HEAD REPOSITIONING ACCURACY IN PATIENTS WITH WHIPLASH-ASSOCIATED DISORDERS

[1,2]Veronique Feipel, [1,2]Patrick Salvia, [1]Helene Klein, [1,2]Marcel Rooze
[1] Department of Anatomy, Université Libre de Bruxelles, email: vfeipel@ulb.ac.be web: homepages.ulb.ac.be/~anatemb
2 Centre for Functional Evaluation, Université Libre de Bruxelles,

INTRODUCTION

Head repositioning accuracy is commonly evaluated in patients with Whiplash-associated disorders (WAD). Most frequently, only neutral repositioning is assessed [1-4]. Only sparse data on repositioning in remote postures in available [5,8]. Similarly, only a few studies considered the components of HRE in all planes of space. Some bi-dimensional studies are available [1,3], but only one reported three-dimensional information [4] without comparing planes of motion.

In this study head repositioning accuracy in patients with WAD was compared to that obtained in healthy controls. A comparison between different repositioning tasks is proposed.

METHODS

29 patients suffering from WAD (age: 37, SD 14, years, 18 females) and 26 healthy subjects (control, age: 35, SD 11, years, 14 females) were recruited. Of the WAD patients, 71% had a grade III injury and 29% a moderate (grade I or II) injury [6].

Active head kinematics was sampled using a 3D-electrogoniometer (CA 6000 SMA, O.S.I., Union City, CA, USA) mounted using a harness at the level of Th1 and a helmet on top of the head [7]. The tasks consisted of neutral position repositioning tasks after maximal flexion-extension (FE) and of repositioning tasks in pure axial rotation (right and left of 50°) and complex postures (50° right or left axial rotation combined to a 20° ipsi-lateral bending). The former was carried out with eyes open (EO) and blindfolded (BF), the two latter only in blindfolded conditions. Four repetitions were requested for each condition. No feedback was given to the subject before the end of the entire test session.

For neutral repositioning tasks, head repositioning error (HRE) in each plane was computed as the absolute difference between initial head position and the final head position after stabilization (Figure 1a), and the maximal overshoot in each plane, not discussed here. For rotation and complex posture repositioning tasks, HRE in each plane was computed as the absolute difference between the end posture reached during the guided trial and that reached during repositioning trials (Figure 1b). A multiple-way repeated-measures ANOVA was used to compare tasks, motion components and groups.

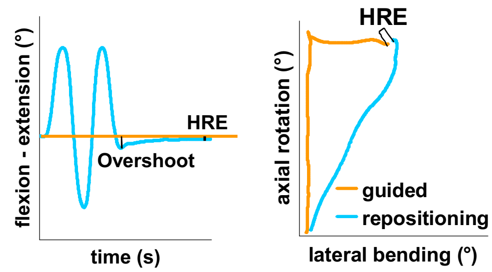

Figure 1: Repositioning parameters for (a) neutral and (b) complex remote repositioning tasks

RESULTS AND DISCUSSION

The HRE values found in the present study are comparable to those reported previously [4,6,7], although some authors found larger values [2,3,8]. These differences could be attributed to methodological differences. HRE was significantly increased (p=0.009) in the WAD group as compared to controls (Table 1), confirming several previous studies [3-7], but not all [3,8].

The primary plane HRE was significantly larger than out-of-plane HRE both for neutral ($p=7.1\times10^{-23}$) and remote ($p=3.0\times10^{-23}$) repositioning tasks, confirming previous work [7,8]. Neutral repositioning tasks displayed better head repositioning accuracy than remote repositioning tasks ($p=6.3\times10^{-18}$). The primary component HRE during neutral repositioning was of the same order of magnitude as the out-of-plane component HRE during remote repositioning in rotation. For neutral repositioning tasks, HRE was larger in blindfolded conditions (p=0.03). A significant interaction between task complexity and component was obtained for remote repositioning tasks ($p=1.1\times10^{-05}$). Specifically, lateral bending HRE was increased when task complexity was larger, probably due to task difficulty and to the fact that lateral bending is not an out-of-plane component in this task.

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Table 1: Head repositioning errors for neutral and remote repositioning tasks.

	Neutral repositioning tasks				Remote repositioning tasks			
	BF		EO		Pure		Complex	
HRE component (°)	WAD	Control	WAD	Control	WAD	Control	WAD	Control
Flexion-extension	3.5 (2.4)	2.1 (2.0)	2.3 (1.8)	1.8 (1.6)	2.2 (1.1)	2.0 (1.3)	2.8 (1.4)	2.5 (1.0)
Lateral bending	0.8 (0.6)	0.4 (0.3)	0.5 (0.6)	0.5 (0.5)	1.9 (1.0)	1.7 (0.5)	3.7 (1.8)	3.1 (1.8)
Axial rotation	1.1 (1.1)	0.6 (0.5)	0.6 (0.6)	0.7 (0.6)	7.8 (3.7)	5.6 (3.8)	5.5 (3.6)	4.9 (2.1)