Author's response to reviews

Title: The pendulum test as a tool to evaluate the passive knee flexibility, stiffness and viscosity of patients with rheumatoid arthritis vs control subjects: a pilot study.

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Author's response to reviews: see over
Dear Editor,

we are submitting a revised version of manuscript Number MS: 5613394610275439, entitled “The pendulum test as a tool to evaluate the passive knee stiffness and viscosity of patients with rheumatoid arthritis.” by Maria S Valle, Antonino Casabona, Rosaria Sgarlata, Rosaria Garozzo, Maria Vinci and Matteo Cioni.

We have revised the manuscript according to the referee’s comments and hope that it will be now acceptable for publication in Musculoskeletal Disorders. We take this opportunity to thank the referee for being very supportive of our work and for his/her punctual comments that have certainly contributed to improve much the overall readability of the paper. Follows a point by point reply to the referee’s comments.

Replay to Reviewer: Lee E Brown

Major Compulsory Revisions

QUESTION 1: The title should not include the word pilot or control subjects. Control subjects will be detailed in the methods and pilot makes it sound as if it is not yet finished.
REPLAY: We have modified the title according to the reviewer’s suggestion

QUESTION 2: In the conclusion section of the abstract you state this test is sensitive but you do not offer any reliability or validity statistics. You need to add these.
REPLAY: We used the word “sensitive” with no statistical meaning but just to indicate the Wartenberg test as adequate tool to measure mechanical changes at the knee joint. However, the reviewer poses an appropriate observation and to avoid misinterpretations we changed the word “sensitive” to “practical” to stress further the ease of use and the effectiveness of the test.

QUESTION 3: On page 6 you need to further define viscosity at it's first usage.
REPLAY: In the current version of the manuscript we extensively define viscosity and stiffness along the Abstract and the Background sections.

QUESTION 4: Also on page 6 you discuss that some subjects could not reach full extension. How did this lack of amplitude affect knee oscillations?
REPLAY: The meaning or the objective of our sentence “We adapted the protocol to patients with RA and to avoid painful mechanical stress of back knee joint and/or reflex responses of
quadriceps or hamstring muscles, the onset angle (knee extension) was coincident with a comfortable position with the knee not fully extended. “was to point out that during testing we attempted to avoid any noxious stimulation of knee, in order do not evoke any nociceptive flexor reflex, which could affect testing by reducing the amplitude of the oscillations.

On the other hand, we agree with the reviewer regarding the possibility that this lack of amplitude could affect knee oscillations. However, we found that the onset angles of both groups of participants were similar and not significantly different (p > 0.05). This phenomenon was due to the fact that hamstring muscles of control subjects were shortened and consequently it was not possible to fully extend the knee. We also observed the shortening of hamstrings during the clinical evaluation. This is a usual observation during clinical evaluation of people with sedentary styles of life and in adulthood. Therefore we added the following sentence:

“...It was not possible to fully extend the knee also in the control subjects because of their shortened hamstrings (evaluated during the clinical examination). This was, probably due to the age and/or the sedentary style of life of these subjects. As a consequence the onset angles of patients and control subjects were comparable over all the testing sessions (see Table 2).” (see Testing protocol)

Furthermore, we have prepared a new table (table 2) reported the onset angle values for each participant.

QUESTION 5: On page 11 in the last sentence of your discussion of stiffness and viscosity you talk about non-significant findings. If they were not significant then there is no need for a discussion. They are not different and therefore the same.

REPLAY: We have removed the sentence as suggested by the reviewer.

QUESTION 6: On page 16 in the first line you discuss impairments in gait of patients. You did not investigate this so you cannot discuss it here.

REPLAY: We have removed the sentence as suggested by the reviewer.

Minor Essential Revision

QUESTION 1: The use of the English language needs cleaning up in this paper. There are several times when minor grammatical changes need to be made. Please have someone with English usage proficiency re-read the article.

REPLAY: We have done extensive linguistic editing of the manuscript by contacting an English native colleague.

