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Japanese physiotherapists' current practice of inspiratory muscle training for individuals with cervical spinal cord injury or chronic obstructive pulmonary disease

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Abstract

The purpose of this study was to describe the current practice of Japanese physiotherapists using inspiratory muscle training (IMT) in management of clients with cervical spinal cord injury (CSCI) or chronic obstructive pulmonary disease (COPD). A survey packet was sent to 250 physiotherapists treating clients following CSCI and 250 treating clients with COPD. The survey required respondents to reply to questions on whether they used IMT and, if so, to describe the type of client for whom it was appropriate, as well as the devices and training protocols they used and any contraindications to them. The response rate for the CSCI survey was 35.6% and that for the COPD survey was 40.4%. The results were compared to those of Canadian physiotherapists. The respondents' application rate of IMT for CSCI was 15.4%, which was similar to that of the Canadian physiotherapists' rate of 17.4% and, for COPD, it was 26.7%, which was five times higher than that of the Canadian physiotherapists' rate of 4.7%. The reasons given for its non-use included emphasis on general exercise, no appropriate clients, emphasis on breathing pattern, no knowledge of IMT, inadequate human resources and no evidence of its effectiveness, which were similar to those of the Canadian physiotherapists. There is, in fact, little evidence that exists as to the effectiveness of IMT with CSCI clients, but there is evidence on its efficacy in clients with COPD. Japanese physiotherapists were found to seldom administer IMT, but the author considers it a potentially effective modality for clients with CSCI and COPD.

Key words

inspiratory muscle training, cervical spinal cord injury, chronic obstructive pulmonary disease, ventilatory muscles, survey

Introduction

Chronic obstructive pulmonary disease (COPD) ranks as the fourth leading cause of death in the world[1] and 10th in Japan[2], and this mortality rate is predicted to rise. Cardiopulmonary physiotherapy in Japan has developed in response to the increasing need for efficient care of clients with chronic respiratory conditions. Individuals with COPD or paralysis as a result of a cervical spinal cord injury (CSCI), consequently, have involvement of the ventilatory muscles. Respiratory care is of particular importance in the acute stage of CSCI and for acute exacerbation in COPD, both of which are a major cause of death. A decrease in the ventilatory muscle strength in chronic respiratory failure causes dyspnoea and an increased limitation in physical activity. This, in turn, exacerbates symptoms, and when a state of hypoventilation exists in the chronic stage of the condition, pulmonary complications consequently ensue.

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Respiratory care, including inspiratory muscle training (IMT), to such individuals is of importance in terms of preventing or assisting in decreasing these pulmonary complications. Furthermore, the role that the strength of the ventilatory muscles plays in clients with COPD is a parameter that can be used as a measure for the severity of their condition, level of exercise tolerance and quality of life. The implementation of IMT has the potential to improve dyspnoea and, consequently, activities of daily living (ADL), so that deterioration in the client's condition can be slowed or prevented. Although some studies have been carried out on the use and effectiveness of IMT and its influence on the prognosis for clients with CSCI and COPD, there is as yet insufficiently substantiated scientific evidence for its efficacy.

According to the result of a recent study in Canada, the percentage of Canadian physiotherapists engaged in the use of IMT to individuals with CSCI was 17.4 (119 respondents) and to those with COPD a mere 4.7 (145 respondents)[3]. Crowe, et al. cited the following reasons for non-use of IMT: 1) lack of knowledge on the part of physiotherapists concerning the method of administration of IMT; 2) no appropriate client; and 3) insufficient scientific evidence[3]. Currently, no empirical data exists in Japan on factors concerning the implementation of IMT for individuals with CSCI or COPD. Therefore, the purpose of this study was two-fold: 1) to describe the current practice of Japanese physiotherapists using IMT in the management of clients with CSCI or COPD; and 2) to contrast the findings of this study with those of the Canadian study by Crowe et al.[3]. The results from a study such as this would contribute to our future knowledge on the clinical use, application and effectiveness of IMT and possibly promote it as a treatment tool to be used by physiotherapists for their clients.

Methods

This study was conducted by two cross-sectional self-administered postal surveys, which was selected as the most appropriate tool for data collection. Part One of the questionnaire consisted of a total of 10 questions that were originally developed by Crowe et al.[3] and were related specifically to physiotherapists' practice pattern of IMT. The details of the questions are described elsewhere[3].

