Literature Review

Physiotherapeutic resources in postural spinal deviations: an integrative review

Recursos fisioterapêuticos nos desvios posturais da coluna vertebral: uma revisão integrativa

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ABSTRACT | INTRODUCTION: This study will evaluate what are the treatment possibilities described in the literature for a school, defined as a lateral curve in the spine, presenting a slight alteration of the vertebrae. **OBJECTIVE:** To identify in the current literature the main physicaltherapy techniques and their benefits for the treatment of scoliosis. **METHODS:** This is an integrative review of the literature on physicaltherapy methods in the treatment of scoliosis. Articles published in 2009 to October 2019 in the electronic databases Medline, Lilacs and SciELO were selected for this review, only articles with Portuguese translation that were submitted to this review. **RESULTS:** After the analysis, seven articles for reading in full were selected for this review. The following procedures were identified: pilates technique, global postural reeducation (RPG), isostretching, klapp method and kinesiotherapy. With the following benefits: improves posture, alignment of the vertebral thoracic spine, improves flexibility, improves asymmetry of the trunk, decreases the intensity of pain, reduces the educational curve, improves postural posture, head alignment, pain, scapulae and highs in height, trunk, abdomen and pelvis, increased strength of trunk flexor and extensor muscles and reduced Cobb angle of scoliosis. **CONCLUSION:** Several physiotherapy methods with benefits for the treatment of scoliosis, highlighting RPG and pilates for improvements in strength, flexibility, pain and reduction of school curves.

KEYWORDS: Scoliosis. Physiotherapy. Treatment.

RESUMO | INTRODUÇÃO: Este estudo vai averiguar quais são as possibilidades de tratamento descritos na literatura para a escoliose, definida como curva lateral na coluna vertebral, apresentando uma leve rotação das vértebras. **OBJETIVO:** Identificar na literatura atual as principais técnicas fisioterapêuticas e seus benefícios para o tratamento da escoliose. **MÉTODOS:** Trata-se de uma revisão integrativa da literatura sobre os métodos fisioterapêuticos no tratamento da escoliose. Foram selecionados para esta revisão artigos publicados de 2009 a outubro de 2019 nas bases de dados eletrônicas Medline, Lilacs e SciELO, apenas artigos com tradução para o português foram considerados para esta revisão. **RESULTADOS:** Após a análise foram selecionados para esta revisão sete artigos para leitura na íntegra. Foram identificadas as seguintes condutas: técnica de pilates, reeducação postural global (RPG), isostretching, método klapp e cinesioterapia. Com os seguintes benefícios: melhora na postura, alinhamento da coluna vertebral torácica, melhora da flexibilidade, melhora da assimetria do tronco, diminuição da intensidade da dor, redução da curva escoliótica, melhora postural no alinhamento de cabeça, ombros, escápulas, ângulo de Talles, tronco, abdômen e pelve, aumento da força dos músculos flexores e extensores de tronco e redução do ângulo de Cobb da escoliose. **CONCLUSÃO:** Existem diversos métodos da fisioterapia com benéficos para o tratamento da escoliose, destacando o RPG e o pilates para a melhora da força, flexibilidade, dor e redução da curva escoliótica.

PALAVRAS-CHAVE: Escoliose. Fisioterapia. Tratamento.

Submitted 03/21/2020, Accepted 04/28/2020, Published 05/15/2020
J. Physiother. Res., Salvador, 2020 May;10(2):355-364
Doi: 10.17267/2238-2704rpf.v10i2.2829 | ISSN: 2238-2704
Designated editor: Katia Sá

How to cite this article: Freitas MGS, Medeiros SML, Câmara GLG. Physiotherapeutic resources in postural spinal deviations: an integrative review. J Physiother Res. 2020;10(2):355-364. doi: 10.17267/2238-2704rpf.v10i2.2829

Introduction

This paper aims to verify what are the possibilities of physiotherapeutically treatment described in literature about scoliosis, and highlights the relevance of the benefits of physiotherapy in patients with this condition, always reinforcing the scientific evidences.

