

# Physical exercise as a treatment for adolescent idiopathic scoliosis. A systematic review

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## 1 Introduction

While physical exercises (PEs) as a form of therapy did enjoy a measure of popularity in the past, and are still applied in some countries, in more recent times the international scientific community has given them scant consideration. One reason for this may be the long absence of papers from peer-reviewed journals. Another possible reason for not using PEs could be that they target mild AIS usually less than 30 Cobb degrees. But PEs, once their effectiveness has been demonstrated, could be important during growth to delay or prevent the need for recourse to a brace and/or to keep the scoliosis as far under the 30° limit as possible. It is possible that differences in the therapeutic behaviour adopted in different countries depend on the literature that is available in each of them, while pertinent and good-quality papers may not necessarily be the prerogative of peer-reviewed journals.

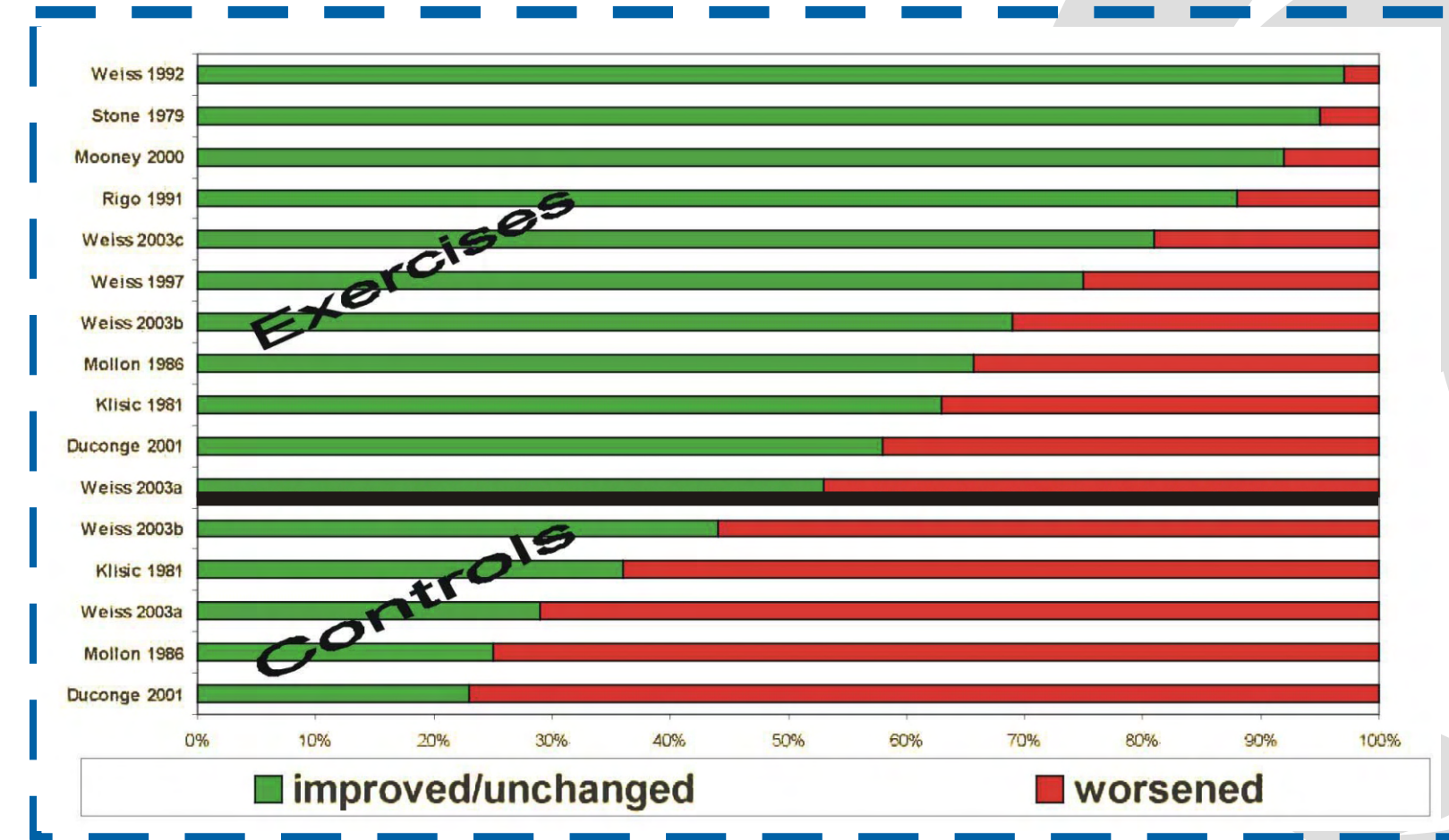
## 2 Aim of the study

Our aim was, after reviewing all the literature and verifying its quality, to establish the current scientific knowledge on the effectiveness of PEs as a treatment for AIS and to reach on this basis an evidence-based clinical conclusion.

Study	12	13	15	16	20	21	22	23	24	25	26
Controlled study	Ho	Ho	Y	N	Y	N	Y	Y	N	N	N
Random allocation	N	N	N	N	N	N	N	N	N	N	N
Prospective study	Y	Y	Y	Y	Y	Y	N	N	N	N	Y
Allocation criteria (other than random) described	Na	Na	Na	Na	Na	Na	Y patients decision	N	Na	Na	Na
Recruitment modality described	Y	Y	N	N	N	Y	N	N	N	N	N
Sample size: experimental group	42	44	89	12	422	34	100	160	43	107	181
Sample size: controls	57	120	107	165			50	50			