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Reviewer: Barry Stillman

Major Compulsory Revisions

ABSTRACT

QUESTION 1: Background: The average reader is likely to have a simple unsophisticated view of what constitutes joint “stiffness”. Accordingly, the authors need to clarify the difference in meaning between “flexibility”, “stiffness” and “viscosity”.

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ABSTRACT
REPLAY: The reviewer’s request to clarify the difference between “flexibility”, “stiffness”, “viscosity”, “first knee flexion” first knee extension” is well appropriate and it has stimulated us to revise the manuscript with much more attention and objectiveness.

Joint flexibility indicates a generic ability to change the angular joint excursion. These changes can be detected by measuring the variations of angular displacement during the series of flexions and extensions. The angular displacement is affected by the passive resistances provided by joint tissues to the movement. Stiffness and viscosity are components of these resistances that may reduce the amplitude of angular displacement and, thus, the range of angular joint excursion.

In accord to these notions, we have made the following changes along the manuscript:

- we removed the word “flexibility” from the title and we reduce its use just to indicate general changes of knee range of motion.
- we adopted much more the intuitive expression “angular displacement”.
- we made extensive changes to the Abstract and Background sections in order to provide clear explanations of the terms “stiffness”, “viscosity”, “first knee flexion” first knee extension” and the associated relationships.

QUESTION 2: Method: Because I do not believe the average reader will know of the pendulum test, I recommend that a brief description of the test be included in the “Methods” section of this abstract. The authors might consider saying something like: With the subjects half-lying, the relaxed knee was dropped from near-full extension and the characteristics of the ensuing damped unsustained knee oscillation evaluated.”

REPLAY: We have modified the text according to the reviewer’s suggestion.

QUESTION 3: Background: Again it is necessary to indicate what “first knee flexion” and “first knee extension” are, and what the amplitude of these means — Is it the same as or different from measures of “flexibility”, “stiffness” and “viscosity”. Without reading the whole paper, the reader of the abstract will not understand the relationship between measures of “stiffness” and “viscosity” on the one hand, and “first flexion” and “first extension” amplitude on the other.

REPLAY: Please, see replay to ABSTRACT, question 1

MAIN PAPER /BACKGROUND

QUESTION 1: Second paragraph: The average reader is likely to have a simple unsophisticated view of what constitutes joint “stiffness”. Accordingly, the authors need to clarify the difference in meaning between “flexibility”, “stiffness” and “viscosity”.

REPLAY: Please, see replay to ABSTRACT, question 1

QUESTION 2: The author’s need to make clear in this paragraph, and with respect to Figures 2 and 5, that they are referring to the ARA classification of levels of severity of RA; where Stage 0 (Early RA) represents possible osteoporotic changes but no destructive joint changes on x-ray; stage 2 (mild RA) represents… and so on. Could the author’s insert a Table containing the criteria for Stages 0, 1, 2, 3 and 4 RA. Note that use of the word ‘Stadium’ is inappropriate in this context. The correct word is “Stage” (or ‘grade’, or ‘level”).

REPLAY: In the first version of the manuscript we referred to the classification of the functional status of RA patients according to the revised criteria of the American College of Rheumatology (1991) (previously called the American Rheumatological Association) and not to
the radiographic classification. We have inserted a table (Table 1) reporting the characteristics of the four functional classes. We have modified the word “Stadium” with the word “Class”.

MAIN PAPER /METHODS /TESTING PROTOCOL

QUESTION 3: The sentence “Due to the inherent viscosity in the system… knee extensors” seems to have a careless use of the terms “viscosity”, “gravity” and “elastic forces”. It might be simpler at this stage to just say that the inherent viscoelastic properties of the joint and surrounding (predominantly muscular) tissues, coupled with the weight /mass of the moving foot and leg, cause the leg to finally comes to rest close to the vertical position.

REPLAY: We have modified the text according to the reviewer’s suggestion.