The spine is an important structure to support an upright posture as well as its maintenance, besides the function of protection of the spinal medulla. It is formed by a set of 33 vertebrae divided into five regions, cervical, thoracic, lumbar, sacrum, and coccyx. In its anatomical curvatures of its vertebrae it can be found 2 kyphosis (thoracic and sacrum) and 2 lordosis (cervical and lumbar). In its constitution it is found inserted in several muscles and ligaments that are very important to support and develop its functionality[1].

The spine can suffer some postural alterations, such as sagittal anatomical plane, as well as cervical lumbar hyper lordosis; in which occurs an accentuation of the posterior concavity of the curvatures, thoracic hyper kyphosis; when there is an increasing of the previous concavity of the thoracic curvature, lumbar kyphosis, diminution of the lordotic curvature causing a flattening of this part of the body, and in the frontal plane – scoliosis; it is characterized by a lateral deviation of the spine, and it might present itself as a 'C' curvature or double 'S' curvature[1,2].

Scoliosis was mentioned by the first time by Hippocrates, whose term is derivative from Greek and it means curvature. It is characterized by an abnormal curvature of the spine, superior than 10° according to the COBB method, associated or not to the sagittal and axial planes. The COBB angle measures the spine curvature in the coronal plane, and scoliosis may be classified in soft (between 10° and 20°), moderate (between 20° and 40°) and severe (>50°)[2,3].

It is divided into two groups: Functional or non-structural, and structural or morphological. In Functional scoliosis its curvature is flexible and can be corrected if the patient leans your body to the convex side. Generally, it does not get any improvement and it does not present any vertebral rotation. The structural scolioses present rotation and anatomical alteration of the vertebrae, and it might progress during its growing. In the structural curvature emerges an extension due to vertebrae's rotation named gibbosity seen in the convex side of the observed curve through Adam's tests, used worldwide for detection of scoliosis[2,3].

Scoliosis is classified in the types: congenital; when the individual is born with it, and it is caused due to an abnormality of the fetus' vertebrae. Neuromuscular; it is caused by diseases, such as cerebral palsy and muscular dystrophy. The idiopathic; it does not known what is the main cause, but it is known that it is developed in puberty phase[3,4]. According to the Scoliosis Research Society (SRS), the idiopathic one is responsible for quite 80% of the scoliosis' cases, girls and adolescents are the most affected. In 30% of the cases, the majority of the adolescents has family history of scoliosis. It may emerge between 4 and 10 of age and represents 10% to 15% of all juvenile idiopathic scoliosis[5].

Physiotherapy has as its main goal, to perform a conservative treatment. It is recommended as the first option of treatment for small curvatures of the spine, and its aims to prevent its progression. It is also used in the preoperative and postoperative in spine's correction. It has extensive resources for treating it such as the Klapp method, kinesiotherapy, electrical stimulation of the muscles, orthoses, osteopathy, global postural reeducation (GPR), pilates and iso-stretching[2,6]. This paper aimed to identify what were the main techniques used in physiotherapy and its long-term benefits for treating scoliosis.

Materials and metods

Strategies of researching

The research was made based on Medline electronic data (National Library of Medicine), Lilacs (Latin American and Caribbean Literature in Healthcare Sciences), and SciELO (Scientific Electronic Library Online), between September 10th, 2019 to October 5th, 2019. The following descriptors were used: Scoliosis, Physiotherapy and Treatment, found on Health Science database (HSD) and Medical Subject Headings (MeSH), in Portuguese, using Boolean operators 'AND' (E) and 'OR' (OU). It was also used as a limit in search strategy of published studies between the years 2009 until October 2019, the descriptors researched are on the title or in the summary and they are available electronically.

Selection of the studies

In order to be included, the tracked studies must be in accordance with the following reasons: the researches have to be treated with some therapeutic resources applied to individuals with scoliosis, available at the scientific-electronica database already described, they might have been published between 2009 until October 2019 and they must have translation into Portuguese language. To be apart from this review, if the studies do not fit in the proposed theme or literature review, they will have been excluded from the research.

Analysis of the papers

The search was carried out by two reviewers, who independently evaluated the titles and the summaries; if there were any disagreement among these when it comes to articles selection, it would be solved by another reviewer. After that first selection, the papers were read and those who were not in the stablished criteria were excluded from the study.

