

LE Soares, RJ Abboud, GP Arnold and S Nasir

Department of Orthopaedic & Trauma Surgery, Institute of Motion Analysis & Research (IMAR)
TORT Centre, Ninewells Hospital & Medical School, University of Dundee, UK • BMSc 2016

INTRODUCTION

Rapid extrication of RTC victims is a crucial moment for pre-hospital care, since inadequate handling during this phase of management has been related to further spinal injuries¹. Cervical spine immobilisation is performed by emergency medical services (EMS) and devices have been designed in order to help this process during extrication.

AIMS & OBJECTIVES

This study examines objectively and biomechanically the RESQroll®, a new device for cervical spine immobilisation on rapid extrication after road traffic collisions.

METHODS & MATERIALS

- Simulation of extrication using a mock car positioned to have access to all 3D motion cameras (Figure 1).

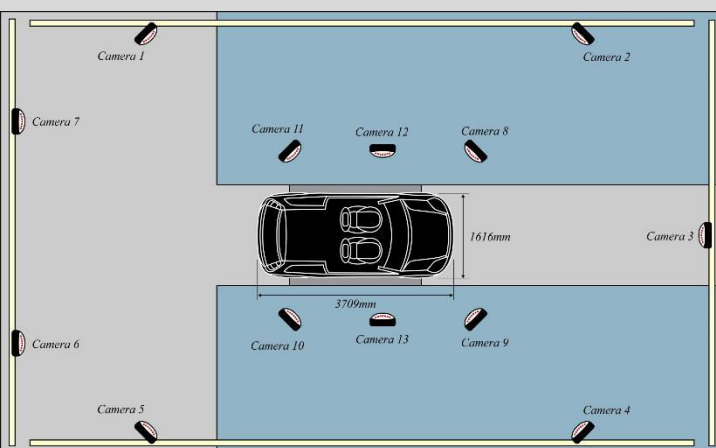


Figure 1. Plan view of the capture lab

- 8 different pairs of paramedic extricated one healthy subject (Figure 2).



Figure 2. Vehicle extrication using the Resqroll®

- Vicon® 3D motion analysis system was used to capture 19 reflective markers (Figure 3).

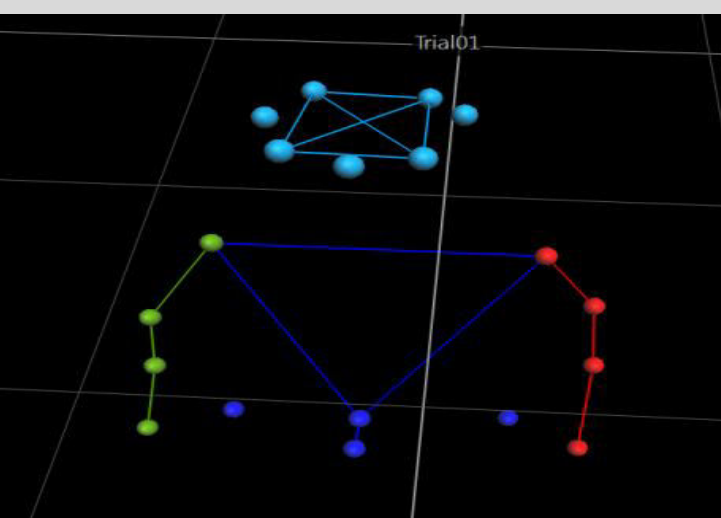


Figure 3. Marker positions

- The range of motion (ROM) of the cervical spine was measured in 3 planes: (b) transverse, (c) frontal and (d) sagittal (Figure 4).

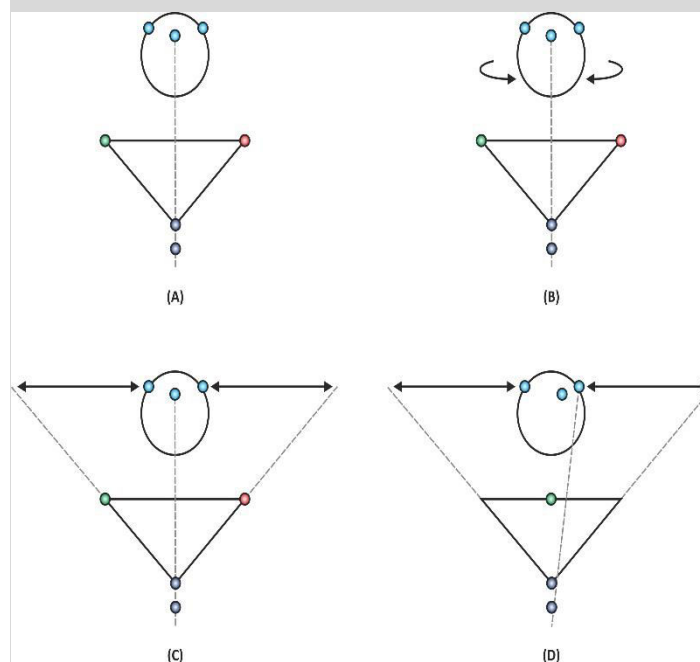


Figure 4. Cervical spine ROM

- Total extrication time and time for the application of the RESQroll® was recorded.

