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Special Rehabilitation Treatment Methodology: INFINITY method®

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Abstract

The INFINITY method® is a special rehabilitation method developed at the Rehabilitation Institute in Brandys nad Orlicí, Czech Republic. It is a kinesitherapy approach based on neurophysiology, biomechanics, and anatomy. The method is employed during rehabilitation of patients with functional and/or structural changes of the musculoskeletal system. It allows adjustment of the postural control system of the body, which gradually improves balance and symmetrization of the whole body in space, thus creating a precondition for better quality and more efficient movement. Specifically, therapy movements can be active and/or passive, and great variability of active movements is a perfect advantage for autotherapy. Now, the corrective therapeutic movement and posture can be conscious, meaning there is an increased awareness and control of the patient's whole body, and/or subconscious, which is based on a reflex therapy. In both cases, straightening and balancing of the patient's body are increased. This method positively affects the musculoskeletal system and quality of the soft tissue, such as the muscle and connective tissue. Thanks to its well-crafted methodology, easily practiced active exercises, and passive therapy performed with the help of a therapist, the method works well for patients with painful disorders of the spine and joints.

Keywords: INFINITY method®, low back pain, rehabilitation, musculoskeletal model, plantography, posturography

1. Introduction

Traditional physical therapy or fitness training has emphasized strengthening of individual muscles. It has been proposed that the skill or the quality of the movement pattern that is used could be more important than achievement of muscle strength [1]. We have observed a demand for rehabilitation treatment based on the knowledge of modern science in our clinical

practice. Therefore, a new rehabilitation technique has been developed with emphasis on simple comprehensible principles, allowing a wide range of variations in therapy and exercises. The new method is applicable for patients with a limited range of motion, for patients after surgery, as well as for patients sustaining moderate diseases of the musculoskeletal system like low back pain (LBP). The new method can also be preventative, keeping people healthy and fit. The specific aim was to develop a large series of autotherapeutic exercises. The method has been developed, and we keep on improving it by incorporating original theoretical knowledge and experience gained in everyday clinical practice.

Our special rehabilitation method is called the INFINITY method[®]. Its name comes from the English word *infinity* because it utilizes movement in a figure of eight as a key segment of the exercises. The INFINITY method[®] is a special rehabilitation method developed at the Rehabilitation Institute in Brandys nad Orlicí, Czech Republic.

The method has been verified in several clinical studies. We hypothesized that there would be certain differences in all measured values of patients before and after rehabilitation treatment with the INFINITY method[®]. The aim of one study was to confirm the relationship between the values of the center of force (COF) that were measured and the pain perceived by low back pain patients using a visual analogue scale (VAS), before and after therapy. The results were then used to assess the effectiveness of the INFINITY method[®] for treatment of patients with LBP [2]. This clinical study of 331 patients showed considerable improvement in all measured parameters. Characteristics of individual groups are described in **Table 1**.

Gender		
Females	234	(70.7%)
Males	97	(29.3%)
Mean age (SD)		
Females	61.5 ± 13.32	
Males	61 ± 12.46	

SD, standard deviation.

Table 1. Characteristics of patients with low back pain.

2. INFINITY method[®]

The INFINITY method[®] presents a kinesitherapeutic approach based on neurophysiology, biomechanics, and anatomy. It is a unique rehabilitation method used in rehabilitation and movement medicine, and it can be applied in patients with musculoskeletal system diseases. The method is employed during rehabilitation of patients with functional and/or structural changes of the musculoskeletal system. It allows adjustment of the postural control system of the body, which gradually improves balance and symmetrization of the whole body in space, thus creating a precondition for better quality and more efficient movement. Specifically,