Description of the papers

To better organize the information of the papers, it was accomplished a synthesis of the main information of each study in a chart which contains the following topics: author, characteristic of the sample, type of intervention, length of time, duration of the intervention, and results.

Evaluation of quality

To accomplish the methodological quality of the included studies in this review, it was used the Scale of evaluation PEDro[20]. The results are described in chart 3.

Results

In the researched carried out in the bases of electronic database, the followed methodology used was: systematic and meta-analyses (PRISMA) showed in (Figure 1)[21]. In LILACS and SciELO bases were identified, respectively, in each one of the 27 and 26 articles potentially relevant. In the MEDLINE, it was not found any article in Poryuguese language. After title and summaries analysis, 24 from LILACS, and 22 from SciELO were excluded, for they did not address the chosen theme or for being review papers. This way, according with inclusion and exclusion of predetermined criteria; seven of them were selected to be read in full, three of them being from LILACS and four from SciELO. The characteristics of the selected papers are described in Charts 1 and 2.

Figure 1. Flowchart of the selected studies in the bases of electronic data according with the recommendation PRISM

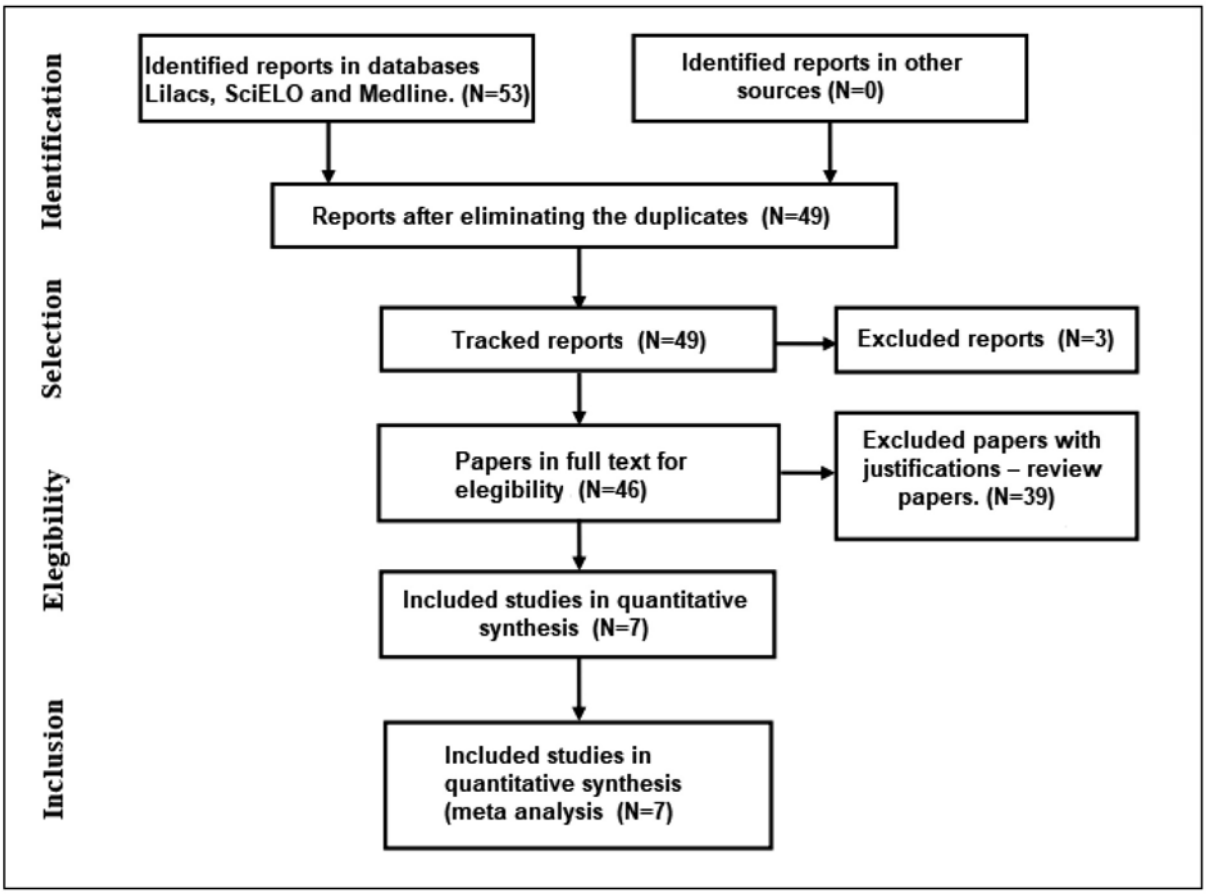

Chart 1. Selected Studies

Author	Characteristic of the Sample	Type of Intervention	Length of time and duration of the intervention	Result
Monte-Raso et al[7]	12 people with an age average of 20 years old with no gender revealed divided in two groups (1 with n=8: with more than 30 attendances in group; 2 with n=4: with less than 30 attendances)	Isostretching	Frequency of 3 times a week. During 54 sessions with 60 minutes of time.	It was efficient in the alignment of the thoracic spine in both groups as well as in the improvement of the flexibility in group 1. It was not efficient to postural asymmetries in the previous and in the posterior frontal plane.
Lunes et al[8]	16 people with an age average among fifteen years old with 3 male patients, and 13 female patients.	Klapp Method	Time length of 10 weeks periodically twice a week. During 20 sessions and longed 70 minutes.	It indicates to a better asymmetry of body and its flexibility. It was not efficient to asymmetries of pelvis, head alignment, and did not occurred modifications in vertebral curvatures.
Toledo et al[9]	20 male and female people with an age average of 11 years old, 11 male people and 9 female people divided into 2 groups (RPG: with n=10 and GC with n=10)	RPG	Lenghth time of 12 weeks twice a week. Sessions with duration between 25 to 30 minutes.	The GRPG presented a significant diminution in the angle of the scoliosis, whilst the GC registered a non-significant increasing.