RESULTS

Findings for mean, maximum and minimum range of motion found during extrication using the RESQroll® are displayed in Table 1 and Figure 5.

Table 1. ROM findings

CROM (deg)	Flexion/Extension	Lateral Flexion	Rotation
Max	65.34	45.4	54.52
Min	19.21	13.51	12.43
Mean ROM	37.54	26.32	30.63
SD	13.80	10.51	13.11

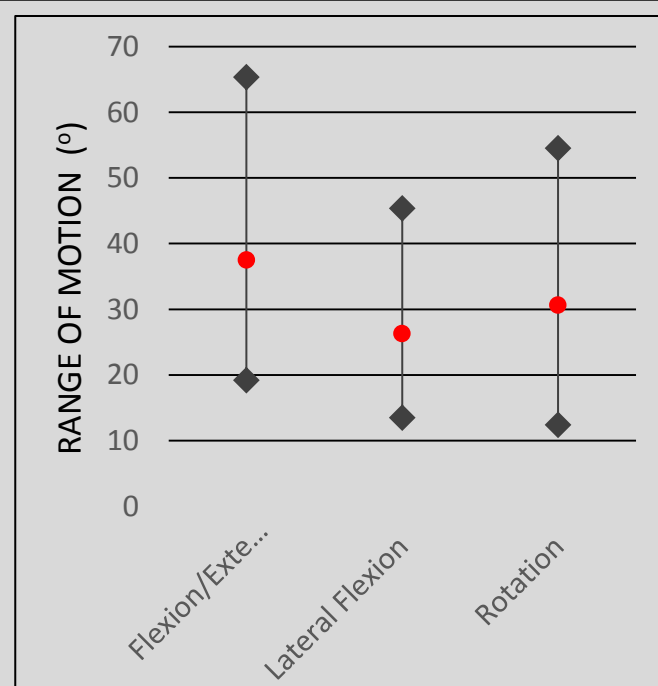


Figure 5. Range of motion of the cervical spine during extrication using the RESQroll® in three planes

Results of time for applying the RESQroll® and total extrication time in table 2 below.

Table 2. Values for application time of the device and total time of extrication

	Application time (s)	Total extrication time (s)	Application time/total time (%)
Mean	46.94	106.55	44.06
Max	78.00	197.00	
Min	32.00	76.80	
SD	11.45	30.41	

Table 3. Level of protection in percentage of total movement restriction in each plane

Mean ROM	Flexion/Extension	Lateral Flexion	Rotation
RESQroll®	37.54°	26.32°	30.63°
Normal ROM ²	113°	83.1°	130.7°
Level of protection	66.78%	68.33%	76.56%

DISCUSSION

Biomechanical Analysis

For all planes, no more than 37 degrees of ROM was recorded. The greatest level of protection appeared to be in the transverse plane during rotation, which restricted to approximately 25% of the full normal active ROM (Table 3). When comparing our results with most recent studies that assessed the cervical ROM during extrication using an assisted technique, our angle values were similar³⁻⁵. Therefore, we suggest that the RESQroll® can effectively protect cervical movement during extrication.

Time Analysis

Our findings demonstrate a significant short mean time for the entire extrication and for the application of the RESQroll®, that was fast enough to take less than 1/10 of the maximum time described by literature. It is possible to suggest that the RESQroll® does not compromise total time of the extrication process like other devices, such as KED, which adds more than 5 minutes to the extrication process⁶.

Limitations

Only 17 trials were available for analysis due to data loss caused by difficulty in tracking the markers by motion camera system. Also, only one healthy subject was used for the extrication simulations. Since our aim was mainly descriptive, comparison to the standard extrication technique and other devices was not conducted.

CONCLUSIONS

While these results suggest efficacy and practicality of this new equipment, further studies on cervical immobilisation during extrication with larger sample and comparison to the manual standard extrication approach are needed to make strong conclusions of the use of this new device as well as to establish clinical significance of spinal immobilisation during pre-hospital care.

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