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Objectives and principles of treatment in idiopathic scoliosis
Obiective şi principii de tratament în scolioza idiopatică

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Abstract

Treatment of idiopathic scoliosis, representing 80% of all cases of scoliosis, has as main objectives: to stop curve progression at puberty (or even reduce it), to prevent or treat respiratory dysfunction, to prevent or treat spinal pain syndromes, to improve aesthetics by postural correction. For each patient, the specific objectives must be set according to the actual clinical condition (scoliosis degree, age at diagnosis).

The choice of treatment methods in evidence-based clinical practice will be done by correlating the information provided by evidence-based medicine with a physical examination performed by a scoliosis specialized physician and with patient preferences: simple observation at 3, 6 or 12 months, physiotherapeutic specific exercises (outpatient or inpatient), night-time, part-time or full-time bracing or fusion surgery.

The most important prognostic factors are: family history, proven progression, decompensation, short curve, pain, flat back (kyphosis reduction) and aesthetic impact.

Physiotherapeutic specific exercises are the first step in scoliosis treatment in order to prevent progression during growth and should be based on three-dimensional auto-correction, training in activities of daily living (ADL), stabilizing the corrected posture, and patient education. Methods with proven efficacy are DoboMed, Lyon, Schroth, Scientific Exercise Approaches to Scoliosis (SEAS), side shift. These exercises are also recommended during bracing and even in painful operated patients. Exercises to improve respiratory function are recommended when needed and during bracing. Sports activities are not a specific treatment for scoliosis, but they are complementary recommended for maintaining general fitness and for their psychological and neuromotor benefits.

Key words: scoliosis, treatment, objectives, physiotherapeutic exercises.

Rezumat

Scolioza idiopatică, reprezentând 80% din totalul cazurilor de scolioză, are ca obiective principale de tratament stoparea progresiei curburilor la pubertate (sau chiar reducerea acestora), prevenirea sau tratarea disfuncţiei ventilatorii, prevenirea sau tratarea durerilor de la nivelul coloanei vertebrale, ameliorarea estetică prin corectare posturală. Pentru fiecare pacient în parte, obiectivele specifice vor fi stabilite în funcţie de situaţia clinică concretă (severitatea scoliozei, vârsta în momentul diagnosticului).

Alegerea metodelor de tratament în cadrul practicii clinice bazate pe dovezi se va face prin corelarea informaţiilor furnizate de medicina bazată pe dovezi cu datele examenului obiectiv realizat de către medicul specialist şi cu preferinţele pacientului: simpla observaţie la 3, 6 sau 12 luni, exerciţii kinetoterapeutice specifice în regim ambulatoriu sau prin internare, ortezare nocturnă, cu timp parţial sau continuă, respectiv intervenţie chirurgicală de fuziune.

Cei mai importanţi factori de prognostic sunt: antecedentele familiale, progresia dovedită, decompensarea, curbura scurtă, durerea, spatele plat (diminuarea cifozei) şi impactul estetic.

Exerciţiile kinetoterapeutice specifice reprezintă primul pas în tratamentul scoliozei pentru prevenirea progresiei în timpul perioadei de creştere şi trebuie să fie bazate pe autocorecţie tridimensională, antrenarea ADL-urilor, stabilizarea posturii corectate şi educaţia pacientului. Metode cu eficacitate dovedită sunt: DoboMed, Lyon, Schroth, SEAS, side shift. Aceste exerciţii se recomandă şi în perioada ortezării şi chiar la pacienţii operaţi în caz de durere. Exerciţiile pentru ameliorarea funcţiei respiratorii sunt recomantate la nevoie şi în timpul ortezării. Activităţile sportive nu reprezintă un tratament specific pentru scolioză, dar sunt recomandate complementar pentru beneficiile psihologice, neuromotorii şi menţinerea condiţiei fizice generale.

Cuvinte cheie: scolioza, tratament, obiective, exerciţii kinetoterapeutice.

