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We thank Dr Haynes for his letter. His comments raise some interesting points for discussion.

He is concerned with our choice of sub-occipital duplex scanning of the vertebral artery (VA) and that it is, in his view, a major limitation of our study due to the lack of evidence of validity for scanning of this segment. This raises interesting issues. We chose to perform the evaluation of vertebral artery blood flow at the atlanto-axial segment for specific reasons. Firstly, this segment of the VA is the most tortuous region and most likely to undergo flow abnormalities on cervical spine rotation (Thiel et al. 1994; Rivett et al. 2003). Secondly, it is where most VA incidents have been reported to occur (Haldeman et al. 2002).

In contrast to Dr Haynes' protocol which compared the velocimeter findings to the mid-cervical duplex evaluation of VA blood flow, we chose to insonate the same region of the VA on which the velocimeter was to be used. This allowed us to make a direct comparison of blood flow in the same region of the VA. It remains to be determined if duplex scanning of the atlanto-axial and mid-cervical regions of the VA yield comparable blood flow results or if one is more sensitive than the other.

We note the reference by Dr Haynes to the systematic review by Khan et. al. (2007) concerning *stenosis* of the vertebral artery and the absence of studies in this review concerning validity of *blood flow* parameters detected by duplex scanning. Nevertheless, our results showed good repeatability of blood flow measures and this is consistent with other authors who have used duplex to examine this level (Johnson et al. 2000; Rivett et al. 2003; Mitchell & Kramschuster 2008).. We were able to detect the characteristic flow signal of the VA throughout the duplex examination, and concurrently view the VA in those subjects included in the study (see below).

Dr Haynes is concerned about the discrepancy between our data and his study (Haynes 2000) and that of Thiel et al (1994). We identified 29.3% of *subjects* in our sample with altered VA flow on cervical rotation, which is consistent with a number of studies which have looked at VA blood flow on cervical rotation (Arnetoli et al. 1989; Refshauge 1994; Licht et al. 1998; Rivett 2000; Mitchell & Kramschuster 2008). It is not surprising that there will be variance between studies when there are clear differences in the design and methods including subject selection, subject posture, and scanning protocols, as will be noted between our paper and the two cited by Dr Haynes (Thiel et al. 1994; Haynes 2000).

We believe it unlikely that our observation that there was a decrease in blood flow on duplex scanning was due to an artefact. We excluded 2 participants where attenuation of the beam did not allow us to obtain an adequate signal. In the participants in whom blood flow velocity was observed to decrease the VA could still be visualised, making attenuation of the beam due to bulging of musculature, as suggested by Dr Haynes, unlikely. Furthermore, the decrease in flow velocity detected with duplex scanning on

contralateral rotation we observed is not an uncommon finding reported in other studies (Zaina et al. 2003; Mitchell & Kramschuster 2008).

Regarding the training protocol, the instruction of the physiotherapists was performed by the 1st author who was trained by Dr Haynes, for which we are most grateful. We acknowledge that one instructor or training program may be more or less successful than another. The protocol adopted here was intended to have face validity by providing instruction and training such as would typically occur in the clinical skill instruction of registered practising physiotherapists in a continuing education setting. However it is important to acknowledge, as reported by Sackett et al. (1991), that the relative rarity of positive subjects, in this case on velocimeter examination, may limit practitioners' ability to recognise abnormal findings when they do encounter them.

As identified above there were design and methodological differences which in and of themselves may account for the differences identified by Dr Haynes. In our view the definitive study remains to be done, however, based on our study we believe the conclusion as presented in our paper is appropriate.

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