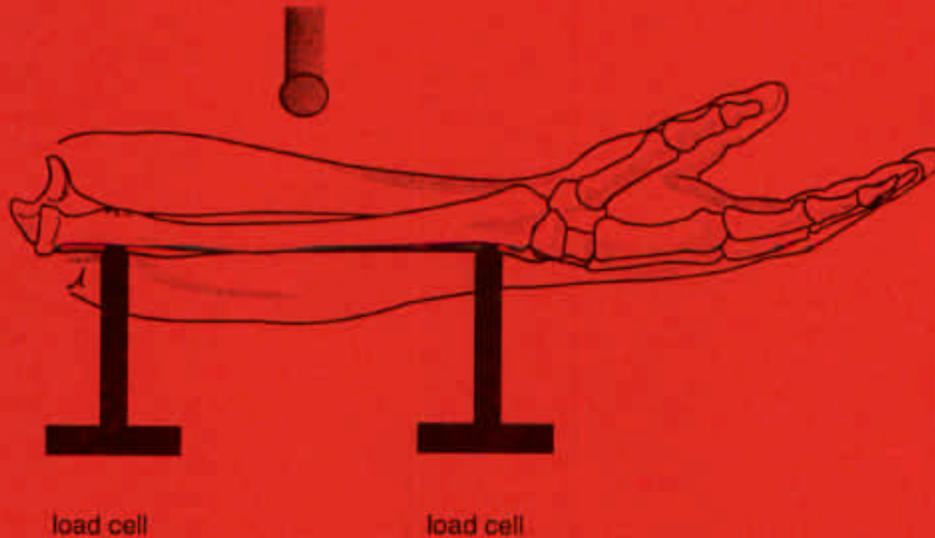
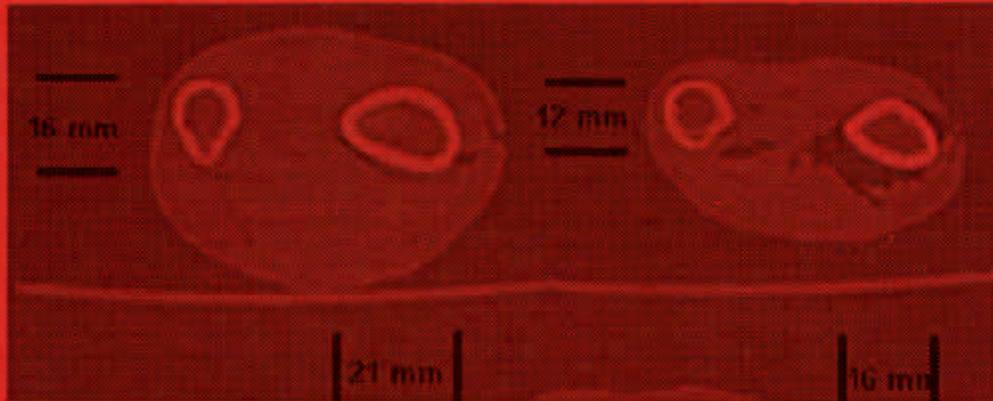


