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Quality Assurance Study on (Physio)therapy According To the Spiraldynamik® Concept for Treating Patients with Knee Complaints

Martin Pielok[1*] **and Robert Theiler** [2]

[1]*Bachlor of Health (NL), Spiraldynamik® Med Center, Zurich, Switzerland*

[2]*Department of Geriatrics, University Hospital, Zurich, Switzerland*

[*]**Corresponding author:** Martin Pielok, Bachlor of Health (NL), Physiotherapist, Research Assistant, Spiraldynamik® Med Center, Restelbergstr. 27, 8044, Zurich, Switzerland, Tel: +41 (0) 43 210 34 48; E-mail: martin.pielok@spiraldynamik.com

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Abstract

Objective: Knee complaints are the most common disorders seen in daily physiotherapy routine, apart from lower back pain. A number of studies have documented a strong correlation between knee, hip and foot biomechanics. Spiraldynamik® is a holistic therapeutic and movement concept. It combines integral natural principles, such as the helix, with archaic evolutionary movement patterns. According to the Spiraldynamik® concept, the functionality of the knee joint is strongly dependent on the functionality of the hip and foot joints. Treatment of the knee joint therefore includes the hip and foot joints as the entire leg is seen as a kinematic chain governed by structural principles. The aim of this study was to document the outcome of the specific Spiraldynamik® therapy in patients with knee disorders.

Methods: This quality assurance study was performed during standardized Spiraldynamik® treatment in patients with knee disorders in three Spiraldynamik® centers. The patient-reported outcome measure Activity Index was used. The study included 48 patients (mean age: 52.7 year, min: 19 year, max: 89 year) with different knee disorders. Mean treatment duration was six sessions (of 50 minutes each).

Results: A significant reduction was measured for maximum pain (p=0.00), average pain (p=0.00), limitations to activity during household work (p=0.01) and limitations to activity during leisure activity (p=0.00). No significant effect was documented for limitations to activity during work activities (p=0.07), quality of sleep (p=0.12) and general health (p=0.68). A high satisfaction score was documented (97.2%).

Conclusion: The Spiraldynamik® concept can be useful in the therapeutic treatment of patients with knee pain and knee disorders. It seems to be effective in reducing disability in daily activities. In addition, a high treatment satisfaction score was documented. Future quality assurance studies should include randomized observational settings and comparisons with standard care.

Keywords: Knee disorders; Spiraldynamik; Patient-reported outcome; Activity index; Alignment; Movement patterns; Helix; Kinematic chain

Introduction

Spiraldynamik®

Spiraldynamik® is a holistic therapeutic and movement concept. Human locomotion and other archaic movements have evolved through time to give them their present upright stance and the history of this process is mapped out clearly in the anatomy of the locomotor system. Numerous anatomical details illustrate that the principle of the helix underlies the arrangement of bones (e.g. 3D shape of femur), joints (e.g. trochogynglimus joints like the knee joint), ligaments (e.g. cruciform ligaments) and muscles (e.g. sartorius, popliteus).

This principle forms the basis for efficient movement, structural health through the balance of tensions and influence both expression and aesthetics [1]. In contrast, inefficient movement patterns, incorrect loading, wear and injuries are some of the consequences of "improper" use of our bodies. As humans, we make choices regarding our own movement patterns; whether to move correctly or incorrectly in anatomical terms. Implementation of the Spiraldynamik® therapeutic and movement concept means following the inherent good sense of anatomical structural evolution and design. (www.spiraldynamik.com)

Knee complaints

Knee complaints may be related to different types of injuries and disorders of the knee joint (e.g. osteoarthritis, patellofemoral knee pain, periarticular knee pain). However, knee pain can be provoked by causes other than intra or extra-articular knee joint disorders [2].

There is evidence that knee pain can be related to adjacent joints such as the hip and foot. There are patient reports of people with knee disorders due to pes valgus and related restrictions in tarso-metatarsal joint movement [3]. There is additional evidence that muscle weakness in the hips and related movement patterns can have a negative impact on the biomechanics of the knee joint [4,5].

Spiraldynamik® therapy for knee complaints

According to the Spiraldynamik® concept, the mechanical properties of the knee joint are dependent on the adjacent joints. The leg is regarded as one functional unit or as a kinematic chain. Therefore, therapy for the knee includes the hip and the foot. The patients are required to learn novel movement patterns and must include these novel patterns in daily life and in their individual gait. At the beginning of individual therapy, the therapist must check to see if the hip, knee and foot joints exhibit the physiological range of motion.

