Author's response to reviews

Title: Laser Triangulation Measurements of Scoliotic Spine Curvatures

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Author's response to reviews: see over
Dear dr. Grivas,

thank you very much for taking your time to revise our manuscript «Laser Triangulation Measurements of Scoliotic Spine Curvatures» (MS: 9370951171719093). We have carefully read constructive comments of both reviewers and prepared the following response. If not explicitly stated, equations, figures, and reference numbers in our response are related to our originally submitted manuscript.

**Reviewer 2**

**Comment 1:**
"Here a clear statement concerning the aim of the study is needed. Eg. “to differentiate a scoliotic subject from a healthy subject” and this needs to be clearly addressed in the Conclusions."

**Our response:**
A clear statement concerning the aim of the study is added in the Background section of the manuscript: “The aim of this study was to develop a new, non-invasive laser based method for differentiating between scoliotic and healthy subjects which could be useful in clinical work with scoliotic patients.”

**Comment 2:**
“The reader is not expected to read all the references before reading this paper. You should include 3-4 lines with the major procedure steps included in [7] in order for the reader to be able to follow the current paper.”

**Our response:**
In Methods, paragraph 5 we added the most important procedure step regarding the determination of the spatial spine curve included in [7]: “The most important procedure step is the determination of the thoracic and lumbar spatial spinal curve between the C and L point by detecting the surface curvature extremes from the 3D measurement of the shape of the back, which is thoroughly described in [7]. In the last step the determined curve of the spine is translated and rotated using the rotation matrix [11].”

**Comment 3:**
“This is a qualitative statement. You need a quantitative statement instead. Eg. What is the threshold for normal/non-normal?”

**Our response:**
In Discussion, paragraph 3 we added the quantitative statement between the normal/non-normal spine curvatures for the LR/AP quotient: “The study has shown a statistically significant higher LR/AP quotient (p < 0.001) in the subjects with scoliosis (0.40 ± 0.28) compared to the subjects with physiological spinal curvatures (0.13 ± 0.06).”

**Comment 4:**
“This paragraph is very complicated and does not help the reader to understand the figures.”

**Our response:**
In this manuscript there is a new – cranio-caudal view on the scoliotic spine curvatures, where the spatial spine curve for each subject (healthy, scoliotic) is differently orientated. That is
why, we would like to clarify the meaning: in case of **physiological spinal curves** the CL line **is vertical**, since the median drops from C1 onto the S1 plate. Hence, the projection of the spine curve is **positioned in the horizontal plane**.

In **case of scoliosis**, the CL line **is not vertical** because the C point is not projected vertically above the L point. The projection of the spine curve is therefore **positioned in the plane, which is not completely horizontal**.

In Discussion, paragraph 4 this text is modified: “In subjects with physiological spinal curvatures, the median drops from C1 onto the S1 plate, the CL line being vertical [16]; therefore, the projection of the spine curve is positioned in the horizontal plane. In the case of scoliosis, the direction of the CL line deviates to some extent because the C point is not projected vertically above the L point. The projection of the spine curve is therefore positioned in the plane, which is not completely horizontal”.

Please note that an initial explanation on this topic is already done in Methods, paragraph 5.

**Comment 5:**
“This is missing. It needs to be correlated to Cobb. Show results and comment.”

**Our response:**
The presented method is based on non-invasive cranio-caudal analysis of the spine curvatures. We did not use the X-ray imaging method for Cobb angle determination and hence the correlation to Cobb was not performed. That is why we omitted the paragraph 5 in Discussion. In the manuscript the reason for that is now described in paragraph 2 in Discussion: “In our case the comparison between the method based on Cobb angle determination and the presented method, based on cranio-caudal analysis of the spine curvatures was not performed, since the X-ray imaging method needed for Cobb angle determination was not used in our research”.

**Comment 6:**
“This clearly is not a conclusion from this paper. Maybe from the previous one?”

**Our response:**
We adjusted the Conclusion in the manuscript, which is now in accordance to the aim of the study, presented in Background: “The main innovation of the proposed method is the ability to differentiate between scoliotic and healthy subjects, based on cranio-caudal analysis of the spatial spine curve, determined by laser triangulation. The method showed statistically significant differences between the scoliosis and the control group. In addition, longitudinal monitoring of developed scoliotic curvatures of spine in individuals can be performed”.

**Editorial team:**
According to constructive comments, made by the reviewers, manuscript was modified. Changed text is marked by red font color.

Yours sincerely,

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Janez Možina

Ljubljana, August 4th, 2015