994). Therefore, it can be considered that the application of the surgical remedy also deserves examination in case of unsatisfactory results using the conservative therapy. On the other hand, our patients could procure independence for ADL and housekeeping activities via occupational therapy in spite of the fact they were having pain. Accordingly, the role of occupational therapy for patients after radical neck dissection is obviously an important rehabilitation approach.

Though the limitation of active abduction in the shoulder is common to most patients who underwent radical neck dissection, there are differences in ROM (Saunders and Johnson 1975; Fialka and Vinzenz 1988; Hillel and Patten 1990; Shone and Yardley 1991; Okinaga et al. 1992). Krause (1992) indicated that the C2, C3, and C4 branches of the cervical plexus are able to continue functioning through the anastomosis with the accessory nerve following radical neck dissection. When this situation is present, it was reported that there were a small number of patients with a ROM of active abduction that went over 90 degrees. However, most reports described that the mean ROM of active abduction was below 90 degrees, thus, the anatomical anastomosis are either not consistently present or, when present, did not consistently innervate the trapezius muscle. In this instance, below 90 degrees of active abduction is thought to be an average ROM in patients who underwent radical neck dissection.

In this study, the limitation of active abduction was measured, and the mean ROM was 59 degrees at the initial evaluation and was 74 degrees at the final evaluation. For eight of the patients one month to three months had already passed before starting occupational therapy. However, in spite of complete palsy of the trapezius, the active and passive ROM on shoulder flexion and abduction was significantly improved in all types of movement. Accordingly, it should be taken into account that our patients were accompanied by secondary disabilities, such as weakness of the surviving muscles or joint contractures, and that the reinforcement and the compensation of the surviving muscles might improve shoulder elevations. To start occupational therapy soon after radical neck dissection has the possibility of producing other results.

CONCLUSION

Occupational therapy is an effective treatment for the improvement of shoulder function, and helping the patient gain independence for ADL and housekeeping activities. However, the occupational therapy has limited effectiveness for coping with the pain.

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