Some functional deficits are seen in patients with knee disorders, e.g. (all active and/or passive) foot pronation deficits, external rotation deficits in hip joints and internal rotation deficits in knee joints (Figure 1) [6]. Patients with patellofemoral knee complaints tend to have a higher Q-angle compared to patients without such knee problems [7]. Deficiencies in mobility and stability can be improved, e.g. by instructive joint mobilization and stabilization exercises.

During therapy, calcaneal and leg alignment are corrected in the weight-bearing leg. Related hip adduction is to be reduced during the weight-bearing phase of the gait. After correcting "improper" movement patterns, the patients are instructed to assimilate the correct alignment during daily life, e.g. walking, climbing stairs, sports etc.

Methods

Study design

This is a quasi-experimental, retrospective, observational cohort study based on the routine clinical practice registry of the Spiraldynamik® Med Centers in Zurich, Basel and Bern in Switzerland. All patients were asked to complete the validated patient outcome measure Activity Index questionnaire [8] before and during the intervention period of routine clinical practice in 2016.

Ethics and consent

This study is part of a quality assurance program on anonymized patient data; therefore, no institutional review board approval is required in Switzerland.

Patient population

Patients with knee complaints and disorders were included in this data collection. Other inclusion criteria were: age 18-90 years, male and female patients. Exclusion criteria were: cancer, severe backpain with radicular syndrome, surgery in the last six months including hip and knee arthroplasty, neurological deficits such as stroke.

The patients were treated at the three Spiraldynamik® Centers during 2016. All patients were given (physio)therapy based on the common Spiraldynamik® therapeutic approach [5]. A total of 48 patients with knee disorders were analyzed (mean age: 52.7 years, min: 19 year, max: 89 year).

Treatment intervention

Patients underwent an average of six treatment sessions lasting 50 minutes each, applied once a week. The content of a normal session involved instructions on correct leg movement patterns during daily activity, including leisure and job activities, three-dimensional usage and strengthening of the affected leg, especially hip and pelvic-gluteal coordination, tibio-femoral coordination, foot alignment as well as instructions on gait.

In summary, the patients were motivated to rethink their "improper" movement patterns and therefore use novel, "proper" movement patterns based on the Spiraldynamik® concept (Figures 1 and 2).

Patient-related outcomes

The patient-reported outcome measure Activity Index was used as a standardized quality assurance program, which covers core dimensions such as pain and disability in daily life (Table 1).

Before starting the interventions, patients were required to provide a baseline measurement (t1). After an interval of four sessions, the patients were asked to repeat the questionnaire.

Q1	How strong were your maximum pain levels or complaints over the past 24 h? (VAS 0-10)	No pain (0) to severe pain (10)
Q2	How strong were your average pain levels or complaints over the past 24 h? (VAS 0-10)	
Q3	How strongly did pain or complaints affect your quality of sleep? (0/25/50/75/100%)	Not at all/slightly/moderate/strong/ extreme
Q4	How strongly did pain or complaints affect your household activities? (0/25/50/75/100%)	
Q5	How strongly did pain or complaints affect your leisure activities? (0/25/50/75/100%)	
Q6	How strongly did pain or complaints affect your work activities? (0/25/50/75/100%)	Not at all/slightly/moderate/strong/ extreme/I do not work
Q7	Are you satisfied with the therapy you have received? (100/66/33/0%)	Full satisfaction/moderate satisfaction/little satisfaction/not satisfied
Q8	Please rate your perceived general health condition (0/25/50/75/100%)	bad/moderate/good/very good/excellent

Table 1: The eight different questions in the Activity Index questionnaire.

Statistical analysis

The statistical analysis was performed with the software "R" (R Foundation for statistical computing, www.r-project.org). To compare the results at the beginning and during therapy, a non-parametric test was used to analyze the data as these were not normally distributed (Wilcoxon test; significance-level p=0.05).

Results

Forty-eight patients with knee disorders were included in the study (Table 2). All patients exhibited multiple disabilities. Eight patients had unspecific knee complaints. Table 3 shows that most of the patients underwent a treatment period covering 4 to 8 sessions. The results of the Activity Index at the beginning (t1) and during therapy (t2), as well as the results of patient satisfaction, are depicted in Table 4.