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Introduction

Scoliosis represents a three-dimensional torsional deformity of the spine and trunk, causing a lateral curvature in the frontal plane, an axial rotation in the horizontal plane, and a disturbance of the sagittal plane normal curvatures (Grivas et al., 2008). Usually, kyphosis and lordosis tend to be reduced towards a flat back.

80% of the cases of scoliosis are idiopathic. The prevalence of adolescent idiopathic scoliosis with a Cobb angle greater than 10° varies in the general population between 1 and 12%, according to different epidemiological studies. It is very likely also influenced by latitude (Grivas et al., 2006; Wong et al., 2005).

Adolescent idiopathic scoliosis is more frequently progressive in girls, especially for higher Cobb angles. So, for a Cobb angle between 10 and 20°, prevalence is similar for boys and girls, while for angle values between 20 and 30°, girls have a more than 5-fold increased prevalence, and for a Cobb angle above 30°, the prevalence is 7-fold higher in girls (Parent et al., 2005).

Even if idiopathic scoliosis may develop throughout the whole period of childhood and adolescence, it is most common during the growth spurt periods, between 6 and 24 months, between 5 and 8 years, and between 11 and 14 years (Negrini et al., 2005). In adulthood, the potential for progression is much lower, unless the Cobb angle is above 30°, wherefrom the risk for progression starts to increase as the curve grows. Also, a scoliosis angle at the end of growth that is over this critical threshold (for other authors up to 50°) increases the risk of health problems in adult life, a lower quality of life, cosmetic deformity, disability, pain and progressive functional limitation (Negrini et al., 2006a).

General goals of conservative treatment

According to the 2011 Society on Scoliosis Orthopaedic and Rehabilitation Treatment (SOSORT) guidelines (Negrini et al., 2012), the basic objectives of comprehensive conservative treatment of idiopathic scoliosis are:

1) To stop curve progression at puberty
2) To prevent or treat respiratory dysfunction
3) To prevent or treat spinal pain syndromes
4) To improve aesthetics via postural correction.

Specific goals of conservative treatment

Specific goals should be defined for each patient from the beginning of conservative treatment, mainly based on the x-ray examination of the spine, and afterward dynamically adapted according to the change in deformity and patient compliance. For each patient, we should set primary goals, secondary goals and absolute goals (Negrini et al., 2012). Primary goals are set at the beginning of treatment, representing the best theoretically possible outcome in a specific clinical situation, but they cannot be achieved in all cases. Secondary goals are compromise goals, set when it becomes clear that primary goals cannot be achieved, but they are not always reached either. Absolute goals represent the minimal outcome that must be achieved in any case: avoid fusion surgery.

Therapeutic measures

Current guideline recommendations for the treatment of idiopathic scoliosis are centered on an evidence-based practical approach scheme. Each clinical situation is categorized according to the age of the patient and the Cobb angle value. For a specific patient, the treatment scheme should be chosen from a range of possible treatment schemes, graded from the least to the most efficient one, but keeping in mind that the most efficient is also the most demanding one (Negrini et al., 2008a). The choice of treatment should be the result of the integration of knowledge provided by evidence-based medicine, individual clinical expertise and patient preferences. The advantage of this type of therapeutic approach is the avoidance of overtreatment or undertreatment.

Treatment options are physiotherapy, corrective bracing, or surgery for mild, moderate, or severe scoliosis, respectively, with both the actual degree of deformity and prognosis being taken into account (Kotwicki et al., 2013).

So, the possible treatment scheme to be proposed to a patient with idiopathic scoliosis is (graded from the least efficient to the most efficient, but also the most constraining one): no treatment at all, observation every 36 months, observation every 12 months, observation every 8 months, observation every 6 months, observation every 3 months, physiotherapeutic specific exercises as outpatient, night-time rigid bracing (8-12 hours), inpatient rehabilitation, specific soft bracing, part-time rigid bracing (12-20 hours), full-time rigid bracing (20-24 hours) or cast, surgery (Negrini et al., 2012).

The most important prognostic factors are: family history, proven progression, decompensation, short curve, pain, flat back (kyphosis reduction) and aesthetic impact.