therapy movements can be active and/or passive. The great variability of active movements is advantageous for autotherapy, thanks to its well-crafted methodology, easily practiced active exercises, and passive therapy performed with the help of a therapist. The method works well for patients with painful disorders of the spine and joints. The corrective therapeutic movement and posture can either be conscious, meaning there is an increased awareness and control of the patient's whole body, and/or subconscious, which is based on a reflex therapy. In both cases, straightening and balancing of the patient's body are increased. This method positively affects the musculoskeletal system and quality of the soft tissue, such as muscle and connective tissue. The INFINITY method® can even be applied in the acute phase when a patient may be suffering from intense pain. Therapy and exercises are based on improvement of stabilization, centering, coordination, perception, and control of the entire body, including the spine. The INFINITY method® is a method of rehabilitation aimed at stabilizing and strengthening the thoracic, back, and abdominal muscles, including deep stabilization system of the spine (DSS) with connection to diaphragmatic breathing. At the same time, it enables increased mobility and flexibility via relaxation, stretching, and mobilization of soft tissues of the musculoskeletal system.

3. Types of movement

The method uses three types of 3D movement. Components of INFINITY method® include visualization, micromovement, and macromovement. Visualization as therapy is especially used by more disabled patients. Micromovement (which is movement in millimeters) can be also used by disabled patients or by patients with a limited range of motion, because of intensive pain or restrictions and other medical indications, for example, patients with discopathy. Micromovement is a fine movement that minimally loads the motor system, improves muscle activity, and trains the higher motor centers in the central nervous system. Macro-movement (which is movement in centimeters similar to tai chi movements) allows this application to be used by less-disabled patients. The macromovement component can also be used as a prevention of low back pain. 3D movements in the continuous figure eight and linear motions are performed from the center of the body and back to stabilize and centralize the whole body and spine, for example, in low back pain patients. The center of the body is identified as the patient's visualization of the body's median. INFINITY method® works in different part of the body. Individual areas of the body targeted by INFINITY include the head, chest, pelvis, spine, and so on. Additionally, the whole body and/or upper and/or lower extremities can be activated by INFINITY. The therapy includes special exercises and training of breathing, which allow both muscle relaxation and activation of several muscle groups, including the deep stabilization system, as well as improving psychological factors.

4. Indications

The method presents many opportunities in the therapy of patients sustaining musculoskeletal system diseases, and it has almost no contraindication if applied well. Patients can visualize

exercise in their mind, and in normal patients, this type of visualization activates muscles and the central nervous system with no overload or damage. The same is valid for micromovements where the range of movements is in millimeters.

The method is very effective when applied in patients with muscle imbalance, patients with changes of muscle tonus (e.g. trigger and tender points), and patients with low tissue quality (mainly older patients). We have achieved excellent results in patients with scoliosis, posture malfunction, as well as patients with spinal pain.

Rehabilitation treatment can also be given to patients with degenerative changes of the musculoskeletal system affecting function, structure, and pain (such as spondyloarthritis, spondylosis including root syndromes, and osteoarthritis of other joints), to patients after surgery (orthopedic and trauma surgeries like arthroscopy, joint replacement), and to patients after other traumas.

5. Statistical studies

We evaluated the efficacy of the rehabilitation therapy using the plantar pressure measurement platform, for example, the pressure mat system MatScan (Tekscan, USA). The patients were assessed using plantography and posturography, during both the start and the completion of treatment. During the measurement process, the patients stood up and had their eyes open. The results were compared before and after the INFINITY method[®] therapy. We compared the values measured before and after the intervention of the INFINITY method[®] [2]. Several variables were measured such as bilateral pressure on the right and left soles of the feet, gravitational forces between both soles, anteroposterior (A-P), and mediolateral (M-L) displacement of COF [3] (COF being the center of gravity of the body between both soles of the feet). During a 30-second period, we recorded the change in value of the COF and the area defined by the movement of A-P and the M-L of the COF. These data allowed us to calculate the difference in COF and COF area before and after INFINITY method[®] therapy. A total of six dependent variables were statistically evaluated. Five of these variables were the posturographic measurements and are presented in **Table 2**.