Diagnoses	n
Principal diagnoses	
M22.2 Patellofemoral disorders	11
M17.1 Primary osteoarthritis of the knee	9
M25.56 Pain in knee	4
M17.5 Secondary osteoarthritis of the knee	3
S83.2 Tear of meniscus, current injury	3
M23.2 Derangement of meniscus due to old tear or injury	2
M17.3 Post-traumatic osteoarthritis of the knee	1
M21.16 Varus deformity, knee	1
M76.3 Iliotibial band syndrome	1
M76.5 Patellar tendinitis	1
M76.9 Unspecified enthesopathy, lower limb	1
M79.66 Pain in lower leg	1
Q65.9 Congenital deformity of the hip, unspecified	1
G57.9 Unspecified mononeuropathy, lower limb	1
Nonspecific knee pain disorders	8
Secondary diagnoses (collective)	90

Table 2: Knee pain disorders in the patient population.

	n	%
4 treatment interventions	31	65
8 treatment interventions	13	27
12 treatment interventions	3	6
20 treatment interventions	1	2

Table 3: Number of treatment interventions in the patient population.

The results show a significant reduction in pain. Limitations to activity were significantly reduced in household and leisure activities. There seems to be a positive, though non-significant impact on quality of sleep and limitations to activity in work activities. The subjective rating of general health did not change significantly. In addition, a high satisfaction score was documented (97.2%).

Item	t1	SD(t1)	t2	SD(t2)	Effect absolute	Effect relative	p-value
Q1	45.4	22.3	27.5	20.1	18%	40%	0.00*
Q2	30.4	23.6	17.5	14.8	13%	43%	0.00*
Q3	15.1	26.7	9.4	18.3	6%	38%	0.12
Q4	30.2	25.2	19.8	17.8	10%	35%	0.01*
Q5	53.1	27.1	38.3	23.2	15%	28%	0.00*
Q6	21.4	28.7	17.2	23.7	6%	19%	0.07
Q7	-	-	97.2	9.4			-
Q8	54.7	15.2	56.4	18.4	<1%	3%	0.68

Table 4: Results before (t1) and during (t2) the intervention treatment period.

Discussion

The results indicate effectiveness of the Spiraldynamik® therapy approach. It seems that the treatment of knee complaints calls for treatment of both the hip and foot. Knee adduction moments appear to point to risk factors in knee pain disorders (knee osteoarthritis, patellofemoral pain or runners knee). The knee adduction moment describes the extent of internal derangement of the knee joint during the weight-bearing phase when standing or walking. The higher the derangement, the higher the knee adduction moments. Hip adduction moments negatively influences knee adduction moments [9]. Gait and running patterns with pronounced knee adduction moments and hip adduction moments are related to tendinitis and bursitis in hip and knee joints [10].

Knee adduction moments and hip adduction moments can be reduced by reducing contralateral pelvis drop [11]. The aim of the Spiraldynamik® treatment is to teach the patient correct movement patterns in anatomical terms. "Improper" patterns are risk factors for joint disorders and can be corrected in the individual patient by changing his or her habitual movement patterns. As a transmission unit between trunk and leg, the hip joint plays an important role in leg alignment and pelvic coordination. Reduction of contralateral pelvis drop to produce an anatomically efficient movement pattern (through correct gluteal activity) in patients with knee complaints could clearly reduce hip adduction moments and therefore lower knee adduction moments.

Patellofemoral pain syndrome (PFPS) is a disorder which often affects runners [12]. In patients suffering from PFPS, conspicuous coordination patterns can be measured during the weight-bearing phase, e.g. pronounced contralateral pelvis drop, reduced strength in the hip abductors, also showing higher EMG activity levels, deviation in the knock-kneed alignment with higher internal rotation in the hip and weakness of the external rotators, pronounced external rotation of the tibia with high EMG activity in the biceps femoris and vastus lateralis and pes valgus [13-15]. Muscle weakness in the external rotators and abductors of the hip may be related to the pronounced hip

adduction and internal rotation during the weight-bearing phase [14]. Focused training of external rotators and abductors of the hip may reduce the pain - however, there is no effect on the movement patterns during running [12,16].

An important reduction in pain and improvement in function, as well as a measurable long-term change in the movement pattern, can be induced by correcting "improper" movement patterns. This can be achieved by mirror or video feedback training combined with verbal therapeutic guidance and instruction (e.g. "try to arrange your kneecap so it faces forwards, not allowing it to turn inwards.") [17,18]. This individual self-motivation of the patient has been used with significant success in both reducing pain and inducing biomechanical change during running and seems to be a promising approach in the treatment of patients with PFPS [3].