QUESTION 4: Second last sentence: Here the author’s indicate that the onset angle was ‘not fully extended’ in the RA subjects because of considerations of patient comfort. although it is made clear eventually (in the results) that there was no significant different between the onset angles of the patients and control subjects; it is important to indicate here in the methods section what angle of knee flexion (mean and SD) was used as the starting position for both subject groups. Otherwise the reader will think that the testing of the two subject groups was not comparable (at least with respect to onset angle).

REPLAY: We have prepared a new table (table 2) reporting the onset angle values for each participant.

MAIN PAPER /RESULTS

QUESTION 5: First paragraph: Given the small number of subjects, I believe a Table of results (mean and standard deviation values for initial angle, F1Amp, E1Amp, R1, etc, and the stiffness and viscosity measures) for the experimental and control group subjects is desirable. Also see 2. above regarding ‘Stadium’ and ‘Stage’.

REPLAY: In the new table (table 2) we reported the data requested by the reviewer.

MAIN PAPER /DISCUSSION

QUESTION 6: Paragraph 5: The subjective capacity to judge “stiffness”, whilst itself not fully understood, does not make mechanical stiffness of rheumatoid and other joints controversial. The controversy regarding mechanical joint stiffness has to do with its nature, behaviour and measurement — which should be clarified by further research involving the pendulum and related tests. Since the pendulum test has nothing to do with perceived joint stiffness (the subject is never asked what do they feel during the test), the issues concerning the sense of stiffness are irrelevant to this paper. I suggest all references to the subjective estimation of stiffness be removed from the paper.

UNLESS the authors would like to suggest that the pendulum test results might form an interesting basis for the further study of the relationship between (types of) joint stiffness and perceived magnitude of stiffness.

REPLAY: We have critically revised this part of discussion and we would like to thank the reviewer for his very helpful comments.

We have now extensively rewritten the paragraphs 5 and 6 focusing mainly on the difficulties of
measuring and interpreting the changes in stiffness values. As suggested by the reviewer, we greatly reduced the discussion on perceived stiffness indicating the Wartenberg test as useful tool for future studies on this issue.

QUESTION 7: Paragraph 7: This is the first paragraph in which reference is made to plasticity. The terms “friction” and “inertia” are also introduced in this paragraph. The authors need to introduce and differentiate between all these terms in the background section of the main paper. The reader should not be left to figure out what all these terms means.
REPLAY: Again, this was a stimulating point to improve the clarity of the paper.
The terms reported in this paragraph are connected to specific physical properties that we did not measure in our experiments. Thus, we preferred to remove them and reorganized the paragraph using the previously defined terminology without to compromise the essential meaning of the original version.

The relationship between articular and periarticular contributions to stiffness also need to be more clearly explained (hypothesised).
REPLAY: We have rearranged the paragraph 5 in the discussion according to the reviewer’s suggestion.

Minor Essential Revisions

ABSTRACT

QUESTION 1: Background /1st sentence: Remove ‘well known’ (The pendulum test is not a well-known throughout the world).
REPLAY: We have removed the text according to the reviewer’s suggestion

QUESTION: 2. Results: Because the r2 values are < 0.8, I believe they should only be characterised as being of moderate strength. Thus the third sentence should read: ‘A regression analysis showed that disease severity correlated moderately with stiffness (r2 = 0.68) and first flexion (r2 = 0.78).’
REPLAY: We have modified the text according to the reviewer’s suggestion.

MAIN PAPER /BACKGROUND

QUESTION 3: first paragraph: Change sentence to read: ‘Furthermore, there is wide evidence of pathological modifications of muscle connective tissues…’
REPLAY: we have modified the text according to the reviewer’s suggestion

QUESTION 4: Second paragraph: Change sentence: ‘In this pilot study we approach this issue by means of the pendulum test of Wartenberg (4) which, until now, has been predominantly used to measure…’
REPLAY: we have modified the text according to the reviewer’s suggestion

MAIN PAPER /METHODS
QUESTION 5: Subjects /Paragraph 1: Indicate the criteria used to characterise the study group subjects as having RA. Simply saying “the presence of RA” is too vague.