Feet parallel, eyes open			Feet parallel, eyes closed		
Parameter	Mean (cm)	SD (cm)	Parameter	Mean (cm)	SD (cm)
Area before*	2.76	4.88	Area before*	3.09	4.46
Area after*	2.23	3.01	Area after*	2.40	5.47
Dist before	37.72	16.64	Dist before*	50.30	30.56
Dist after	36.97	15.26	Dist after*	46.68	27.50
Var before	0.03	0.02	Var before*	0.04	0.03
Var after	0.03	0.02	Var after*	0.04	0.02
AP Exc before	2.75	1.25	AP Exc before*	3.25	1.61

Feet parallel, eyes open			Feet parallel, eyes closed		
Parameter	Mean (cm)	SD (cm)	Parameter	Mean (cm)	SD (cm)
AP Exc after	2.67	1.14	AP Exc after*	2.87	1.44
ML before*	1.80	1.39	ML before*	1.77	1.53
ML after*	1.56	1.08	ML after*	1.48	1.41

Feet parallel, eyes open			Feet parallel, eyes closed		
Parameter	Mean (cm)	SD (cm)	Parameter	Mean (cm)	SD (cm)
Area before*	4.43	3.49	Area before*	9.27	8.12
Area after*	4.03	3.80	Area after*	7.90	6.19
Dist before*	49.92	23.79	Dist before	87.60	45.79
Dist after*	46.85	22.03	Dist after	85.34	41.53
Var before	0.04	0.03	Var before	0.07	0.05
Var after	0.04	0.03	Var after	0.07	0.04
AP Exc before	2.94	1.22	AP Exc before*	4.25	1.82
AP Exc after	2.93	3.32	AP Exc after*	3.94	1.66
ML before*	2.98	1.27	ML before*	4.48	2.27
ML after*	2.76	1.44	ML after*	4.21	1.75

Dist, distance; Var, variability; AP, anteroposterior directions; ML, medial-lateral directions.

*Statistical significance at $p < .05$.

Table 2. Posturographic parameters—results of the paired samples test.

A VAS was used to assess each patient’s personal assessment of pain [2]. Given the results, it can be stated that due to the rehabilitation process, there was a statistically significant improvement of the above parameters (**Table 3**). There were significant differences in measurements between pre- and post-rehabilitation treatment.

Measurements in the antero-posterior direction of movement of the COF, medial-lateral movement of the COF, the area covered, the COF distance, and the variation of COF were all reduced. The subjective assessment of pain also showed a statistically significant reduction. The results of this study show that the INFINITY method® rehabilitation treatment resulted

Parameter	Mean (cm)	SD (cm)
VAS before*	5.3	1.78
VAS after*	3.5	1.77

* Statistical significance at $p < .0001$.

Table 3. VAS parameter—results of the paired samples test.

in statistically significant improvements in the observed plantographic and posturographic parameters of stance stability. Subjective pain using VAS was also much lower, which must be considered as being extremely beneficial to overall patient health [2].

There are various rehabilitation techniques employed in clinics that exhibit different success for the given diagnosis. Our empirical evidence initiated further theoretical studies of the musculoskeletal system based on mathematical modeling (**Figure 1**).

The mathematical models can assess muscle activity of various motion patterns and can validate the effectiveness of the motion pattern used in the INFINITY method®. It was hypothesized that a figure of eight motion contributes to the stabilization and the strengthening of trunk muscles, including the deep stabilization system. Advances in mathematical modeling and technology are creating new opportunities that may be able to quantify the effect of physiotherapy on the lumbar spine [4]. The overall aim of one particular study was to compare the effect of a figure of eight movement on deep muscle activation and spinal load with simple movements during rehabilitation.

The spinal muscle and L5/S1 load were assessed using mathematical modeling. The model was designed to study the INFINITY method® that is primarily based on small micromotions [2]. The study indicates that a more complex motion provides higher frequency load to passive structures and requires complex activation of muscles enhancing neural system involvement. The conclusions were that the complexity of motion pattern directly influences the spinal load and muscle activation pattern [5]. Simple pendulum-like or circular-like motions do induce harmonic muscle activation and spinal load. But the results show that the figure of eight pattern (∞) proposed in the INFINITY method® doubles the frequency of spinal loading while conditions complex muscle activation patterns that could induce remodeling in passive structures, strengthen active structures, and effectively train the central neural system (**Figure 2**).

