Reviewer's report

Title: Time-course of Exercise and Bone Changes in a 12-Month Exercise Trial

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Reviewer: Robin Daly

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This is a very well written and presented paper examining the relationship between exercise intensity (impact loads at different acceleration levels) assessed by accelerometers and changes in BMD and bone geometry in 34 premenopausal women who had completed a 12 month exercise intervention. Although the authors have previously reported that the number and intensity of impacts over 12 months were significantly related to changes in BMD and bone geometry, the novel aspect of this paper is that it examines whether impact loads after 3 or 6 are associated with bone changes after 12 months. This provides some interesting new data on the time course and level of impact loading that may stimulate an adaptive skeletal response in adults.

Major Compulsory Revisions

My main concerns with the paper relate to the accelerometer data and how it has been presented and analysed. Participants were asked to wear accelerators every day for 12 months but according to the authors ‘.. daily compliance for using the monitor was not controlled’. What exactly does this mean? Do they have data on the mean number of days that the monitors were worn by each participant over the 12 months (or during each period)? Given that the accelerometer data was reported as ‘daily’ intensity of impacts I presume this data is available and thus should be reported.

As indicated above, the authors report the accelerometer data for each individual as an average based on the number of days it was worn each week. However, if some participants only wore the accelerometer 4 out of 7 days it is possible that they could have the same average impacts as another person that wore it all 7 days (but the total number of impacts would be less). Thus, this assumes that the person that wore it for 4 days maintained this level of activity over 7 days which may not be correct, especially if it was not worn during the dedicated exercise training. Would similar results be observed if the total number of impacts at each acceleration level (for each individual) was tabulated for each period and correlated with the bone changes?

Compliance with exercise program (1 out of 3 days) and daily 10 min bouts of loading at home (average 2.4 times/week out of 7 days) was generally poor. Is there a reason for this relatively poor compliance? Is it possible that the findings in this paper are more a reflection of exercise compliance, especially since the authors previously reported that there were significant differences between the most and least compliant participants? Would it be worth including exercise...
compliance as a covariate in the analysis to help overcome the issue related to presenting average accelerometer data?

Is there a reason why total hip data was not reported?

P7. Cortical bone was separated from trabecular bone using a threshold of 450 HU, but was a proportion of the cortical bone ‘peeled’ away from the outer perimeter to ensure that only trabecular bone was included in the results?

P8. Since a QCT density calibration phantom was not scanned simultaneously with the participants, it is correct to refer to CSMI as a 'true density-weighted' max and min CSMI?

Do the authors have any data or a reference to support that cortical attenuation correlates with cortical vBMD? It is interesting that 0-3 month impacts at 1.1g or above were correlated with cortical attenuation but generally not cortical area. The limited data available indicates that exercise has little effect on cortical vBMD in older adults, but can alter cortical bone geometry. In light of the significant correlations between cortical attenuation and average daily impacts in this study, this requires further discussion/comment.

P9. I am not sure the phrase ‘... duration of exercise program needed to obtain positive bone response’ is strictly correct. Doesn’t the accelerometer data provides a measure of intensity (or daily impacts) more than duration?

P11, para 2. I think it is important to specify that ‘.. even 3 months of exercise were associated with 'cortical' geometrical adaptation’ since there was no effect of trabecular bone.

Minor Essential Revisions

Please clarify what you mean by ‘50% of the estimated bone length from the distal endplate of the femur. Was femoral bone length physically measured or just estimated?

Table 1. The results for the 0-12 month accelerometer data in this paper are slightly different to those reported for the exercise group in the authors 2006 Osteop Int publication. Is there a reason for this difference?

For figure 1, it might be useful to include a symbol for those correlation coefficients which were significant. It would also be more informative if the scale for the y-axis (R) for the FN and trochanter were the same so that it is possible to compare and contrast the results.

Discretionary Revisions

**Level of interest:** An article whose findings are important to those with closely related research interests

**Quality of written English:** Acceptable
**Statistical review:** No, the manuscript does not need to be seen by a statistician.

**Declaration of competing interests:**

I declare that I have no competing interests