The results of a very recently published research (Fusco et al., 2014) emphasize that conservative treatment initiated already in childhood may favorably change the natural history of juvenile idiopathic scoliosis, with the aim of reaching a curve as far as possible from surgical thresholds. Observation, physical exercises, braces can be useful tools in the hand of physicians, but they must be carefully utilized.

Physiotherapeutic specific exercises

A recent Cochrane review has come to the conclusion that there is evidence in favor of exercises as an adjunctive treatment, but of low quality (Romano et al., 2012). Also, the other recent systematic reviews of all the existing studies show the effectiveness of physiotherapeutic specific scoliosis exercises and that auto-correction is the main goal (Fusco et al., 2011; Mordecai et al., 2012; Negrini et al., 2008b). These exercises have been shown to be effective in reducing the progression rate (in early puberty) and/or improving Cobb angle (around the end of growth), as well as in reducing brace prescription (Negrini et al., 2014).

According to the SOSORT consensus paper of 2005, physiotherapeutic specific exercises should always include: three dimensional auto-correction (3D), training in ADL, stabilizing the corrected posture, and patient education (Weiss et al., 2006). A lot of methods ("physiotherapeutic

specific exercises schools") have been developed, but only some of them have published scientific proofs of efficacy: DoboMed, Lyon, MedX, Schroth, SEAS, side shift (Negrini et al., 2012).

The Schroth school has proved its efficiency both for intensive inpatient rehabilitation and outpatient approach. The primary goals of this method, founded in 1920 by Katharina Schroth (Weiss, 2011), are to facilitate correction of the asymmetric trunk and the ability to maintain this in activities of daily living. The treatment program consists of specific exercises and postural techniques and bracing, depending on the curvature pattern, skeletal maturity, risk of progression, and compliance of the patient. The physical therapist uses exteroceptive stimulation and applies passive detorsional forces to facilitate three-dimensional corrections. Corrective breathing techniques enable detorsion of the rib cage to correct the collapsed areas of the trunk (Bettany-Saltikov et al., 2014). For inpatient rehabilitation, the length of stay is between 4 and 6 weeks, with daily sessions: 2 group-sessions of 1.5 hours each, in the morning and in the afternoon (groups are matched according to the individual curve pattern), and shorter individual training sessions between. After discharge, patients should practice their individualised 30-minute exercise program daily.

In order to develop and maintain the correction of the scoliotic posture, asymmetric positioning is used, based on targeted stretching of the collapsed areas of the concave trunk. Overcorrected positions are used. Mirrors are placed in front and at the back of the patient. Therapist assistance is essential in the Schroth program, providing support by guiding resistances, auxiliary handholds, auditory feedback, and specific verbal instructions. Exercises for the correction of the scoliotic posture include: elongation, realignment of trunk segments, positioning of the arms, specific corrective muscle tension.

The primary focus during breathing therapy using the Schroth method is to develop corrective breathing patterns with the help of manual resistances. Mobilization of the restricted thoracic concave side ribs leads to corrections from "inside the body" by improving selective expansion and reduces rotation of the vertebral bodies (Fusco et al., 2011).

DoboMed is a difficult method, developed in Poland by Professor Dobosiewicz. The principle is to correct scoliosis by active movements of the vertebral column, the main corrective technique consisting of an active three-dimensional auto-correction, with special emphasis on the kyphotization of the thoracic spine (Dobosiewicz et al., 2008). The exercises, performed in closed kinematic chains, are based on symmetrically positioned pelvis and shoulder girdle, so that the vertebrae belonging to the primary curve are mobilized from their pathological position towards their normal position in the axial plane of the trunk. Selective respiratory movements guide the derotation of the thoracic spine (Bettany-Saltikov et al., 2014). The last stage is the active stabilization of the corrected position, endured as postural habit (Fusco et al., 2011).

The Scientific Exercise Approach to Scoliosis program (SEAS), based on the former Lyon School methods of auto-elongation, is an auto-correction program. This should be done exclusively by the patient, through spinal deep paravertebral muscles, in all three planes, without external help. The therapeutic goals of the SEAS protocol are to improve spinal stability, to develop balance reactions, and to preserve/improve the physiological sagittal spinal curves (Negrini et al., 2006b). It is founded on the principle of a cognitive-behavioral approach (Fusco et al., 2011).

