Spinal Instability: Causes, diagnostics and treatment; The Dynasom Concept:

A new concept evidenced by research results of 440 patients

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Background:
Acquired spinal Instability is a biomechanical dysfunction and its development during or subsequent to the growth phase plays a major role in the progression of spine diseases amongst adults.

Patients and methods:
We evaluated 440 chronic and sub acute low-back pain patients. There were 179 males and 261 females ranging in age from 16 to 92 years (mean age M 48, F 53). The patient population was divided into two groups. (I) the first group consisted of 140 patients (32% of the population) who started the therapy program, but discontinued the therapy for various reasons after completing a total of 9 sessions. (II) The second group consisted of the remaining 300 patients (68% of the population) who completed the whole program of 18 therapy sessions. The patients experienced spine symptoms on average for 8 months prior to our first evaluation. The 440 patients’ diagnoses were categorized into 153 with scoliosis, 28 with Spondylolisthesis, 32 with herniated discs, 70 with degenerative diseases, 141 with multi-segment degenerative changes, and 16 experienced spine symptoms without pathology. However, in 99% of the patient population a minimum translation between the vertebrae in the lumbar spine was present, which causes a Dysbalance in the connective tissues surrounding the spine, and thus leads to spine symptoms.

Treatment:
The two groups received the same balance correction (improvement of the three-dimensional lumbar spine functionality) with the 1st-LBE apparatus twice weekly.

Results:
56 patients (40%) of the first group experienced no improvement and thus no further therapy treatments were recommended. However, 84 patients (60%) reported a significant improvement. These patients discontinued the treatment for various other reasons. Of the second group, 33 patients (11%) experienced no changes and 267 patients (89%) reported a significant improvement. For this last subgroup we continued with a maintenance program of 9 therapy sessions twice monthly with a further follow-up after 12 months.

Conclusions:
Acquired spinal Instability is a major contributing factor to the development of spine diseases and therefore it is crucial to diagnose this early and treat the Dysbalance by improving the three-dimensional lumbar spine functionality. Optimal results in spine stabilization are reached with an intensive program of twice weekly for 18 sessions followed by a maintenance program of 9 therapy sessions twice monthly. This will assure that the spine is not only protected from early wear and tear but also from further pathological risks.
Implication:
Further research is needed to analyze and treat the other causes of the spinal Instability.

Keywords:
Acquired spinal Instability, Spine diseases, Translation, Dysbalance, biomechanical dysfunction.

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Introduction:
Long-term instability of the spine always effects changes in spinal structure, in other words, how the vertebral bodies are ordered to one another, which determines the spine’s mechanical functionality (= posture, range of motion of the vertebral bodies and the effect of gravity).
For each degree of stability, the movement segments require stabilizing components such as the vertebral bodies, facet joints, ligaments, disks, and in particular, muscles. Even the daily intervertebral disk dehydration from morning to evening results in a decrease in the volume between vertebral components and a loosening of the ligaments, therefore also a loosening of the movement segments. The specific flexibility of the spinal ligaments, which function as a linked chain, can not compensate or even out this instability on their own. Therefore, the stability of all movement elements is of crucial importance [4], for if just one stabilizing element is weak, it may allow for hyper mobility. The adaptive, elastic musculature contributes extensively to overall stabilization [7].

This means that when a spinal illness is present, it has usually developed over the course of several years, even if at first no pain symptoms were present. Of course, if poor posture, round or flat back, growth dysfunctions such as a wedge-shaped vertebra, half vertebra, other segment dysfunctions or M. Scheuerman are present, they too influence the functionality of the spine. These types of structural changes lead to poor posture with functional limitations, further promoting spinal instability. Spinal illnesses almost always begin with a change in the static and functionality of the spine. At the beginning, the various contributing factors slowly and subtly cause spinal changes. Within a movement segment a translation or rotation of a spinal component to another occurs. This change in position most often takes place in the form of spondylolisthesis (anterolisthesis and retrolisthesis) or scoliosis and is often combined with a rotation of one or more vertebrae.

Medical science devotes little attention to these light or moderate positional changes, casting them off as a natural adaptation process of the body. Moreover, patients’ symptoms are viewed as a psychological problem and thus the patient spirals into a vicious cycle of pain, reduced mobility and frustration.