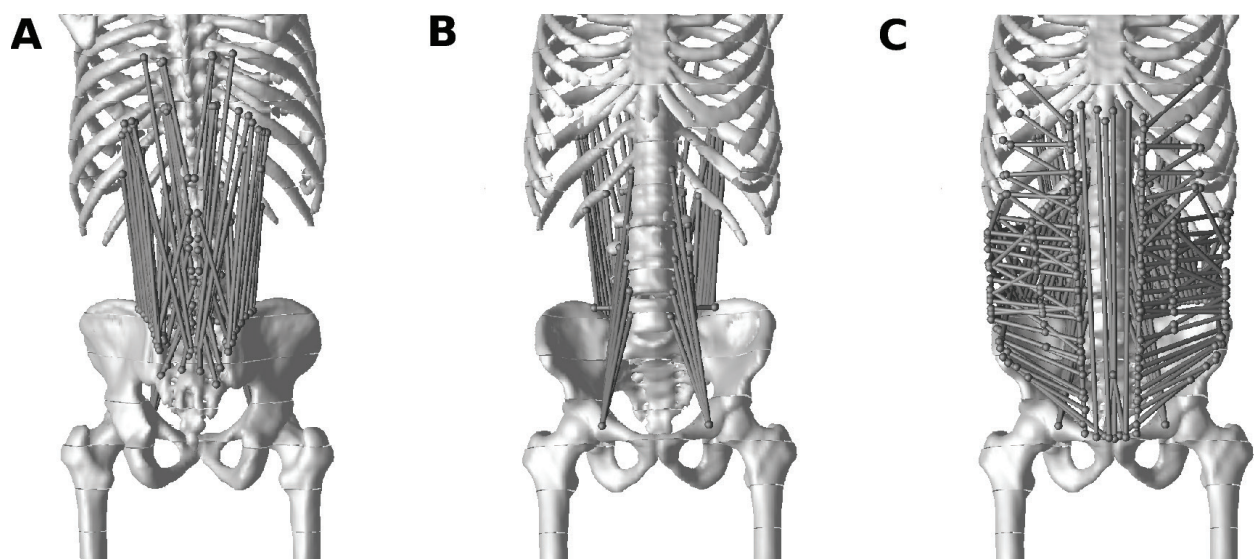


Figure 1. A Rear view, B Front view - spine muscles, C Front view - abdominal muscles.

