

## OVERVIEW OF ARTICLES IN EARLY VOLUMES OF SJRM

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This article reviews papers published on the start of *Scandinavian Journal of Rehabilitation Medicine* (SJRM), mainly related to: (i) methodological studies of muscle function and perceived exertion, (ii) studies of the background to and use of physical training in clinical praxis, and (iii) studies of respiratory problems and treatment in patients with spinal cord injury. The importance of the findings in those presentations for the future development of research and clinical praxis in rehabilitation medicine is discussed.

#### METHODOLOGICAL ARTICLES ON MUSCLE FUNCTION AND PERCEIVED EXERTION

An article by Nachemson & Lindh (1) described methodology for the measurement of strength of back muscles, using mechanical dynamometers. They showed that the strength of spinal and abdominal muscles was of doubtful importance for the prevention of low back pain syndrome. Nachemsson was subsequently appointed Professor of Orthopaedic Surgery in Göteborg, and further elucidated the prevention and treatment of low back pain. For example, in a paper in the first issue of SJRM he set out critical and constructive comments on the use of physiotherapy for low back patients (2). Lindh, who at the time of the study was a physiotherapist, became the first from her profession in Sweden to complete a doctorate and subsequently, as a physician, was appointed Specialist and Associate Professor in Rehabilitation Medicine.

Methodology for the measurement of isometric muscle strength was reported by Höök & Tornvall (3), using strain gauge equipment, and the possibility of adjusting the measuring devices with respect to the length of the trunk and extremities. The equipment was later used in studies of muscle function in various patient groups and in training studies, both in healthy individuals and in different patient groups, some of which were published in SJRM. Nordgren (4) published a study on anthropometric measures and muscle strength in young women, and discussed “corrections” when comparing results from men and women. Pedersen & Staffeldt (5) studied various types of tests of back muscle strength, and found that tests of isometric muscle strength were probably most reliable and best suited to the prediction of maximal lift.

An important, and very often cited, paper by Gunnar Borg (6) on perceived exertion as an indicator of

somatic stress was published in issue 2 of SJRM. The scale has 6–20 steps, with verbal anchoring for every second step. It has been used in many studies on physical work capacity and training. To date, this particular article has been cited well over 4,700 times. Another article by the same author on the same topic, published in 1982 (7), has been cited more than 13,000 times.

Hansén & Ottosson (8) described a new tilting table for patients in the prone position, which made it easier for some patients, for example those with high cervical lesions, to use their arms when lying down.

#### PHYSICAL ACTIVITY AND TRAINING

A series of articles in issue 3 (1971) reported the background and current use of physical training. Grimby & Saltin (9) described the physiological effects of physical training in general. At the time of publication the content was relevant and up to date, and it is currently still valid, although further information is now available on the details of training effects, especially at the molecular level in the muscle tissue. As noted in the final sentence of the article, further epidemiological studies are necessary to establish the favourable effects of increased physical activity for primary prevention. Such studies are now available; to a large extent concerning different health conditions; for example, for cardiovascular diseases, see Li et al. (10).

In a review of physical training in different patient groups in 1971, Höök & Grimby (11) gave a pertinent summary of its use at the time. In the 1960s physical training was starting to be used in several medical conditions, and experience was being gained. Scandinavia and other north-western European countries were at the forefront of this methodology, together with some centres in the USA. However, randomized controlled trials (RCT) were usually not available, an exception being a study in Göteborg on physical training after myocardial infarction, published by Wilhelmssen and co-workers (12). In the following years a large number of RCT studies were published on this topic, and the benefit of physical activity in various clinical conditions was well established, as can be seen from several reviews (13, 14). It is notable that Saltin spent nearly half a century researching and writing on the preventive use of physical exercise and training in healthy persons and in various clinical conditions, in later years together with Pedersen (14).

The article by Höök & Grimby (11) pointed out that considerably increased effort was required in the education of physiotherapists concerning training using conditioning exercise and activation of different patient groups. This has since become reality, with increased theoretical and practical knowledge, scientific training and independent research in these and other allied medical professions. The use of training and activation in clinical practice has increased markedly.

Saltin published guidelines for physical training (15). The basic principles remain valid and of importance, as they appear in this and similar publications that created the basis for physical training, both for preventative purposes and, appropriately modified, for different clinical conditions. The recommendations have naturally been modified and applied to different situations, and their scientific basis strengthened to a large extent, but some general principles are still valid. These can be found in the recommendations of The American College of Sports Medicine (16) and in FYSS 2017 (Physical activity in the prevention and treatment of disease) (13).