Part Two of the questionnaire sought background information on the respondents in which they were asked about the following: their highest academic qualification, years of professional practice, present case load of CSCI and COPD clients and as to whether they were in the acute or chronic stage of their conditions, involvement in clinical education of physiotherapy students, size of their facility in regards to numbers of beds and whether or not they were working in a teaching institution.

In order to obtain an adequate number of respondents that was roughly equivalent to that of the Crowe, et al.'s study[3] the author had to carry out two methods of sampling. For the first samplings of respondents, the author referred to the Proceedings of both the Japanese Physical Therapy Association (JPTA) and Tōkai-Hokuriku Physical Therapy Association Congresses over the past 10 years, and from these two sources 40 experts on CSCI and 129 on COPD were obtained. Those selected had specifically presented research papers on topics related to these conditions in either scientific journals or meetings. Because the number of respondents proved insufficient from this first sampling for the study the author decided to consult the 2006 Membership Directory of JPTA for the second sampling. From these members a further 210 respondents were systematically selected for the CSCI survey and 121 for the COPD survey; these additional 331 selected respondents were working in acute care settings and rehabilitation centres where CSCI or COPD clients were most likely to be treated by physiotherapists. Specifically, these institutions were chosen by their order of listing in the directory from each of the 48 prefectures, and the first physiotherapist listed at each institution was selected as a respondent. Sampling was carried out in such a way that the seven major regions of Japan, namely, Hokkaido, Tōhoku, Kantō, Chūbu, Kinki, Chūgoku

/Shikoku and Kyūshū/Okinawa were, in general, represented. The number of respondents from each of the seven regions are listed here, respectively: 22 for CSCI and 26 for COPD, 35 and 25, 46 and 46, 36 and 48, 37 and 44, 40 and 24, and 34 and 38. In this way, a total of 250 respondents for the CSCI survey and 250 respondents for the COPD survey were available to be sampled for this investigation.

The original English version of the ten questions on Part One of the questionnaire was translated into Japanese by the author, followed by the physiotherapists at the University of Kanazawa Hospital, Department of Physical Therapy critically examining it for its wording and phrasing. The two surveys took approximately 10 to 15 min each to complete and were mailed to all of the respondents with a letter of explanation concerning the purpose of the study, together with a stamped-addressed return envelope. The instructions to the respondents included a guarantee of confidentiality and the need to respond to every statement, and a guarantee that the questionnaires would remain anonymous.

The study was carried out in November of 2007, and the time period required for the surveys to be returned to the investigators was within two weeks of receiving the mailed questionnaire. No reminder, by telephone or otherwise, was necessary. Approval by the research ethics board for this type of survey was not mandatory at the location of the principal investigator.

A descriptive summary and frequency analysis were carried out for all of the items on the questionnaire. Pearson's correlation coefficient was employed to assess any correlation between the answer to each item and the respondents' demographic background. Responses to the questionnaires were coded and entered into a data file using *Microsoft Excel 2001*. An alpha level of 0.05 was selected for statistical significance, using the Statistics Package for Social Sciences version 11.5 (SPSS Japan Inc.) and the computer software *Microsoft Excel 2007* for the data analysis.

Results

In total, the response rate of the respondents from both selected sources was 32.4 per cent (%) for the CSCI survey and 38.4% for the COPD survey. The mean (and standard deviation) professional experience for all of the respondents was 12.1 (7.1) years. The respondents' numbers (and percentage) for level of academic achievement are listed as follows: 84 (47.6) diploma, 23 (13.0) associate degree, 47 (26.6) baccalaureate degree, 20 (11.3) master's degree and three (1.7) doctorate degree. In both the CSCI and COPD surveys there was no statistically meaningful correlation among the practice patterns for IMT, academic background, years of professional practice and work setting. The majority (91.5%) of the respondents were engaged in the clinical education of physiotherapy students. Tables 1 and 2 show types of devices used for IMT and the method of its administration.

Use of IMT for individuals with CSCI

The number (and percentage) of respondents surveyed whose usable returns were eligible to be processed because they had experienced treating CSCI was 65 (80.2) out of a total of 81 respondents, but only 10 (15.4) of them had actually carried out IMT. Of these 10 respondents, seven worked in acute care and three in a rehabilitation centre.