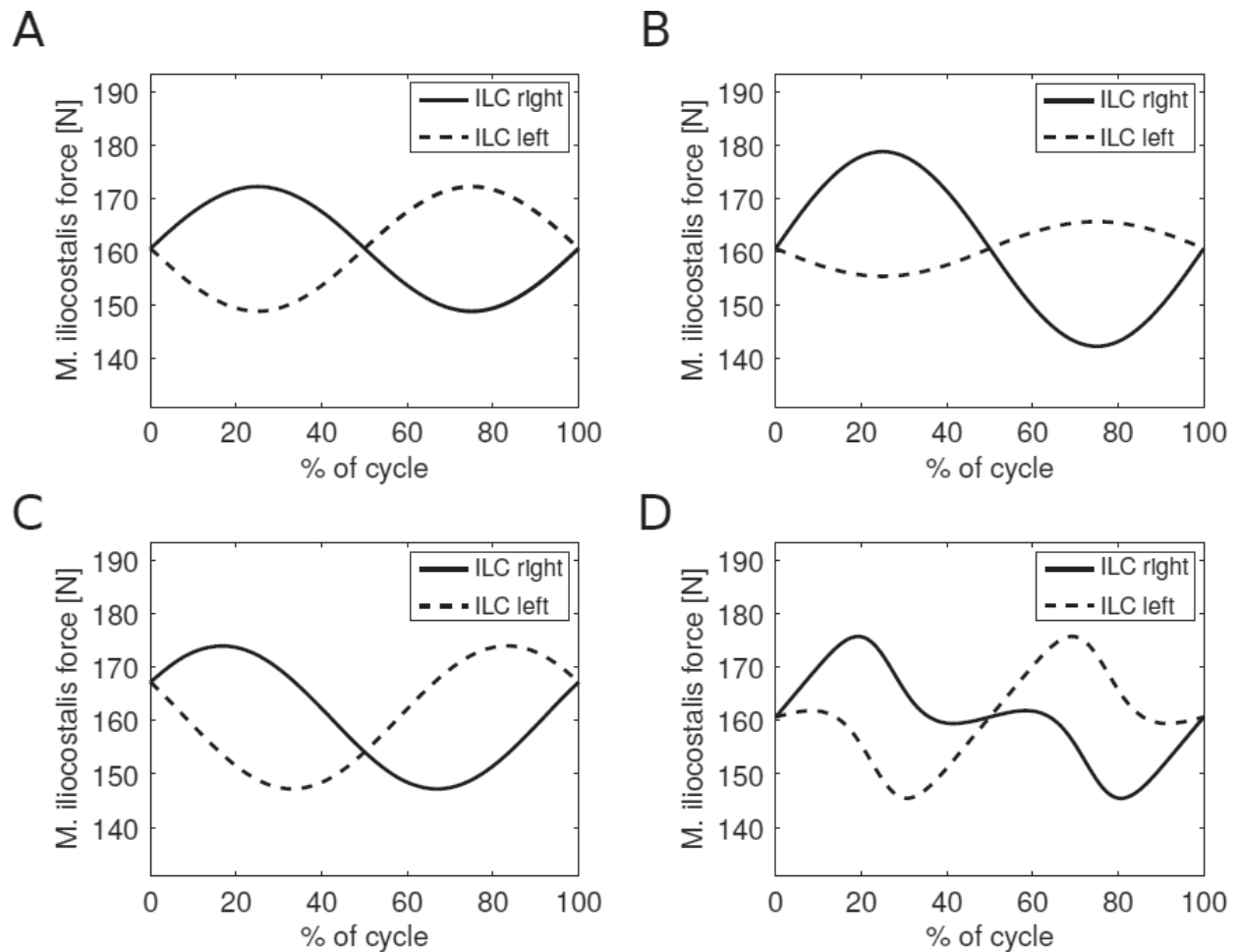


Figure 2. Movement patterns.

6. Conclusions

The INFINITY method® is a rehabilitation therapy and exercises developed by Michaela Tomanová, MD, PhD, who is the head physician and director of a large rehabilitation clinic in the Czech Republic. The clinic has 220 beds. Based on clinical experience gained in the years of practice, Dr. Tomanová has developed a system of diagnosis and therapy for patients with musculoskeletal problems. The basis of INFINITY method® was laid out in the beginning of this century, and the method has been improved and developed since then. The method has been based on knowledge gained in works published already.

The method utilizes motion in all three planes of the body and in all possible directions. The method primarily addresses muscles and connective tissues that are used in an incorrect manner due to our modern lifestyle, that is, muscles that are overloaded or underloaded. Corrective motion patterns similar to daily activities are used. Relaxation and strengthening of individual muscles and muscle groups occur during therapy, and the quality of connective and soft tissues is influenced as well. The muscle tone is normalized. Movements in an

upright standing position are necessary to correct the optimal body posture, including neutral positions. Therapy and exercises gradually and automatically lead to improvement in posture. The method also improves body segment positions because it impacts the whole posture and spine stabilization with the help of gravity effects. The emphasis is on proprioception, exteroception, sense of position, and sense of movement, as well as the patient's awareness of his or her own body and its motion.

The considerable advantage of the INFINITY method[®] is a wide range of autotherapy techniques, well-understood principles, and a wide range of variations. Using these treatments and exercises, the musculoskeletal system is loaded, but not overloaded, and it activates and often relaxes these structures as well. The patient experiences whole-body stabilization after treatment and practices the method with the assistance of a therapist. The treatment also results in biomechanical rebalancing and body symmetrization in a space allowed by structures of the musculoskeletal and central neural system. This should also result in improvement in quality and effectiveness of the motion, and also in improvement in connective and soft-tissue quality and functionality (muscles, ligaments, tendons) as well as a reduction of pain in the musculoskeletal system.

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