

The 3D- reproducibility of the ‘pre-manipulative position test’ in manual therapeutic examination.

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SUMMARY

The purpose of this study was to determine the intra- and inter-examiner reliability of the ‘pre-manipulative position’ test at the cervical spine.

Two manual therapists performed the pre-manipulative position test at 3 spinal levels and this was registered by an electromagnetic tracking device.

The intra-examiner reliability was ‘fair’ to ‘good’ (ICC 0,67-0,94).

The inter-examiner reliability was ‘poor’ to ‘good’ (ICC 0,42 - 0,90) with, generally, larger confidence intervals and therefore has to be interpreted with caution.

INTRODUCTION

Although the risk-ratio of serious adverse events is very low, manual therapists are advised to use pre-manipulative tests as a screening tool for complications at the cervical spine [1,2].

Beside valid, a test should be above all reproducible. In one single study the reproducibility of the pre-manipulative tests, as described by the Australian Physiotherapy Association (APA), showed good inter-examiner reliability but no intra-examiner reproducibility was investigated [3].

The purpose of this study is to investigate the intra- and inter-examiner reliability for the pre-manipulative position test (as part of the tests described by the APA-protocol) in a quantitative way, at three different cervical motion segments.

Registration of movements is performed by the use of electromagnetic trackers [4].

METHODS

The examiner positioned each of 3 motion segments (C1-C2, C3-C4, C5-C6) of 16 healthy individuals in the pre-manipulative position and each procedure was registered. Each of the three spinal levels were put in a pre-manipulative position for a supine HVT (High Velocity Trust) traction manipulation sequentially.

Pre test power analysis, with power set at 0.80, estimated a sample size of 10 subjects. Knowing that power increases by sample size and because of practical issues we chose to include 16 subjects. The electromagnetic tracking device used in this study is the Polhemus Liberty (Polhemus, Vermont, USA). One sensor was placed on the forehead at the midline of the junction between nasal and frontal bone. The second sensor was fixed at the sternal angle.

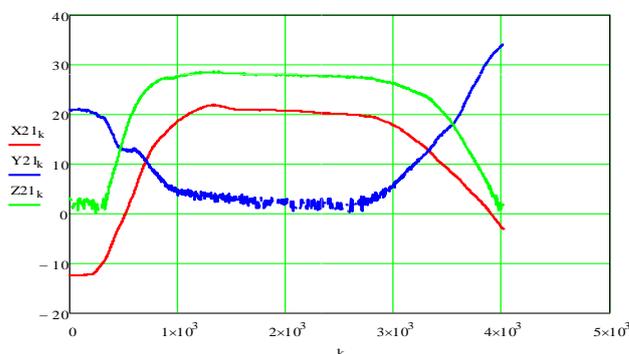
3D-changes in positions and orientations of the 2 sensors were represented as rotations around the 3 axes of the reference frame of the transmitter. Calculation were performed using a Mathcad routine using the ZXY Cardan

convention. The data from every PMP (pre-manipulative position) were graphically represented (figure 1). With the use of the tracer function the PMP could be selected and the rotations around each of the three axes was read. These rotations around the 3 axes were analyzed.

Statistical analysis was performed using SPSS 17 software (SPSS Inc., Illinois, USA). The intra- and inter-examiner reliability was investigated by the use of the Intra-class Correlation Coefficient (ICC). Data were checked for distribution characteristics and when necessary Spearman Rank Correlation coefficients were calculated instead of ICC. Additionally a t-test comparison was performed at $p < 0.05$ level.

A Two Way Random model, type Consistency was selected for comparison between datasets [5]. The values of the ICC for the reliability were interpreted as pointed out by Swinkels [6].