Segura et al[10]	8 female people with an age average among 10 and 16 years old.	RPG	Frequency twice a week. During 40 sessions at about 45 minutes.	A significant reduction in the angle of the scoliosis, even not registering a difference in the discrepancy of the inferior members.
Araújo et al[11]	31 male and female people with an age average among 18 and 25 years old. Divided in two groups (Control: n=11 and Experimental Group: n=20)	Pilates	Lenghth time of three months during 24 sessions with duration of 60 minutes.	A significant diminution of the intensiveness of the pain in the experimental group.
Miotti de Moura et al[12]	1 indivíduo com idade média de 11 anos do sexo feminino	Pilates	Time lenght of 4 weeks three times a week. During 10 sessions with duration of 60 minutes of time.	Postural improvement in the alignment of head, shoulders, shoulder blades, angle of Talles, body, abdomen and pelvis. Increasing of flexibility and the strenghth of flexor muscles and the extenders of the body.
Fiorelli et al[13]	1 male person with na age average of eleven years old.	Kinesiotherapy	Not revealed	Sharpened reduction of scoliosis' angle.

Source: Researched data (2019)

The total of participants included in the seven addressed studies were from 111 individuals, 63 female (56.76%) and 48 male (43,24%)[8,9,10,11,12,13], and 1 with no gender revealed[7]. In two studies the sample present individuals with an age average between 18 to 25 years old[7,11]. In five other studies, the individuals were aged equal or minor than 15 years old (8,9,10,12,13), in which two of these studies the participants were aged equal to 11 years old[12,13].

Each study had a different duration, one did not reveal the time of the interventions[13]. Two performed the interventions with an average of 10 to 12 sessions totalizing the target minimum time[9,12]. Two performed with an average time of 20 to 24 sessions[8,11], one performed 40 sessions[10] and one performed a time of 54 sessions[7].

The authors from this research chose to use studies from Cobb angle[9,10,11,13], and other for a postural assessment for therapeutic monitoring[7,8,12]. Four of them demonstrated numerical results in degrees regarding the Cobb angle[9,10,13], and one of the does not display this information in its results[11], a study examines and and exhibits a lower limb discrepancy[10], another with chronic pain in the spine[11], three articles were evaluated in a postural evaluation photographed with anatomical points marking[7,8,12], two of the were used to evaluate the flexibility[7,12], and the strength of the extensor and flexor muscles of the trunk[12].