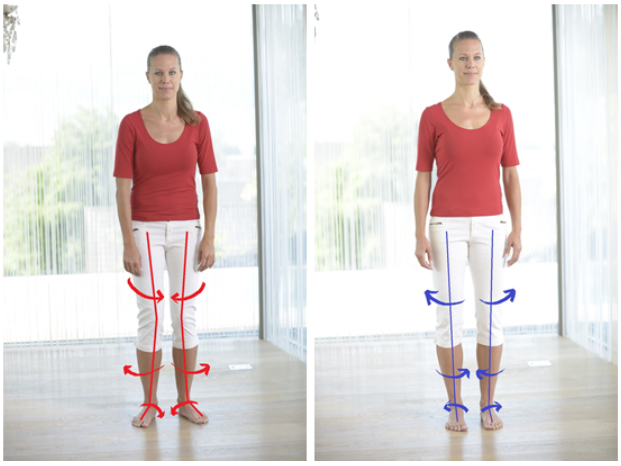

Figure 1: Left: inefficient leg alignment (often seen in patients with knee complaints as well as in runners with patellofemoral pain syndrome), Right: corrected, efficient leg alignment. Source: Spiraldynamik® AG.

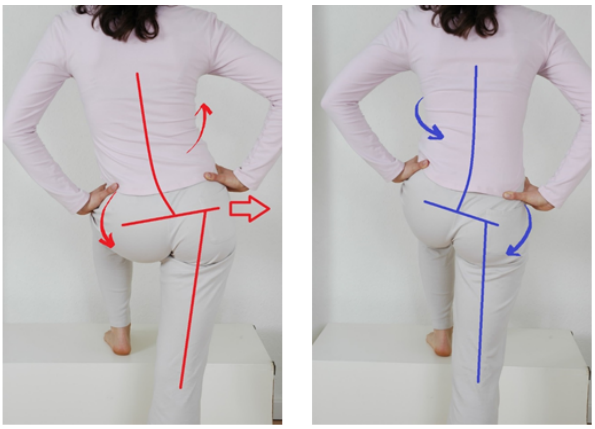

Figure 2: Left: inefficient pelvis drop in weight-bearing phase (often seen in patients with knee complaints as well as in runners with patellofemoral pain syndrome). Right: corrected, efficient pelvis movement in weight-bearing phase. Source: Spiraldynamik® AG.

Strain symptoms in patients with PFPS can induce ineffective movement patterns of the pelvis, hip, knee and foot joints: contralateral pelvic drop in the weight-bearing phase, absence of femoral external rotation in the hip, absence of tibial internal rotation in the knee, as well as pes valgus (Figures 1 and 2). Feedback coaching based on specific therapeutic know-how appears to be an important factor in success and superior to conventional or standard physiotherapeutic care.

In our study in patients with knee complaints, a positive effect was shown for the reduction in maximum and average pain, as well as for the reduction of limitations to activity in household work and leisure activity. The vast majority of the patients were highly satisfied with the therapy they received. Of 48 patients with knee pain disorders, 11 patients had clear diagnosis of PFPS.

One limitation to this observational cohort study is that we had no control group that was subject to different therapeutic approaches, standard care or conventional drug treatment. Additional factors during the treatment period may have also induced a positive effect on the individual outcome for each patient. However, it is important to use patient-reported outcome measures in the clinical setting. We used the Activity Index to document the therapeutic process and the effect of each individual treatment. The documentation and the outcome report can be used as a feedback instrument to discuss the outcome with the patient and to change the therapeutic approach, if necessary. This feedback helps to improve the individual communication between the physiotherapist and the patient. This could be a factor that influenced the highly rated satisfaction score. An additional advantage of standardized documentation could be an effective communication between therapists, medical doctors and health insurances. In future research, larger patient populations should be evaluated and risk factors should be calculated for responders and non-responders.

Conclusion

The Spiraldynamik® concept can easily be applied in patients with knee disorders. Spiraldynamik® therapy was shown to reduce pain and disability. A high proportion of patients were satisfied with the therapeutic approach. Quality assurance documentation appears to be a useful tool for implementing a standardized quality assurance program that measures the patient-reported outcome with the Activity Index and seems to support patient satisfaction, in addition to the therapeutic approach with the Spiraldynamik® concept.

Conflict of Interest

M. Pielok is a physiotherapist and research assistant for Spiraldynamik® AG. R. Theiler is a Medical Advisor to the Qualitouch Foundation and owner of the Trade Mark Qualitouch

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