The Issue:
Definition of Instability;
The vertebrae are no longer positioned optimally to one another or no longer move optimally together (uncontrolled movement), rather they slip within one or more adjacent movement segments ventrally, dorsally, laterally or rotate. Consequently the load distribution is disturbed and a massive one-sided (unequal) pressure on the disks, vertebral bodies and spinal joints occurs, as well as asymmetric strain on the ligaments and musculature, leading to changes in muscle length. These biomechanical changes cause the disk material to deteriorate or are the result of degenerative changes in the disks. From this, the ossareous structures, such as vertebral bodies and joints, face wear and tear or deform. Furthermore, the connective tissues, including joint capsules and articular cartilage become overstretched, the functionality of the spine (balance and strength = neurological and mechanical problems) becomes restricted and illnesses as we know them develop: scoliosis, slipped vertebrae, disk herniations and degenerative changes (see fig. 1).
Fig. 1: 60-yr old patient with an s-shaped scoliosis (Instability of the spine) causes the advanced degenerative changes (Spondylophytes).

Fig. 2: The misalignment shown here sends distinct impulses from the brain to the left side and weak impulses to the right side. Over time, this information is retained and incorrect posture and movements become habitual. Consequently, the muscular tension (hypertonicity = shortening) on the left side pulls the spinal column over and causes the curvature. On the right side, the muscular tension decreases (hypotonicity = lengthening), further abetting the development of the curvature. This imbalance disturbs both the static and dynamic spinal functionality in all aspects of daily life and the condition worsens through normal exercises and strength training. The result is back pain symptoms which increase through the active form, or are strain related (i.e. workplace).

To summarize, even a misalignment of a single vertebral body leads to a disorder in the afflicted movement segment and changes the entire biomechanics of the spine [1]. Consequently nerve impulses are transmitted incorrectly and an incorrect movement pattern (with a dysbalance) is stored unconsciously. The load distribution along the spine is no longer optimal and an unequal load distribution results along adjacently positioned movement components – vertebral bodies, intervertebral disks, facet joints (cartilage), ligaments and musculature. Over time, an abnormal strain on the affected vertebral structures causes damage as well as early wear and tear. In this case, the organism sends pain signals as a warning mechanism and these must be taken seriously, as treatment of the biomechanical disorder is indicated [11].

Patients and Methods:

From January 2004 to December 2007 a total of 440 patients were evaluated with the LBPRS (the Low Back Pain Rating Scale) at our Dynasom Rehabilitation Centers in Stadelhofen and Wetzikon.

The Dynasom Lumbar spine diagnosis:

1. The radiological diagnosis

In addition to the widely known spinal diagnoses, as part of the Dynasom Concept we also examine the minimal translation of the lumbar vertebrae, to analyze the sacrum position and the alignment of the super-adjacent vertebral components. Furthermore we analyze the sacrum angle (SA) and the relation to TH 12 and to all sub-adjacent vertebrae (see fig. 3 & 4) using the a.p. and lateral x-rays. The structure and form of the individual vertebral bodies, including their configuration influence the form and alignment of the entire lumbar spine.

This information is the foundation for a conclusive assessment of the individual biomechanics and functional deficits of the patient’s spine. Together with the patients description of their ailment the Dynasom diagnosis is complete.
2. The Dynasom three-dimensional function diagnosis with the 1st LBE

The dynamic functional examination takes place on the 1st LBE as part of the initial examination. We observe the patient’s muscular balance and mobility stereotype. (see fig. 5, and 6).

![Fig. 5](image)

**Fig. 5**

Minimal s-shaped scoliosis causes an unequal load distribution along the intervertebral disks of a 30-year old patient.

![Fig. 6](image)

**Fig. 6**

This patient’s 3-dimensional functional test shows a dysbalance in the erector spinae system.

Note: 99% of back patients have a dysbalance in the erector spinae system, independent of the pathological development, which can be observed as the cause of acquired physical spinal illnesses.

3. Muscular function capacity and strength examination of all lumbar movement segments on the 1st LBE

A static muscular function and strength test of the m. erector spinae, m. iliopsoas and m. quadratus lumborum muscles at preset angles of spinal extension takes place on the 1st-LBE (also repeated in the course of therapy in the 3rd and 9th session and subsequently at the end of a treatment series). The machine isolates the spinal muscles for testing purposes using fixations at the knees, hips and shoulders. This allows for an exact measurement of muscle activity, including strength and balance (motorical nerve system) in all lumbar movement segments, which provides us with information to the biomechanics and construction of the spine as well as the individual strength capacity of the patient. The results of the static function and strength diagnosis are used to assess therapy progress and plan further spinal rehabilitation treatment.

The Dynasom lumbar spine therapy

Dynasom Therapy is an active and passive treatment – **Dynasom Dosaged Exertion Therapy (DDET®)**, adapted to each patient based on their diagnosis. In accordance with the spine’s main function, the active therapy consists of repeated extension of the lumbar spine (motion with dosaged exertion) of the over-stretched muscle fibers (weak side), and depending on the established diagnosis, is combined with the lateral function, lateral flexion or rotation of the spine. The passive therapy is aimed to alleviate the shortened muscles (strong side). This dynamic correction leads to an improved of the spine’s three-dimensional functional capacity. This is the main goal of Dynasom Therapy, to improve muscle coordination (balance and strength) by regulating the nerve impulses, which guarantees an optimal spinal function.
To summarize, the functional goals of spinal rehabilitation according to the Dynasom Concept are:

- even out muscular deficits (dysbalance and muscular atrophy)
- reestablish joint stability
- reestablish the physiological joint positions (according to the individual spinal construction)

The dosaged strength improvement is targeted and efficient, and the muscles gain neuromuscular functionality as well as optimal (intermuscular) coordination.