Issue 3 of SJRM also included articles on the physical training of handicapped schoolchildren (17), in which the physiological effects of training were demonstrated, and on the use of physical activation in psychiatric praxis, which was strongly advocated by Dencker (18), and which, at that time, was relatively new and little known in clinical therapy. The effect of physical training has now been clearly observed, both for cognitive functions (19) and mood, with clinical use in depression in particular (20). The use of physical activity and training in the management of patients with schizophrenia appears to be successful and can improve physical condition, psychiatric symptoms, social and physical function and quality of life (21), probably even to an extent that is not possible using traditional treatments. Thus, the views expressed by Dencker (18) at an early stage have now proven to be of clinical value and are used in clinical praxis.

### RESPIRATORY FUNCTION IN PATIENTS WITH SPINAL CORD LESIONS

In a series of 4 articles in issue 3 (1971) Axel R. Fugl-Meyer, as the first or only author, described different aspects of respiratory function in patients with spinal cord lesions. These articles belong to Fugl-Meyer's doctorate thesis. Reduced vital capacity was reported as a result of reduced total lung capacity and expiratory reserve volume, with a further reduction in sitting and head-up tilted position, particularly in patients with cervical spine lesions. The maximum respiratory pressures were markedly reduced in these patients (22). Another article, on patients with tetraplegia, demonstrated re-

duced maximum expiratory flow over the whole vital capacity, as well as reduced maximum expiratory pressures (23). However, flow-volume curves during forced expiration and inspiration, and during quiet breathing showed considerable flow and volume reserve during quiet breathing, except in 2 patients with the highest lesions. No patients showed evidence of hypoventilation. In a third paper, on ribcage and abdominal volume ventilation partitioning in patients with tetraplegia, the contribution of the ribcage to tidal volume was usually lower than in normal subjects (24). However, some findings could not be fully explained. The numbers of subjects in the studies by Fugl-Meyer were unfortunately rather small, at least partly dependent on the availability of patients at the clinic in Göteborg.

At that time, studies on respiratory function in patients with spinal cord injury were scarce, and thus the studies by Fugl-Meyer presented new information. However, in subsequent years a relatively large number of studies on respiratory function in these patients has been published, with larger groups of subjects and with repeated measurements (e.g. 25, 26), including studies on chest wall mechanics in patients with tetraplegia (e.g. 27). In that study an optical contour mapping approach was used to record ribcage and abdominal volume partitioning and compliance. It was found that the abdomen contributed considerably more to the tidal volume in patients with tetraplegia than in normal persons, confirming in general the results from the study by Fugl-Meyer & Grimby (24). Abdominal wall compliance was increased, with a reduction in ribcage compliance indicating increased stiffness (see below for the treatment approach for respiration function in patients with tetraplegia).

In the final article by Fugl-Meyer in issue 3, 6 patients with tetraplegia were treated with insufflation using a specially constructed pump and forced inspiration and expiration against resistance (28). A moderate increase in total lung capacity and marked increase in expiratory reserve volume and maximum voluntary ventilation were achieved. In a later study by Hultgren et al. (29) initiated by Fugl-Meyer, on 11 patients with tetraplegia, the reduced total lung capacity, vital capacity, expiratory reserve volume and maximal respiratory pressures were improved after 6 weeks of similar training. Improvement was largely maintained after 1 year and even in 5 patients re-studied after 5 years. As a background to Fugl-Meyer's studies it is of interest to note that, with glossopharyngeal breathing (GPB) approximately one-third volume could be added to the vital capacity in patients with tetraplegia (30), and that an increase from 30% to 65% of predicted normal vital capacity was shown after learning GPB (31). Although Fugl-Meyer's technique did not produce such a large increase in vital capacity, it still had

valuable clinical effects and eliminated problems in learning the GPB method. Unfortunately, the findings by Fugl-Meyer and co-workers have not resulted in any documented clinical practice in patients with spinal cord injury. However, a positive effect on vital capacity, with less decline after active lung volume recruitment (“air stacking”) using passive insufflation was shown recently by Chiou et al. (32) in patients with Duchenne muscular dystrophy. Several theoretical explanations were given for the improvements, one of which was the same as in the original article by Fugl-Meyer (28), that there was an increase in compliance of the ribcage with a reduction in the stiffness of tendons and ligaments.

### GENERAL COMMENTS

The series of articles published in the first 4 volumes of SJRM reflects the Editor’s interest in presenting the physiological background to the assessment of function and interventions in rehabilitation. Similarly, the neurophysiological background was demonstrated in articles dealing with, for example, electro-diagnostic methods, and treatment procedures, such as peripheral nerve blockade with phenol, cooling for spasticity, and muscle vibration. This demonstrates the important ambition at that time to give rehabilitation a basis in medical sciences. The Editor also took the opportunity to publish articles from international meetings, on topics such as head injuries and psychological aspects of cardiac rehabilitation, as described in more detail in a review article on the first four volumes of SJRM (33).

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