For these 10 respondents the following results are described (Table 1). Of the three respondents who used Threshold trainers, one respondent reported setting the breathing pattern, whereas one reported setting it according to the client's capability and one setting was undetermined. Two respondents combined interval and continuous training. Of the three respondents who reported using manual resistance for the diaphragm (n=2) and elevator muscles of the scapula (n=1), two of them also used interval training and set the breathing pattern. Two respondents reported encouraging clients to continue IMT throughout their hospitalisation, and another three reported advising them to continue with IMT until becoming capable of comfortably self-manipulating a wheelchair without experiencing any dyspnoea. Three respondents reported continuing IMT training of their clients until their maximal

Table 1. Training protocols for clients with cervical spinal cord injury (n=9 respondents)

Respondent and Device Used	*Times/ Day*	*Days/ Week*	*Minutes/ Session*	*Interval (I)/ Continuous (C)*	*Breathing Pattern Fixed*	*Intensity: Initial (I) and Progression (P)*
1 : Coach 2	1	5	5	I	Yes	I: 5-10 sec inspiration P: client subjective report
2 : Manual resistance	1	5	15	C	Yes	I: client-dependent P: client-dependent
3 : PFlex	1	5	15	C	Yes	I: client subjective report P: trial and error
4 : Threshold	2-3	5	5	I, C	client-dependent	I: 30% PImax P: retest PImax and increase
5 : Manual resistance	3	5	2-5	I	Yes	I: client subjective report and change in vital sign P: based on therapist's experience
6 : Diaphragmatic breathing	2	5	5	I	Yes	I: ? P: client-dependent
7 : Threshold	1-2	4-5	15-30	I, C	Yes	I: 25-30% PImax P: tolerate 15 min→30 min at 30% PImax
8 : Manual resistance	1	5	10	I	Yes	I: client-dependent P: client-dependent
9 : Threshold	1	5	10-15	?	?	I: >30% PImax P: tolerate 20-30 min

PImax: maximum inspiratory pressure; ?: not stated.

Table 2. Training protocols for clients with chronic obstructive pulmonary disease (n=23 respondents)

Respondent and Device Used	*Times/ Day*	*Days/ Week*	*Minutes/ Session*	*Interval (I)/ Continuous (C)*	*Breathing Pattern Fixed*	*Intensity/Initial (I) and Progression (P)*
1 : Manual resistance or weights	1-3	>5	5-10	?	No	I: depending on vital sign P: patient-dependent
2/3: Threshold	2	7	5-10	I	Yes	I: client subjective report P: client subjective report
4 : ?	1	5	5	C	Yes	I: client subjective report P: client subjective report
5 : Abdominal weights	1	4-7	10	C	Yes	I: 10RM diaphragm strength P: client subjective report
6 : PFlex	1	1	20	I, C	Yes	I: client subjective report P: client subjective report
7 : Threshold	3	7	5	I	No	I: 30-50% Pimax P: retest PImax and increase
8 : Threshold	2-3	frequently	20	I	No	I: 20-40% PImax P: retest PImax and increase
9 : Incentive spirometer	2-3	7	?	I	?	I: client-dependent P: client-dependent
10: Inspilex	3	7	?	I	No	I: holding for 3 secs P: none
11: Threshold	3	?	5	I	Yes	I: 60% PImax P: client subjective report
12/13/14/15 : Threshold	2	6	15	C	Yes	I: 30% PImax P: 3-4 on Borg scale
16/17: Threshold	1-2	7	15	I, C	No	I: client subjective report P: 30% PImax/client subjective report
18: Threshold	1	1	15	I, C	No	I: client subjective report P: client subjective report
19: Threshold	?	?	?	?	?	I: 30% PImax P: ?
20: Coach 2	3	5	20	I	Yes	I: 80% maximum load P: 80% maximum load
21/22: Threshold	3	7	15-20	I, C	Yes	I: 20-40% PImax P: retest PImax and increase
23: Threshold	2	7	5-30	C	No	I: up to 60% PImax P: client subjective report

PImax: maximum inspiratory pressure; ?: not stated.

negative mouth pressure (PImax) recovered to −50 or −80 cm H_2O, whereas another one reported training clients until the vital capacity and amount of thoracic expansion plateaued. Furthermore, another four respondents used a maintenance programme by means of deep breathing exercise and encouraging continuation of IMT indefinitely.

Outcome measures employed were ventilatory muscle strength as PImax (*n*=5), ventilatory muscle endurance (*n*=3), maximal positive mouth pressure (PEmax) (*n*=3), transcutaneous oxygen saturation (*n*=2), general exercise capacity (*n*=2) and vital capacity/tidal volume (*n*=1).