Figure 1: graphical presentation of 1 PMP



RESULTS AND DISCUSSION

-The intra-examiner reliability is ‘fair’ to ‘good’ for each motion component and at each spinal level. The ICC’s ranged from 0.67 to 0.94. The only ‘poor’ value (ICC=0.53) is the Y-motion component at level C5-C6 for examiner 1 (Table 1). The correlation for the Z-motion component in examiner 1 is ‘fair’ to ‘very strong’ and ‘positive’. From the results of the paired sample t-test it can be concluded that there is no significant difference between the ‘test’ and ‘retest’ from both examiner 1 and 2 around nearly all of the three axes and nearly at all spinal levels. Only for examiner 2 the rotations around the X- and Z-axis at C3-C4 and the rotations around the Y-axis at C5-C6 indicated low reproducibility.

-The inter-examiner reliability is ‘fair’ to ‘good’ for each motion component at spinal levels C1-C2 and C3-C4 with ICC’s ranging from 0.60-0.90. At spinal level C5-C6 the inter-examiner reliability was ‘poor’ with ICC’s ranging from 0.42-0.81. The correlation for the Z-motion

component of the 'test' is 'fair' to 'very strong' and 'positive'. Between examiner 1 and examiner 2 there is a significant difference for both the 'test' and 'retest' at all spinal levels and around all three axes.

DISCUSSION

The results of this study enable us to make a cautious positive judgment about the reproducibility of the supine pre-manipulative position test.

This study investigates the reproducibility of end-positions around the axes of a 3-dimensional reference frame and therefore indirectly offers reasonable base for extrapolating the results to other supine pre-manipulative tests.

We cannot extrapolate the results of this study to pre-manipulative tests executed in sitting position.

Care has to be taken when extrapolating the results to patient groups.

However, extrapolation to a population of experienced manual therapists is reasonable.

The 95% confidence intervals for the ICC's of the inter-examiner reliability are large, which means that these ICC values have to be interpreted with greater caution.

The results of this study show 'fair' to 'good' ICC values for intra-examiner reliability for both examiners.

Further analysis of the motion components with reference to a local anatomical reference frame could sort out some of the limitations of the present study such as absolute degrees and translations to anatomical planes.

Analysis of differences between groups have been performed using a 'Paired Sample T-test'. Nevertheless the corresponding groups with 'significant differences' in the 'paired sample T-test' have ICC values which are 'fair' to 'good'. This can probably be explained by the spread of observations.

CONCLUSIONS

It can be concluded that the intra-examiner reliability of the 'pre-manipulative position test' is 'fair' to 'good'. For clinical practice this means that an experienced manual therapist, acting conform the proposed standard by the APA, is able to position and reposition the patient after the necessary pause in the 'pre-manipulative position' before initiating a High Velocity Thrust.

The inter-examiner reliability has to be interpreted with caution because of the large confidence intervals. Future studies regarding the validity of the 'pre-manipulative position test' should bear this in mind. Clinically this implies that both test and manipulation are preferably executed by the same therapist.

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Table 1: Intra-examiner reliability of the pre-manipulative position test

	C1-2 R1	95% CI	R2	95% CI	C3-4 R1	95% CI	R2	95% CI	C5-6 R1	95% CI	R2	95% CI
TX RX	0,860**	0,633- 0,951	0,889**	0,690- 0,963	0,935**	0,826- 0,977	0,916**	0,770- 0,971	0,671**	0,279- 0,871	0,918**	0,781- 0,970
TY RY	0,679**	0,274- 0,879	0,887**	0,685- 0,962	0,824**	0,567- 0,935	0,908**	0,749- 0,968	0,529*	0,062- 0,805	0,944**	0,848- 0,980
TZ RZ	0,184ns	-,345- 0,624	0,905**	0,730- 0,968	0,259ns	-,254- 0,659	0,892**	0,709- 0,962	0,013ns	-,492- 0,472	0,806**	0,529- 0,928

T: test, R: retest, R1: examiner 1, R2: examiner 2, CI: confidence interval, X-Y-Z: refer to respectively X,Y and Z axis motion components