**New method of assessing outcome of treatment for cervical myelopathy (M/T method) — preliminary report**

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**Abstract:** In some patients with cervical radiculomyelopathy, neurological examination reveals extreme muscle weakness in an upper extremity with no, or a relatively insignificant, sensory deficit. In assessment of treatment outcome in these patients, the previous method used is thought to be unsuitable. We developed a new method of assessment (the M/T method) in which the recovery of upper extremity muscle weakness is assessed. The purpose of this study was to evaluate this new method. In the M/T method, change in the function of the spinal cord, including the anterior root, is expressed as an index number (recovery rate) in relation to the time-course. The function of the nerve tissue is expressed as the value for the manual muscle testing (MMT) of muscle power, and the muscle tested is represented by one that has the least MMT value before treatment. The unit of measurement of the time-course is 3 months. The index is the difference between the MMT value at the time of follow-up and that before treatment, divided by the number of time units after treatment. The index can be expressed in both fractional and decimal forms. Fractions are useful for examining an individual patient’s progress and the decimal form is useful for comparing the data of multiple patients. The M/T method was employed in 16 patients (13 men, 3 women; age, 45–79 years; follow-up, 6 months — 8 years) whose chief complaints were muscle weakness in the upper extremities and who had undergone double-door laminoplasty. Seven patients had an M/T index of 1 or more; the score was 4 in one patient, 2 in four patients, and 1 in two patients. Two patients had an M/T index between 0 and 1; 0.17 and 0.25. Five patients had an index value of 0. The M/T index in two patients was less than 0; −0.17 and −0.11. Using the M/T method, recovery can be presented as an index number, and as a result, it is easy to compare differences in the recovery rate among patients. The M/T method is useful for evaluation of the viability of the spinal cord, including the anterior root; in particular for those patients in whom neurological examination reveals extreme muscle weakness in an upper extremity with no, or a relatively insignificant, sensory deficit.

**Key words:** method of assessment, cervical myelopathy, M/T method

**Introduction**

In some patients with cervical radiculomyelopathy, neurological examination reveals extreme muscle weakness in an upper extremity with no, or a relatively insignificant, sensory deficit. Crandall and Batzdort first used the term “motor system syndrome” to describe this condition. Keegan suggested the term “dissociated motor loss syndrome”, and Sobue et al. used the term “cervical spondylotic amyotrophy” for the same condition. Controversy remains as to whether these terms describe the same condition and whether this condition is radiculopathy or myelopathy, but it is generally accepted that the anterior portion of the spinal cord, including the anterior root, is mainly affected in this condition. The neurological feature of this condition is that sensory deficit is absent or relatively insignificant.

In general, to assess the effectiveness of treatment for cervical radiculomyelopathy, various methods, which are based on the Japanese Orthopaedic Association (JOA) Score System, are now used. With these methods, the degree to which the symptoms and signs improve after the treatment in comparison with those before the treatment is determined. For example, in Hirabayashi’s method, which is now generally used in Japan, the postoperative sum of individual JOA scores is compared with the preoperative sum. However, this type of method seems to be unsuitable for the condition mentioned above, because the main neurological sign is the muscle weakness in an upper extremity, with few other abnormalities. For this reason, we
developed a new method (the M/T method) to assess the effectiveness of treatment for this condition, in which recovery of the muscle weakness of an upper extremity is assessed.

There is a relation between the effectiveness of treatment and the viability of the nerve tissues. It is natural to assume that a patient in whom symptoms and signs improve quickly has more viable nerve tissues than a patient whose condition takes a long time to improve. Therefore, to assess the viability of the nerve tissues, the time-period in which the improvement occurs must be determined, in addition to comparing the symptoms and signs at some point after treatment with those before treatment. Our new method of assessment involves the element of the post-treatment time-course, which is lacking in other methods, for determining the viability of the nerve tissues more clearly.

In this study, our method was examined in patients whose neurological examination revealed extreme muscle weakness in an upper extremity with absent, or relatively insignificant, sensory deficit.

**Method**

In the M/T method, the change in function of the spinal cord, including the anterior root, is expressed as an index (recovery rate) in relation to the time-course. The function of the nerve tissue is expressed as the value for manual muscle testing (MMT) of muscle power, with the muscle represented by one which has the least MMT value before treatment. However, in patients whose function worsened during the follow-up period, the worsened muscle is represented. Regarding the post-treatment time-course, one unit of measurement is 3 months. Thus, 1 year has four units.

The M/T index (recovery rate) is expressed as the difference between the MMT value at the time of follow-up and that before treatment, divided by the time units (one unit = 3 months) after treatment.

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\text{Recovery rate} = \frac{(\text{MMT at follow-up}) - (\text{MMT before treatment})}{\text{Time units}}
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where “M” is the difference between MMT value at the time of follow-up and that before treatment, and “T” is the number of months after treatment, divided by three. The index is presented in both fractional and decimal forms. Fractions are useful for examining an individual patient’s progress. The decimal form is useful for comparing the changes for multiple patients. The maximum value for the index is 5/1 (5), and the minimum is −5/1 (−5). For example, in a patient whose muscle power improved from an MMT value of 2 to 5 within 6 months after treatment, the recovery rate is 3/2 (1.5); that is, the difference between MMT after and before treatment (5 − 2 = 3) is divided by the 2 units (6 months) of the time-course.

**Patients**

The M/T method was employed for patients whose chief complaints before the operation were muscle weakness in the upper extremities and who had undergone double-door laminoplasty. There were 13 men and 3 women. Their ages at the time of operation ranged from 45 to 79 years. The follow-up time ranged from 6 months to 8 years.

**Results**

Seven patients had an M/T index of 1 or more; the index was 4 in one patient, 2 in four patients, and 1 in two patients. Two patients had an M/T index between 0 and 1; 0.17 and 0.25. Five patients had an M/T index of 0, and two patients had a negative index; −0.17 and −0.11.

With the M/T method, differences in recovery can be expressed as differences in the index number, and the patients can be subdivided into four categories; those whose nerve tissue function improved quickly, those whose function took a long time to recover, those whose function did not change or whose change was very slight, and those whose function worsened.

In the patients whose function improved quickly, this took up to 3 months (Table 1).

In the patients whose function took a long time to recover, the proximal muscles of the upper extremities, i.e., deltoideus and biceps brachii, were mainly affected (Table 2).

In the patients whose function did not change, the distal muscles of the upper extremities, i.e., abductor digiti quinti and flexor digitorum profundus, were mainly affected (Table 3).

In the patients whose function worsened, this occurred more than 1 year after operation (Table 4).

**Discussion**

To investigate nerve tissue viability in patients with cervical myelopathy, recovery should be examined in relation to the time-course after treatment. It is natural to assume that a patient in whom the symptoms and signs improve quickly has more viable nerve tissue than a patient whose condition takes a long time to improve. The feature of the M/T method is that it involves the