Patient characteristics described	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
Intervention described	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
Blinded assessment of outcomes	N	N	N	N	Na	Na	N	N	Na	Na	Na
Identification of confounding factors	N	Y	Na	Na	Na	Na	N	Y	Na	Na	Na
Statistical control for confounding factors	N	N	N	Na	Na	Na	N	Y	Na	Na	Na

## 3 Methods

We searched the Medline, Embase, Cinhal, and Cochrane Library databases from the date of their inception to December 2002 without applying any language restriction. Finally we performed a hand-search of 9 non-indexed journals from their inception to 2002. The inclusion criteria were the following. Patients: diagnosis of AIS, patients treated exclusively with PEs. Experimental intervention: control intervention, outcome measure. Outcome: Cobb degrees. Study design: any study design. We evaluated the internal validity of the retrieved studies (methodological quality) considering the following factors: controlled study, random allocation vs. other criteria to experimental and control intervention, prospective vs retrospective study, sample size, recruitment modality described, patient characteristics described, intervention described, blinded assessment of outcomes, identification of possible confounding factors, statistical control for the confounding factor.



## 4 Results

11 papers were found out of 576 considered. Design of selected studies: randomized 0, prospective 6, controlled 7, compared to historical controls 2, prospective and controlled 1. The methodological quality of these studies was found to be very poor. With one exception, the published studies demonstrated the efficacy of physical exercises in reducing both the rate of progression or the magnitude of the Cobb angle at the end of treatment.