Chart 2. Description of the techniques applied in the selected studies

Technique / Author	Description
Isostretching Monte-Raso et al[7]	Excentric isometric exercices, in which the time of maintenance of postures is ruled by three deep extended-expiration lying, sitting, or on foot, using the ball and the stick. Counting 67 postures.
Klapp Method Iunes et al[8]	Exercices: relaxation, creep next to the ground, horizontal sliding, lateral sliding, big bow, turn the arm and great curve.
RPG Toledo et al[9]	It was used the postures 'frog on the ground' and 'frog on the air'. The evolution of the postures goes according to the breathing control, and the capability of keeping its alignment and necessary corrections, basically depending of the presented conditions by each individual.
RPG Segura et al[10]	Postures sitting and frog on the air
Pilates Araújo et al[11]	Warm-up: 8-minute walk. Stretching the spine forward, rolling over, pulling the leg forward, Mohammedan pray. Specific part: Exercises with ball and exclusive equipment for Pilates technique were used. Twelve exercises were performed with tem repetitions each.
Pilates Miotti de Moura et al[12]	Preparation: Rolling down while standing, stretching in the supine and prone position. Specific parts: specific exercises were used from solo pilates method with some apparatuses. 10 repetitions for each exercise. Body-stress relaxation exercise: this exercise is compounded by three movements, and it is a 5-minute longing each.
Kinesiotherapy Fiorelli et al[13]	Pelvis retroversion, 10 minutes. Feet upon Swiss ball and pelvis augmentation in 12 series three times. Quadrilateral in 90° grade, knees slightly flexed, flexed upper limbs and hands holding Swiss ball with 10 series. Exercises with William's series – 8 series; keeping it for 15 seconds.

Source: Researched data (2019)

According to the selected papers for this review. It was identified the following benefits after performing the exercises of each proposed technique: posture improvement, thoracic spine alignment[7], improvement of flexibility[7,8,12], improvement of body asymmetry, diminution of pain[11], postural improvement in the alignment of the head, shoulders, shoulder blades, Talles angle, trunk, abdomen, and pelvis[12], increased strength of the trunk flexor and extensor muscles[12], and reduction in the scoliosis angle[9,10,13]. In some studies, there was no effectiveness for pelvic asymmetries, head alignment and there were no changes in vertebral curvatures, not effective for postural asymmetries and it did not register any difference in the discrepancy of lower members[7,8,10].

Chart 3. Methodological Evaluation from the studies through the scale PEDro

	2	3	4	5	6	7	8	9	10	11	TOTAL
Monte-Raso et al[7]	X			X			X	X	X	X	6/10
Lunes et al[8]				X			X	X		X	4/10
Toledo et al[9]	X		X	X			X	X	X	X	7/10
Segura et al[10]	X		X	X			X	X	X	X	7/10
Araújo et al[11]	X		X	X			X	X	X	X	7/10
Miotti de Moura et al[12]											0/10
Fiorelli et al[13]											0/10

2. Aleatory allocation of the individuals; 3. Aleatory allocation of the individuals; 4. Resemblance among the initial groups from the beginning of the study; 5. Blind people; 6. Blind therapists; 7. Blind evaluators; 8. Measurement of 85% from the results; 9. Treatment intention; 10. Comparison among the groups; 11. Precision and variability.

Discussion

This study aimed to determine what were the possible ways of treating scoliosis described in the current literature and its main benefits. The selected studies in this review analyzed larger samples of young and female participants, as expected since an idiopathic class is a condition which prevails in this population[7,8,9,10,11,12,13], Wajchenberg et al.[14], shows in your study that genetic influences factors, and the environment under an idiopathic selection has been researched since the most remote times and that there is no definite answer yet. However, it is known that adolescent idiopathic scoliosis is a disease related to genetic factors and certain groups are more susceptible, as well as female individuals[14].

