Author’s response to reviews

Title: An immediate effect of PNF specific mobilization on the angle of trunk rotation and the Trunk-Pelvis-Hip Angle range of motion in adolescent girls with double idiopathic scoliosis – a pilot study

Authors:

Agnieszka Stępień (orthosas@wp.pl)
Krzysztof Fabian (thruman@o2.pl)
Krzysztof Graff (graffk@wp.pl)
Małgorzata Podgurniak (mpodg@wp.pl)
Andrzej Wit (andrzej.wit@awf.edu.pl)

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Author’s response to reviews:

Dear Reviewers,

Thank you very much for your effort to help us to prepare the manuscript. We are grateful for all comments, both positive and critical. We respondent to all comments and recommendations. We hope that this version of the manuscript is better than before.

Reviewer #1: The paper is much better now, but there are still many points to be addressed.

--> Table 4 is hard to understand. Please summarize it using means and SD.

The Table 4 was changed. Our goal was to show frequency of certain TPHA values before and after mobilization in the study group. We believe that this version of the table is acceptable.
Only double curves were included, this limits the generalizability of the results. Please state that PNF reduces ATR and TPHA in AIS girls with double curves in the whole manuscript, and add it to the limits of the paper.

The manuscript was modified according to the comments.

"This is the first study, which demonstrates the immediate effectiveness of selected elements of PNF in the treatment of AIS" this sentence is still there, and still not supported by data. Please remove it.

The sentence was removed.

The discussion is redundant, and there is no logical sequence. Please start from your findings and then compare them to the literature data. The whole speculation about muscles is not relevant, since in your study didn't include any EMG record. Please cut it.

The discussion section was changed in compliance with the comments. The fragment including information about muscles was shortened. Previously it had been added due to the suggestion of one of the reviewers. Technique “Contract relax” used in mPNF mobilization is a muscle relaxation technique, based on contraction and relaxation of a muscle. This is a reason, why have considered this issue. Only a note regarding this technique and resistance used during mobilisation was left in the manuscript (Lines 326-341).

The language needs some improvements.

The manuscript was reviewed by a native speaker.

Reviewer #3:

Line 282: "A multivariate analysis confirmed a considerable influence of PNF mobilization on the significant changes of ATR, TPHA and DB." should be mentioned in Results.
Thank you for your suggestion. This sentence was placed in the Results section, lines 231-236.

Reviewer #4:

--> The study has some glimpses of being interesting and new topic for scoliosis rehabilitation area. But still the main idea is not clear and concise. Range of motion limitation should have been assessed before the start of the study (and maybe made comparison with health group) and placed into "inclusion criteria". The paper is now better structured and written with the revision version. The methods appear to be adequate and the analysis and interpretation of results is more appropriate. But I'm still confused for the preparation period of the study. You mention that the study was conducted on 83 girls with 32 double adolescent idiopathic scoliosis with a right-sided thoracic curve (mean 25.10\(\pm\)13.9) and 33 a left-sided thoracolumbar or lumbar curve.

It seems there has occurred a misunderstanding, possibly due to an improper structure of the sentence “The study was conducted on 83 girls aged 10 to 17 years (mean 13.7 \(\pm\)1.9) with double adolescent idiopathic scoliosis with a right-sided thoracic curve (mean 25.10\(\pm\)13.9) and a left-sided thoracolumbar or lumbar curve (mean 20.80\(\pm\)11.4)”. The research included only girls with double scoliosis – one curve was located in the thoracic spine (mean 25.1\(\pm\)13.9), while the other curve was located in the lumbar spine (mean 20.80+11.4).

--> Did you found limitation in range of motion in the trunk-pelvis-hip angle and trunk rotation angle for all type of scoliosis patients and for all 83 girls? I am asking because for telling that "we reduced the limitation", you have to have the limitation at baseline or have a control group and comparison with scoliotic patients. Please clarify this.

In abstract's results section: "In adolescent girls with double scoliosis significant differences between the left and 42 right side of the body concerning the Trunk-Pelvis-Hip Angle ranges were noted" . Why did you perform PNF unilaterally instead of bilaterally? How would you know that their concave side don't have motion limitation?" Because in the manuscript you reported that "The criteria for inclusion were as follows: female, double idiopathic scoliosis with a right-sided thoracic curve and a left-sided lumbar/thoracolumbar curve diagnosed on antero-posterior radiogram, absence of systemic diseases, age 10-17 years, participation consent." You did not measure the range of motion first. You had to assess range of motions and then put the
"range of motion limitation" for your inclusion criteria, at the beginning of the study. With this version, your study look like having bias.

Thank you very much for this opinion. Your advice and recommendation to include only participants with range of motion limitations are very valuable for us. I would like to justify our way of thinking and explain the used methodology.

1. In the previous research, we found the limitation in the range of motion of TPHAright in the group of 49 girls with double scoliosis aged 10-16 compared to their 49 counterparts without scoliosis from the same age group (Stepień et al., 2016). The value of TPHAright was significantly lower in the group of scoliotic girls (-2.37°, SD 8.30) than in the control group (-8.64°, SD 4.70). No differences between TPHAleft values in both groups were found – scoliotic girls (-10.93°, SD 4.64), control group (-11.00, SD 3.30). Moreover, in both groups the value of TPHAright was significantly lower than the value of TPHAleft (p=0.001). It means that the range of motion in TPHAright in the girls with double scoliosis had the lowest value. However, it didn’t mean that TPHAright was lower than TPHAleft in every subject with scoliosis. In some girls with double scoliosis movement symmetry or a slight limitation of rotation on the other side was noted. This variability may result from numerous factors which cannot be described with the present level of knowledge. Despite this the significant differences were noted in the whole scoliotic group.