1. The diagnostic measures during the course of therapy

During the progression of therapy it is important to reconfirm the diagnosis and adjust the treatment plan as necessary. A patient’s subjective information (perceived reactions) is central to further treatment progression. Individual strength capacity depends on the patient’s diagnosis, symptoms, constitution and condition. Specific muscular differences (such as muscular deficit pain or reduced regenerative ability) can only be diagnosed through an individual strength improvement treatment of the spinal muscles. A broad knowledge and specialized further education in the fields of radiology, biomechanics and muscle-nerve physiology of the spine are a prerequisite for doctors and physical therapists who implement the Dynasom Concept, interpret patient’s therapy progress and to understand the development of the treatment concept.

2. Effects of Dynasom Therapy

Dynasom Therapy effectuates an improvement of the functionality of the musculature surrounding the spine (responsiveness, proprioception and strength) along with an increase in exertion capacity (dosaged exertion). Both are dependent on one another. By attaining sufficient muscular strength and balance, a functional improvement and therefore optimal spinal movement is possible.

The central aspect of the therapy is to improve the functional capacity of the spine. This is achieved by way of the guided movements on the 1st LBE and the support and corrections of the doctor and physical therapist.

During spinal extension the force of gravity is eliminated and thus the vertebrae are gently pulled apart, minimizing the pressure on the disks.

The extension takes place at the muscular level. The muscles are „shown“ how they should move. The physiological development of the movement into the singular spinal segments enables the correction of disorders and misalignments. The neurological steering so greatly improves the geometry and movement of the vertebral segments to one another and to the components within the vertebral segments, as well as their equilibrium, that the end effect is the vertebrae return to their original position and move optimally. Every spine can be treated individually using a moderate, dosaged modification of the range of motion (three-dimensional movement in flexion, extension, lateral flexion and rotation), taking into consideration the type of dysfunction [13].
Furthermore, with Dynasom’s 1st LBE, the muscles surrounding the spine attain a most effective intensive focused strength increase. The effort intensity is determined per patient individually. Muscle strength capacity refers to the maximum level at which a muscle can perform a typical dynamic or static exertion in a specific time interval and intensity, without any overstrain. Specifically strengthening a patient’s atrophied paravertebral muscle group also improves muscular balance. Here the muscle is steered and activated for exertions specifically opposing/contrary to the misalignment to successfully work against them. Muscle strength and balance, and spinal function are dependent on one another. Both together can bring about a structural change at the origin of the spinal dysfunction/ailment. Such changes are evidenced with Dynasom therapy (see fig. 7, 8, 9, & 10).

![Fig. 7](image1) Prior to treatment: the minimal scoliosis causes the disorder

![Fig. 8](image2) Post treatment: the scoliosis corrected and no longer has a dysfunction

![Fig. 9](image3) Prior to treatment: The multisegmentary Retrolisthesis causes irritation of nerves and places strain on other spinal components.

![Fig. 10](image4) Post treatment: The reestablishment of the vertebrae’s normal position leads to an optimal spinal functionality.

The intervertebral disks increase in volume and the slipping of vertebrae is reduced. Functional scolioses (in different age groups), even those with structural components, as well as structural scolioses (up to a certain age) can be partially corrected. This influences the entire statics and biomechanics of the spine positively, which guarantees the patient a longterm improvement in posture and movement (see fig. 11 & 12).

![Fig. 11](image5) prior to therapy

![Fig. 12](image6) after 2 months of Dynasom treatment

<<When comparing the two x-rays it is evident, that the patient’s observable, prominent, left-convex torsion scoliosis improved significantly with Dynasom Therapy. The scoliosis is remarkably flatter and the torsion components have decreased.>> Peter Walthard, Radiologist/Zurich.

3. Dynasom Therapy treatment intensity

For 80% of back patients two sessions a week for a total of 18 sessions on the 1st LBE is sufficient to attain the desired stability (balance and strength in the erector spinae system). This type of therapy intensity allows the muscles an optimal combination of exertion and regeneration, such that the unequal load distribution on other spinal components is reduced. Reducing overstrain makes the correction of functional scoliosis and spondylolisthesis as well as the reestablishment of an optimal biomechanical function possible, to minimize the risk for lumbar vertebral syndrome in the future.
To maintain the achieved results, a maintenance program of one therapy session every two weeks for a total of 9 therapy sessions in all [9]. Thus, the spine is protected from premature degenerative changes, and the development of further pathological risks can be prevented.