## 5 Discussion

It has to be borne in mind that these low-quality studies represent the source of the only data that our extensive search of the literature was able to produce. This being the case, we have no choice but to use them as a basis on which to draw some kind of a clinical conclusion: should (or could) PEs be used to treat AIS? Of the papers reviewed, only one gives negative results. This study was controlled (but retrospectively, while the treated group was prospective) and published in an indexed English journal: this granted a big impact to this paper, that has been almost the only one cited in the indexed literature, where PEs effectiveness is usually denied. The patients included in this study showed less compliance than those considered in other studies, presumably because the PEs were performed only at home. Moreover, the PEs were proposed only for 12 months, and children were not considered until they had finished growing: these results should consequently be considered brief term data and not final results as in most of the other studies considered in this review. Finally, this PE programme was the most "mechanical" encountered: in fact, only after Stagnara there was a shift from a "mechanical" to a "neurological" perspective as regards PEs for AIS: there is now a general consensus on this approach. All the other papers that included a control group were more recent and proposed a more complex neuromotor PE programme than Stone's; the results of these studies were, if compared with the natural history of the condition, as favourable as the ones given by studies in which there was no control group. From a clinical point of view, the most important papers are the ones proposed by den Boer, who obtained the same results in PE treated and braced patients, the two that consider the Lyons method these studies presented data collected throughout Europe, and considered only children who had reached the end of growth and the one recently published by Weiss; the results of this latter, prospective, controlled study, which are comparable to those obtained in adulthood, might be considered quantitatively surprising, but it should be borne in mind that they refer to an intensive in-patient programme. As regards the percentages of patients worsening/remained unchanged or showing an improvement, the results are in favour of PEs; the degree of curvature in the PE groups seems to reduce or remain stable regardless of the baseline curvature (ranging in the different studies from 17° to 43° Cobb), while the results given by the various control groups, whose starting degrees were lower than those recorded in the PE groups, were worse. In any case, these results should be considered preliminary, as they are not supported by the quality of the studies.

Study	Population				Follow-up		
	Total	Exercises	Controls	Age	range	average	range
12	99	42	57	12-15	10	4-22	12 months
13	164	44	120	13.6	10-15	26	2.2 years
15a	94	30	64	10	4-11	21	at least 4 months
15b	102	59	43	13	12-14	29.5	DS 2.1 years
16	12	12	No	13.1	11-16	33.5	DS 3.1 years
20	591	422	169	10.10	7-16	15.6	4.7 years
21	34	34	No	11.6	8.7-14.1	14.9	2 years
22	150	100	50	11	5-15	14	0.7-4.3
23	210	160	50	10.8	10-15	16	3 years
24	43	43	No	12		19.5	1-7 years
25	107	107	No	21.6	10.9-48.8	43	at least 3 months
26	181	181	No	12.7		27	4-6 weeks

Study	Exercises			Compliance
	Type	Aims	Characteristics	
12	Miles method	mobilization, strengthening, posture	instructions from physio. exercises performed at home	about 50%
13	Side shift therapy	side shift, posture	instruction from physio. side shift in daily living	50%
15	Schroth method	actively straightening, auto-correction	intensive in patient exercise programme	
16	Medc. library torso Machine	strengthening	daily	
20	Lyons method	posture control, strengthening, balance	twice a week with physio and other times at home	71%
21	Many methods	active postural correction	twice a week with physio and other times at home	see text
22				
23	Lyons method	posture control, strengthening, balance	twice a week with physio and other times at home	75%
24	Schroth method	actively straightening, auto-correction	three times a week with physio	
25	Schroth method	actively straightening, auto-correction	intensive in patient exercise programme	
26	Schroth method	actively straightening, auto-correction	intensive in patient exercise programme	

## 6 Conclusions

Through an extensive review of the literature, we were able to show that the efficacy of PEs in the treatment of AIS to reduce progression of the curve remains to be demonstrated beyond doubt. On the other hand, it would be wrong to say that PEs proposed to obtain this primary outcome are useless: to date there is no definite proof either way. More research is needed in this field, and in the light of all these preliminary data, prospective randomized trials are to be recommended. Anyway, PEs have been shown to influence positively parameters such as breathing function, strength, and postural balance in AIS patients. With no doubts, even if PEs will not show stabilizing effects on scoliotic curves, their utility to reduce specific impairments and disabilities in AIS patients cannot be neglected. Waiting for stronger data on the primary result of preventing progression, given the length of time needed in this field to complete studies such as randomized trials, and the difficulties involved, the option of treating adolescents with PEs can be discussed with patients and their families and decisions reached according to their preferences: the effectiveness data here proposed, the possible outcomes (the delaying or avoidance of recourse to a brace and/or the keeping of the scoliosis below (as far as possible) the limit of 30°, which is thought to be dangerous in adulthood, and all the other positive effects of PEs), as well as the costs involved in PE treatment, should be thoroughly discussed.

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