Individuals selected for IMT were: those who were at high risk for pulmonary complications such as pneumonia and atelectasis and required an increased vital capacity (*n*=4); had complete paralysis due to CSCI and were required to be weaned from a ventilator (*n*=2); incomplete paralysis as a result of CSCI at the fourth to sixth level (*n*=2); or fatigue to accessory muscles of respiration due to overuse (*n*=1). The respondents reported that the use of IMT would be inappropriate for such clients with the following conditions: dementia (n=3); long-term mechanical ventilation (*n*=2); severe hypertension (*n*=2); lowered level of consciousness (*n*=1); pneumothorax (*n*=1); and decreased lung compliance (*n*=1). In addition, two respondents reported that IMT could be used as a treatment for any client with CSCI.

The reasons for non-use of IMT were: no appropriate clients (*n*=14); unavailability of device (*n*=9); priority given to general exercise and/or training for ADL (*n*=7); emphasis on expiration, concentrating on establishing an effective breathing pattern and prevention of pulmonary complications (*n*=7); lack of evidence for its efficacy in the literature (*n*=6); lack of knowledge and experience by the physiotherapist in applying IMT (*n*=6); inadequate human resources (*n*=2); and lack of a physician's referral for IMT (*n*=1).

Use of IMT for individuals with COPD

Out of 96 respondents' usable returns, the number (and %) of respondents who had actual experience in treating COPD was 86 (89.6), but only 23 (26.7) of them had actually carried out IMT.

For these 23 respondents the following results are described (Table 2). Eight out of the 16 respondents who used Threshold trainers had fixed the breathing pattern of the client. Out of the seven respondents who used manual and/or weight resistance for the diaphragm, three of them had also fixed the breathing pattern. Ten respondents reported encouraging a virtual lifetime of IMT. Four respondents terminated IMT when the client's symptoms improved, and three of them when the client's adherence waned. Out of those respondents who used a Threshold trainer, the number of them who used interval and continuous training or a combination of both was five each. Another five respondents used a maintenance programme incorporating Threshold trainers, and two encouraged a general exercise regimen such as deep breathing exercise and walking.

The outcome measures employed for IMT were PImax (n=13), level of dyspnoea (n=15), general exercise tolerance (n=13), PEmax (n=9), level of quality-of-life (*n*=6), ventilatory muscle endurance (*n*=2) and arterial blood gases/vital signs (*n*=1). As for the measurement tool for the level of dyspnoea, five respondents used the *Borg Scale*, two used the *Medical Council Dyspnoea Scale* and level of transcutaneous oxygen saturation and one used the *Hugh-Jones Scale*. Five respondents reported using the six-minute walk test for measurement of general exercise capacity. As for the measurement tool for quality of life, these respondents used the *St. George's Respiratory Questionnaire* that is a specific assessment tool used for COPD clients and/or the *Airways Questionnaire 20* that is a specific assessment tool for clients with bronchial asthma.

Individuals chosen for IMT were as follows: any COPD clients (*n*=7); those COPD clients classified from Category I (mild) to III (moderate) (*n*=4); those with a high motivation and understanding of IMT (*n*=3); those whose condition would not be improved by therapeutic exercise alone (*n*=2); those in need of bronchial hygiene (*n*=2); and those with intact functioning of the diaphragm while receiving supplementary oxygen, weakness of the inspiratory muscles (PImax of <-60 cm H_2O) and

difficulty of being weaned from the ventilator (*n*=1).

The respondents reported that the use of IMT would be inappropriate for such clients with the following conditions: dementia (*n*=8); end-stage COPD (*n*=7); low motivation and lack of understanding of IMT (*n*=5); poor nutritional state (*n*=5); pneumothorax and/or emphysematous condition (*n*=4); existing heart failure (*n*=2); a highly decreased physical activity level (*n*=2); decreased lung compliance (*n*=1); a highly variable intrathoracic pressure (*n*=1); and myopathy (*n*=1). These reasons given for non-use of IMT were similar to those reported by the Canadian physiotherapists.

The most frequent difficulty cited by the respondents for the use of IMT was setting the correct amount of load for the client. As a precautionary measure, they stated that the amount of load was set at a minimum and progressively increased in order to prevent damage to the ventilatory muscles and possible resultant pain and dyspnoea. One respondent in the CSCI survey stated that IMT should be used selectively for clients with neurological conditions, but did not state the reason.