Side shift exercises consist of auto-correction of the spine curve through a lateral shift of the trunk to the concavity of the curve, so that lateral tilt at the inferior end vertebra is reduced or reversed, and the curve is corrected in the side shift position. For that, patients in standing position are instructed to shift their trunk to the concavity of the curve, to hold the side shift position for 10 seconds, to return to the neutral position, and to repeat the exercise 30 times a day. The method is indicated for scoliosis with a single curve, at any location (thoracic, thoracolumbar, or lumbar). In case of a double major curve, the larger curve is treated. Hitch exercises represent another option for lumbar or thoracolumbar curves: in the standing position, patients are instructed to lift their heel on the convex side of the curve while keeping the lower limb extended, to hold the hitch position for 10 seconds, to return to the neutral position, and to repeat the exercise 30 times a day. In the hitch position, the pelvis on the convex side is lifted, lateral tilt at the inferior end vertebra is reduced or reversed, the curve is corrected and waist asymmetry is diminished. In case of a double major curve, hitch shift exercises could be an option: patients are instructed to lift their heel on the convex side of the lower curve, to immobilize the lower curve by their hand, to shift the trunk to the concavity of the upper curve, to hold the position for 10 seconds, to return to the neutral position, and to repeat the exercise 30 times a day (Fusco et al., 2011; Bettany-Saltikov et al., 2014). Side-shift exercises and hitch exercises are a useful treatment option for idiopathic scoliosis (Maruyama et al., 2008).

According to the 2011 SOSORT guidelines, physiotherapeutic specific exercises should be recommended as the first step of treatment in idiopathic scoliosis to prevent/limit deformity progression and bracing during growth, and should be based on 3D auto-correction, training in activities of daily living, stabilization of the corrected posture, and patient education. A method with scientific proofs of efficacy should be chosen, the therapists should be specifically trained in the method they use, and included in scoliosis treatment teams. Exercises are individualized according to the patients' needs, curve pattern and treatment phase, even if performed in small groups, and should be practiced regularly (Negrini et al., 2012).

The same guidelines recommend that physiotherapeutic specific exercises should also be performed during brace treatment. Spinal mobilization exercises should be used in preparation to bracing, and stabilization exercises in auto-correction during brace weaning. Physiotherapeutic specific exercises are also recommended in painful operated patients, in order to reduce pain and increase function.

Various types of respiratory impairments are present in scoliosis patients: abnormal ventilation patterns (mainly restrictive), impaired function of respiratory muscles, restricted and asymmetric motion of the chest

wall, abnormal patterns of ventilation during exercise. Cardiorespiratory failure is not a common problem, being present only in cases of severe scoliosis, with onset in pre-puberty and with a strong tendency to progression. SOSORT guideline recommendations are to use exercises to improve respiratory function during brace treatment and whenever needed. Physiotherapeutic specific exercises should be used to train regional respiratory strategies in order to promote expansion and ventilation of specific lung compartments (Negrini et al., 2012).

Sports activities are not prescribed as a scoliosis treatment, but they are recommended because of specific psychological, neuromotor and general organic well-being benefits. Physical education at school should be continued. Nevertheless, restrictions may be imposed for certain types of sports activities, according to the severity of the curve and the risk of progression. Sports activities should also be continued during brace treatment, because of physical and psychological benefits, but caution is needed regarding contact and highly dynamic sports. Competitive activities with important mobilization of the spine should be avoided in patients with scoliosis at high risk of progression (Negrini et al., 2012).

Conclusions

1. Conservative treatment initiated as soon as possible may favorably change the natural history of juvenile idiopathic scoliosis.

2. Physiotherapeutic specific exercises are useful tools for the treatment of these patients, on their own or combined with brace therapy, avoiding surgery in a significant number of cases.

Conflicts of interest

There are no conflicts of interest.

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