2. Owing to this, in the case of girls with double scoliosis, the authors decided to use one-sided mobilization mPNF to the right to increase the value of TPHAright. We did not see the need to perform mobilization mPNF to the left, since the values of TPHAleft did not differ between the scoliotic and control groups in the previous study. Our aim was to describe a certain phenomenon in the whole group of girls with double scoliosis. On the other hand, we decided to observe girls in this group, who did not demonstrate lower value TPHAright before mobilization.

3. Girls with double scoliosis were qualified to the study because of the type of scoliosis, not because of TPHA ROM the convex/concave side of scoliosis. Each of the participants was examined prior to the mobilization. We expected lower values TPHAright than TPHAleft in this group. Pre-mobilization measurements of TPHA in 83 girls with double scoliosis confirmed our assumption – TPHAright value (+1.82°) was significant lower than TPHAleft (-7.65°) in the study group.
4. Your valuable remarks made us look more closely at the aforementioned girls who did not demonstrate lower value TPHAright before mobilization. In 71 out of 83 girls, the TPHAleft test revealed higher values than TPHAright. 12 girls didn’t demonstrate lower value of TPHA right. Despite this, in the whole group of 83 girls TPHAright value was significantly lower than TPHAleft. In the examined group, the research revealed an improvement in ATR and change of values of TPHA test after mobilization. These changes were also noted in all the 12 girls who did not have lower TPHAright value. In our opinion excluding the girls would deprive us of valuable information concerning the influence of mobilization mPNF on the examined parameters in this group.

This subgroup mainly included girls with low scoliosis (up to 15o) – 6 girls and low to moderate scoliosis (16-24o) – 4 girls. Two girls had scoliosis of over 30 degrees. In the case of 11 girls, skeletal maturity was graded at the level of 3-5 per Risser scale, while one girl got the result of 1. It means that in the subgroup of these 12 girls, there were mainly girls with non-progressive slight scoliosis. Despite the fact that they had slight scoliosis, 8 girls from this group underwent physiotherapy which may also positively affect movement symmetry.

An improvement in ATR in this subgroup indicates that there exists a certain mechanism apart from a one-sided movement asymmetry which affects the posture in scoliosis. However, a small research sample does not let us analyse this interesting phenomenon and compare the results with other girls. Observations in this field will be continued in the future.

5. Simultaneously, we would like to inform that we are currently conducting research on the groups of girls with other types of scoliosis.

The manuscript was modified according to comments. Changes in the manuscript – lines 132-134, 205-207, 287–297, 342-355.

---> What is the normal range of motion for the TPHA (Test 2)? What are normal values and which values are considered limitation? What was your participant score at baseline? How did
you decide that your participant has limitation? In addition, what is clinically important difference for the tests?

The analysis of results from the previous studies mentioned above revealed significant differences between girls with double scoliosis and their healthy counterparts. The research provided only general knowledge regarding the values of TPHA in the group of scoliotic and healthy girls. At this stage, it is difficult to define unequivocally what a clinically important difference for the tests is and what does it mean “limitation”. There are many factors such as age, weight, bone maturity, high which can influence TPHA ROM. This issue needs further research and broad experience which will allow to elaborate certain norms. We are currently analysing data in order to describe a clinically important difference for the TPHA test in more detail. Changes in the manuscript – lines 342-347.

--> In line 225-227, as you reported "Power and sample size analysis revealed that with the number of subjects N=83, the test power for all the examined parameters was higher than 90%." It is better to report sample size calculation in "statistical analyses" section. It is also still no clarified. How did you calculate the sample size? With pilot study or with previous study conducted? Please add clarification.

Sample size calculation has been moved to statistical analyses section (Lines 149-150). The report “Power and sample size analysis” was prepared on the basis of the data obtained during the study but the design of the study was made on the basis of a pilot study, presented during SOSORT congress in 2014. Conclusions regarding sample sizes are very similar.

Results of the power analysis obtained from the pilot data are in an attachment.

--> In line 320-326 you reported "The changes probably resulted from the choice of a PNF movement pattern suitable for the vertebra orientation in the horizontal plane in double scoliosis and limitations of TPHA motion noted in previous studies. The unilateral bilateral lower extremity PNF patterns were used in a precisely selected position of the patient's body, with bending at the thoraco-lumbar junction and rotation......" What are these previous studies, you need citations. It is not still clear that how PNF changes vertebral orientation. It may be related with muscular tensions, isn't it? Please clarify this explanation.
Yes, it is true that it is not certain that the selected PNF pattern changed vertebral rotation. There is no evidence for that. The mechanism of the changes is not known. They may result from the change in muscle tension, but it is only a speculation. Further research aimed at explaining the observed mechanism is needed. Due to this, we removed this fragment of the manuscript and included an explanation that the mechanism needs further research (Line 352-355).

--> The discussion section should emphasize to a greater extent the issue of the interpretation of the results.

The Discussion section was changed.