A study by Vieira et al.[15] with the objective of detecting early signs of scoliosis in preschool children, found positive responses in the Adams test with "C"-shaped gibosity. And he described that it may be a scoliotic attitude related to the phase of musculoskeletal development, not necessarily presenting a future scoliosis. With findings in literary dominance, the prevalence of 38.9% of gibosity in girls aged between 8 and 15 years old[15].

All selected studies have their literary importance and most had a significant change in the angle of scoliosis[9,10,13]. Most of the selected studies had reduced dimensions[7,8,9,10,12,13]. Most of them combined with an incomplete demonstration of some information in which may influence the images, after an analysis an average score of 0.44 points was applied using the PEDro scale. It is important to note that two of the studies deal with case studies[12,13]. The candidates of the present study use only papers with translation in Portuguese language which permit the research, but these factors are not allowed in the results found.

The selected studies[7,8,9,10,11,12,13] showed that physiotherapeutic conservative treatment is common in this class of patients that presented favorable results.

In view of the improvement of the benefits already described, none of these had any side effects or complications for the participants, inhibiting the progression of scoliosis and reducing the risk of invasive treatment. 81.08% of the general sample of the studies were classified as positive results and 18.92% as unchanged. Indicating that physiotherapeutic treatment for scoliosis is beneficial, reinforcing scientific evidence and relevance for new health professionals and other users[7,8,9,10,11,12,13].

In a study by Viola et al.[16] corroborating with the results found in this research on the benefits of Physiotherapy, a conservative rehabilitation protocol for different types of spine diseases was proposed through sessions of motor physiotherapy, kinesiotherapy and physical analgesics, which showed a significant reduction in volume of spine surgery, reducing their exposure to invasive procedures as well as reducing the final surgical cost[16].

The RPG technique reduced the scoliotic curve in the two studies included in this review[9,10]. A literature review carried out by Teodori et al.[17] found 11 studies involving the application of the RPG technique for treatment of divergent dysfunctions, through the main postures 'Frog on the ground and Frog on the air', it presented satisfactory results in general regarding the increasing of muscular strength and flexibility, improvement of urinary incontinence, increased cervical mobility and chronic pain relief, improved respiratory functions and improved functional capacity, proving that GPR is a good technique for the prevention and recovery of musculoskeletal disorders[17], relating to what has been observed.

A study by Rossi et al.[18] with young and healthy women who presented muscle shortening of the anterior chain, using the RPG, with the position of 'frog on the floor' was sufficient to improve the position of the head and shoulder, immediately after applying the technique. This posture aims to stretch the muscles and fasciae of the anterior chain of the body, aligning and reducing tension and overload in the joints and muscles[18]. This method corroborates with the results found[9,10], as it proves to be effective in correcting postural changes by stretching muscle tissue, promoting the balance of the muscles responsible for posture

Pilates exercises showed benefits in reducing chronic back pain, improving postural pattern and flexibility[11,12]. As it has been stated, this method works with low muscle impact exercises, intensely strengthening the stabilized muscles of the spine. Conceição et al.[19] in your study of cases related to

chronic low back pain, found that the pilates method provided improvements in spine stabilization and mainly significantly reduced the participants' daily quality of life[19].

After investigating possible treatments described in literature for treating scoliosis and its benefits, we can claim that there are different types of interventions that could be used for treating postural deviances. That did not mean that such technique would be better than other, but they may be integral or specific for different conditions.

Conclusion

In view of the presented studies, it was verified that a diverse range of methods in Literature in Physiotherapy with benefits that could be effective for treating scoliosis, such as the RPG and Pilates as better method of improvement of strength, flexibility, pain, and diminution of the scoliosis' curvature. It happens through different techniques and exercises for improving muscle strengthening, stretching, and spinal mobility. It is necessary many clinical trials to reinforce the evidences about the methods of physiotherapy in scoliosis.

Author contributions

Medeiros SML e Freitas MGS participated of the conception, study design, search and analysis of the statistical data of the research, interpretation of the results, and in the writing of the research report. Camara GLG supervised the research.

Competing interests

No financial, legal or political competing interests with third parties (government, commercial, private foundation, etc.) were disclosed for any aspect of the submitted work (including but not limited to grants, data monitoring board, study design, manuscript preparation, statistical analysis, etc.).

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