Discussion

The findings of this survey revealed that, as in Canada, IMT in Japan is not widely used for clients with either CSCI (15.4% in Japan vs. 17.4% in Canada) or COPD (26.7% in Japan vs. 4.7% in Canada). One factor for this differential finding may be attributed to the fact that, generally in Canada, IMT is administered by the respiratory technologist[3], a healthcare professional that is not yet available in Japan. However, in the current survey one respondent stated that one certified respiratory therapist was involved in using IMT for clients following CSCI. The rate of administration of respiratory muscle training among respondent physiotherapists was revealed to be 24%[4], although it is not clear whether this percentage included the use of IMT carried out specifically by physiotherapists. The above finding suggests that IMT has not pervaded the practice of pulmonary rehabilitation for clients with COPD. The reasons for non-use of IMT to COPD clients by the Japanese physiotherapists were similar to those cited by the physiotherapists in Canada[3].

Comparison of study results vis-á-vis literature on IMT effectiveness

In both the CSCI and COPD surveys 13% and 37% of the respondents, respectively, cited that priority was given to rehabilitation interventions such as *general exercise and or training for ADL* as the reasons for non-use of IMT. This finding suggests that physiotherapists would possibly prefer to give COPD clients exercise tolerance training, synchronisation of breathing and bodily movement and treatment for strengthening of lower limb muscles, all the protocols of which have already been verified as being effective[5]. Alternatively, the above finding may signify a possible lack of awareness regarding the importance of chest care on the part of the Japanese physiotherapists. *Lack of evidence for the efficacy of IMT in the literature* was cited as the reason for non-use of IMT in 11.0% and 22.6% of the respondents in the CSCI and COPD surveys, respectively. According to Brooks et al.'s systematic literature review[6], all of the articles they reviewed mentioned the use of IMT for clients with CSCI at the fourth to seventh level for at least 15 min, twice per day and for five to seven days per week. It was found that the strength of the ventilatory muscles increased for both the IMT and control groups using abdominal weights and/or some unknown intervention. There was a significant difference in the level of dyspnoea the clients experienced between the two groups when measured on the *Borg Scale* with 2.9 for the IMT group and 1.4 for the control group[6]. The meta-analysis by Lötters, et al. revealed that both *IMT alone and IMT with general exercise* significantly increased the strength of the ventilatory muscles and decreased the level of dyspnoea[7]. Further, Geddes, et al.'s study confirmed that IMT with the use of a Threshold trainer significantly improved the clients' ventilatory muscle strength and endurance and decreased their level of dyspnoea[8]. Although the effectiveness of ventilatory

muscle training is ranked on a scale of B (due to lack of scientific evidence) in the *Japanese Rehabilitation Guideline for COPD*[5], some evidence has shown otherwise[7,8]. For the respondents in the COPD survey who cited *lack of evidence for the efficacy of IMT in the literature* as the reason for non-use of IMT, it is possible that they placed emphasis on strengthening of the lower limb muscles, exercise tolerance training and dyspnoea-reduction measures in the case of clients with COPD, all of which are ranked A (scientific evidence verified) in the *Japanese Rehabilitation Guideline for COPD*[5].

Ten respondents in the COPD survey who used Threshold trainers aimed at 30% PImax as a target for the effectiveness of IMT. This load for improvement of dyspnoea and exercise tolerance is supported by the result of meta-analysis[9]. As the respondents stated in this survey, inspiratory muscles of clients with CSCI and COPD have a higher risk of being fatigued or strained, so that it is necessary to commence IMT training with a minimum load of 20% PImax and to slowly increase it.

Brooks, et al. supported an IMT regimen of >15-min at twice-per-day and >5-days-per-week[6]. In the CSCI survey none of the respondents who engaged in the use of IMT complied with the above frequency of twice daily, but they did, in some cases, comply with the number of days >5 days-per-week of training. Hill, et al. found in their literature review on clients with COPD that a regimen with IMT of >10 min at twice-per-day and >4 days-per-week was effective[10]. More than half of the respondents of the COPD survey fulfilled the latter criteria. Another reason given for non-use of IMT was *impossibility of long-term use of IMT due to time constraint*. The factor for this reason is stated as follows: whether or not IMT can be effectively carried out in the framework of a 20-min intervention programme that is the time allowed for the fee-for-service.