REPLAY: We have modified the text according to the reviewer’s suggestion. The modification reported in the text is the following one: “The diagnosis of RA was performed at the Department of Internal Medicine, Medical School, University of Catania according to the criteria of the American Rheumatism Association (ARA) [5]. The ARA standards included the presence of morning stiffness, arthritis of three or more joints areas, arthritis of hand areas, symmetrical distribution of arthritis, rheumatoid nodules, serum rheumatoid factor, and radiographic changes. Only patients with a diagnosis of RA performed by using ARA standards were included in the test group. The criteria of inclusion, concerned also the presence of a main localization at the knee joint and an age superior to eighteen years.“

QUESTION 6: Testing protocol /Second sentence: Change sentence to read: “After lifting the relaxed leg to a horizontal position, the examiner released the limb and let it fall and freely swing; into flexion, then extension, then flexion…’

REPLAY: We have modified the text according to the reviewer’s suggestion

QUESTION 7: Recording system: The sentence commencing “Given the coordinate data from markers,...” Should be changed to read: “The knee joint flexion-extension angles throughout the pendular movement were calculated from the reference marker coordinate data.”

REPLAY: We have modified the text according to the reviewer’s suggestion

QUESTION 8: Mechanical measurements and estimations /First paragraph /last line: Substitute “period of the first cycle (T)”.

REPLAY: We have modified the text according to the reviewer’s suggestion

QUESTION 9: Mechanical measurements and estimations /Following equation 1: change sentence commencing “where J is the sagittal movement of inertia…” to read: “where J is the sagittal movement of inertia applying to the leg-foot complex rotation around the knee axis”.

REPLAY: We have modified the text according to the reviewer’s suggestion

QUESTION 10: Statistical procedures /Second paragraph /last line: Use the term “Student’s t-test”

REPLAY: We have modified the text according to the reviewer’s suggestion

MAIN PAPER /RESULTS

QUESTION 11: Displacement parameters: Change sentence commencing “In the latter case the result…” to end as follows: “oscillations detected in the patient group.”

REPLAY: We have modified the text according to the reviewer’s suggestion

MAIN PAPER /DISCUSSION

QUESTION 12: First paragraph /Second sentence: Change sentence to read: “The analysis of limb oscillations…markedly reduced in these patients, coinciding with a significantly increased knee stiffness.”

REPLAY: We have modified the text according to the reviewer’s suggestion
QUESTION 13: Second paragraph /First sentence: Change this sentence to read: “Wartenberg (4) introduced…of testing tone (especially spasticity) of knee extensor muscles in patients with neurological diseases.”
REPLAY: We have modified the text according to the reviewer’s suggestion

QUESTION 14: Third paragraph /First sentence: Change this sentence to read: “Whilst the amplitudes of flexion and extension joint excursions are common… studies based on the Wartenberg test, a combination of the kinematic data with anthropometric data allows for the derivation of useful kinetic data.”
REPLAY: We have modified the text according to the reviewer’s suggestion

QUESTION 15: Paragraph 7 /Last sentence: Indicate that the observations of Johns and Wright apply to small healthy (eg. metacarpophalangeal) joints.
REPLAY: We have modified the text according to the reviewer’s suggestion

MAIN PAPER /CONCLUSIONS

QUESTION 16: Third sentence: Change sentence to read: “This test is simple and can be performed… motion systems, both of which have become increasingly available throughout the clinical environment.”
REPLAY: We have modified the text according to the reviewer’s suggestion

QUESTION 17: Fourth and fifth sentences should be changed to read something like the following: Furthermore, being a test under non-weightbearing conditions, the pendulum test is likely to less painful than weightbearing activities including walking and negotiating stairs.
REPLAY: We have modified the text according to the reviewer’s suggestion

QUESTION 18: Figure 1 legend: Spelling error “lateral malleolus”.
REPLAY: We have corrected the word according to the reviewer’s suggestion

QUESTION 19: Figure 2 Legend: Change the word “Stadium” to “Stage”. Change “The period of one cycle” to read “The period of the first cycle”.
REPLAY: We have modified the text according to the reviewer’s suggestion