Note: At the end of each treatment series of 9 therapy sessions, we assess whether further treatment is required. The precondition for continuation of treatment is that the completed series were successful.

4. Indications for Dynasom Therapy

Spine
- Lumbar vertebral syndrome
- Lumbar spondylolysis (pseudo-radiculard) syndrome
- Lumbar radicular syndrome

Etiology of these syndromes
- Degenerative changes
- Muscular insufficiency and imbalance
- Misalignments and malformations
- Postoperative conditions
- Spondylolysis, spondylolisthesis
- Spinal canal stenosis
- Inflammations, rheumatic illnesses
- Osteoporosis

Die Indikationen sind unabhängig von Alter, Geschlecht und Beruf des Patienten.

5. Contraindications for Dynasom Therapy

Spine
5.1. Absolute contraindications
- Sarcomas and metastasis in the spine
- Unconsolidated fractures
- Cauda equina syndrome
- Progressive neurological deficits with radicular syndromes

5.2. Relative Contraindications
- Acute radicular syndrome from the first few days up to the first few weeks
- Advanced osteoporosis and osteomalacosis
- Inflammations, rheumatic illnesses in an acute, florid stadium

6. Results of Dynasom Therapy

The 440 patients, all of which underwent the Dynasom Diagnosis examination, were divided into two groups. Both groups received the same spinal balance correction twice weekly, the first group over a total period of one month, and the second group over two months. In addition, the second group completed the maintenance program of one session bimonthly over a period of 4 1/2 months and received a follow-up assessment 6–12 months thereafter.

First group – 9 therapy sessions
40% of the patients in this group experienced no improvement and thus no further therapy treatments were recommended for the following reasons:
1. 75% with advanced multisegmental pain symptoms
2. 7% multi-morbid patients
3. 5% were looking for a quick solution to their illness
4. 5% not interested in working actively
5. 3% traumatized
6. 3% depressive
7. 2% other factors
60% of patients in this group reported a significant improvement of their symptoms. However, these patients discontinued treatment for various other reasons:
1. 30% felt good and did not want to continue treatment.
2. 20% had difficulties with traveling and time pressure due to their work and/or private situation.
3. 20% a third party doctor recommended discontinuation of treatment.
4. 15% health insurance does not support/cover therapy, and insurer recommended discontinuation of treatment.
5. 10% patients thought the therapy was too expensive.
6. 5% other factors

**Second group –18 therapy sessions**

Of the second patient group, 11% experienced no change, therefore a maintenance program was not recommended to this subgroup. However, **89% reported a significant improvement**. Consequently, for this last subgroup we recommended a maintenance program of 9 therapy sessions twice monthly with a further follow-up assessment after 12 months.

A therapy session takes 20–30 minutes depending on the diagnosis and the ability of the patient (not including patient questioning, advising and other services).

**Goals of the maintenance program:**

1. Anchor the achieved therapy results.
2. Long-term maintenance of actual muscle strength and balance.
3. Thereby possibly further reducing spinal symptoms.

**Advantages of the maintenance program:**

1. The patient is becomes independent and learns how to deal with their pain (i.e. residual symptoms), as well as to take responsibility for their well-being.
2. The patient is continually supervised, in the event that something negative happens, such as a worsening of the condition caused by over-strain or a wrong movement.
3. The maintenance program takes place over a longer time period and this ensures a long-term improvement of the symptoms.
4. Long-term observance of the symptoms in different circumstances is advantageous for the overall benefit of the patient.

**Results of the follow-up questionnaire assessment after further 6 to 12 months:**

35% are pain-free and feel Dynasom Therapy is the best therapy they ever did.
45% are very satisfied and confirm that the therapy results are a long-term benefit and assess Dynasom Therapy as a good therapy.
20% are satisfied, but feel Dynasom Therapy is not better than other therapy alternatives.

**Conclusion:**

Spinal instability is a biomechanical dysfunction, which leads to neuromuscular problems. Its development during or subsequent to the growth phase plays a major role in the progression of acquired spinal diseases amongst adults. Spinal instability can be diagnosed early as a pathological development (dysfunction = dysbalance), in either a light, moderate or advanced stadium. The improvement of the three-dimensional lumbar spinal function should be in the foreground of treatment, with the goal of bringing uncontrolled movements in one or more movement segments under control. This positive development is a central component of the Dynasom Concept, not only in treating spinal illnesses, but also in preventive treatment. To guarantee the best treatment results, the patient must be informed that their level of motivation and interest in their body, health and therapy progress is central to a successful treatment.
Literature


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