In the COPD survey one respondent reported their reason for selection of a client for IMT being that the diaphragmatic function must be intact. In a client with end-stage COPD the diaphragm becomes flattened due to hyperinflation of the lungs decreasing its range of excursion, and, therefore, any effectiveness from IMT cannot be expected. This respondent's response suggests that he/she would treat only clients without severe flattening of the diaphragm.

When using non-targeted inspiratory resistive trainers such as PFlex clients may unconsciously slow their breathing rate in an attempt to overcome the resistance. Alternatively, clients may increase the breathing rate to overcome the resistance, consequently, leading to an increase in the workload, reduced ventilatory efficiency and oxygenation, and increased shortness of breath[11]. In either case, a training effect may not be achieved. In both the COPD and CSCI surveys six of the respondents reported using PFlex, manual resistance or weights and a fixed breathing pattern. Therefore, they may have used IMT as a means to control the breathing rate. Nine out of the 19 respondents who used Threshold trainers fixed the breathing pattern. It is, however, possible for users of this device to set their own breathing rate because of the provision of a pre-set pressure intensity control incorporated within the device. Two out of the nine respondents who reported setting the breathing pattern may have misinterpreted the question on the breathing rate in regards to the use of the device.

Three respondents in the CSCI survey and nine respondents in the COPD survey employed PEmax as an outcome measure, which was contrary to what the author expected. PEmax of clients has been found to significantly increase following IMT with 40% PImax[12]. However, among those who reported using PEmax as an outcome measure only five respondents in the COPD survey employed 40% or greater PImax (including those who progressively increased it from 30%). Among the other respondents, one in the CSCI survey and four in the COPD survey reported employing 30% or less of PImax. In general, IMT with 30% PImax has been found to result in a non-significant increase in PEmax[13]. One factor for employing PEmax as an outcome measure is that a combination of IMT with a general exercise or

pulmonary rehabilitation programme results in an increase in PEmax.

The diaphragm, often the sole surviving ventilatory muscle, of clients with CSCI may become overloaded and, consequently, further fatigued by the use of IMT. In fact, the diaphragm is naturally maintaining or increasing its strength, which generally nullifies the use of IMT. This may be the reason for why IMT is not popular in its use for CSCI clients.

Despite the increasing body of supportive evidence for IMT, particularly in clients with COPD, it is not widely used by Japanese physiotherapists. In conclusion, further studies on the effectiveness of IMT with clients in the acute stage of CSCI or in acute exacerbation of COPD are required through the implementation of well-designed and randomised controlled trials with adequate modes, intensity, and time and frequency of training. In addition, further education to physiotherapists on treating these two client groups is required in regards to the effects of IMT. This would help to overcome the apparent barriers to the implementation of IMT and further assists its promotion as a treatment procedure for these clients by the physiotherapist.

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頸髄損傷および慢性閉塞性肺疾患の患者さんに対する吸息筋強化法 ―我が国における実施状況―

荻原新八郎

要　　旨

頸髄損傷（CSCI）や慢性閉塞性肺疾患（COPD）では肺合併症による罹病率や死亡率が高い。これらの患者さんの吸息筋は肺合併症の予防に重要な役割を果たしている。そこで全国の現役理学療法士500名の中、CSCI患者さんに関しては250名、COPD患者さんに関しても250名に対し、各疾患の患者さんに対する吸息筋の強化法（IMT）の実施状況について調査した。その結果、回収率は前者が35.6%（89/250票）、後者が40.4%（101/250票）であった。CSCI調査群の有効回答者81名の中、CSCIの治療経験のある者は65名（80.2%）であり、その中の10名（15.4%）がIMTを実施していた。COPD調査群の有効回答者96名の中、COPDの治療経験を有する者は86名（89.6%）であり、その中の23名（26.7%）がIMTを実施していた。以上のように、両調査群共にIMTの実施率は低かった。その要因として、他の治療手段の重視、文献における有効性の欠如、IMTの知識･実施経験の不足、時間的問題が挙げられた。COPD患者さんに対するIMTの有効性を支持する文献は幾つかあるが、CSCI患者さんに対する研究は少ない。したがって、CSCI･COPDの患者さんに対してIMTのさらなる研究が望まれる。加えて理学療法士は、このような患者さんの四肢・体幹の運動機能や、それに基づく日常生活活動の改善を目指す際、生命の維持に直接関わっている臓器の一つ、すなわち呼吸器に常に注目すべきであろう。