**24TH INTERNATIONAL WORKSHOP
ON HUMAN SUBJECTS FOR
BIOMECHANICAL RESEARCH**



**ALBUQUERQUE, NEW MEXICO
NOVEMBER 3, 1996**

MICHAEL KLEINBERGER, CHAIRMAN

H S B R

**24TH INTERNATIONAL
WORKSHOP ON
HUMAN SUBJECTS FOR
BIOMECHANICAL RESEARCH**

**US Department of Transportation
National Highway Traffic Safety Administration**

**Michael Kleinberger, PhD
Chairman**

**ALBUQUERQUE, NEW MEXICO
NOVEMBER 3, 1996**

Table of Contents

	Page
Introduction	iii
Michael Kleinberger, Chairman	
Study of Forearm-Airbag Interaction Using the Research Arm Injury Device (RAID)	1
Mitchell B. Oslon, Charles W. Yeiser, Shashi M. Kuppa, Lynne M. Taylor, Richard M. Morgan, and Rolf H. Eppinger	
Discussion	15
Assessing Arm Injury Potential from Deploying Air Bags	17
Kristie L. Johnston, Kathleen DeSantis Klinich, Daniel A. Rhule, and Roger A. Saul	
Discussion	39
Air Bag Interaction with Cadaveric Upper Extremities	41
C.R. Bass, S.M. Duma, J.R. Crandall, T.J. Micek, E.M. Sieveka, M.J. Lange, N. Grillo, P.G. Martin, and W.D. Pilkey	
Discussion	57
Methods for the Investigation of Airbag-Induced Upper Extremity Injuries	61
Warren Hardy	
Discussion	67
Dynamic Three-Point Bending Tests of the Human Forearm	73
Frank A. Pintar and Narayan Yoganandan	
Discussion	79
Head Impact Modelling Using Computer Accident Simulation Based on Cadaver Records	81
Michael Garrett	
Discussion	91
Ongoing Investigation of Brain Injury Kinematics	93
Warren Hardy	
Discussion	103

Table of Contents

(Continued)

	<u>Page</u>
An Experimental Study of Airbag-Induced Eye Injuries	107
Stefan M. Duma, Tyler A. Kress, David J. Porta, Peter G. Martin, Rodney J. Simmons, Cherie L. Alexander, and Charles D. Woods	
Discussion	123
<i>In Situ</i> Measurement of Loads in the Tibia	125
Kelly B. Kennett, Jeff R. Crandall, Cameron R. Bass, and Gregory S. Klopp	
Discussion	139
Human Subject Protection in Low-Speed Rear-End Automobile Testing	141
Brault JR, Wheeler JB, Siegmund GP, and King DJ	
Discussion	151
Pure Moment Testing of Flexible Segmented Structures	153
Roger W. Nightingale, Daniel L. Camacho, Joseph J. Robinette, and Barry S. Myers	
Discussion	161
Pendulum Impact Test System to Study Whiplash Injury Biomechanics	163
Anthony Sances, Jr. and Srirangam Kumaresan	
Discussion	171
PANEL DISCUSSION: Development of Pediatric Dummies & Injury Criteria	175
Panel Members: Michael Kleinberger (NHTSA), John Melvin (General Motors), Marc Beusenbergh (TNO), Priya Prasad (Ford), and Barry Myers (Duke University)	

INTRODUCTION

The Twenty-Fourth International Workshop on Human Subjects for Biomechanical Research was held in Albuquerque, New Mexico on November 3, 1996. The Workshop ran from 9am until 4pm, and consisted of twelve technical presentations on human subject testing, followed by a panel discussion on the development of pediatric dummies and associated injury criteria. Total attendance for the Workshop was 117 people representing 12 countries and 5 continents from around the world; 81 from North America, 1 from South America, 21 from Europe, 11 from Southeast Asia, and 3 from Australia.

Technical presentations addressed injuries to almost every part of the human anatomy, from the vertex of the skull to the medial malleolus. The first five presentations focused on upper extremity injuries resulting from airbag deployments using a variety of research tools. Remaining presentations discussed a variety of issues in head, neck, and lower extremity injuries. The final portion of the program was the panel discussion on pediatric injuries. Panelists included researchers in the field of biomechanics from industry, government, and academia.

I would like to express my appreciation to the staff of Conrad Technologies, Inc. for all of their assistance before, during, and after the Workshop. In particular, I would like to thank Ms. Linda Albright for her help in arranging for the audiovisual equipment and refreshments at the Workshop, and for the transcription of the numerous audiotapes. A very special thanks goes out to Ms. Thuvan Nguyen for guiding me smoothly through my first year as Chairman. Her professional assistance and dedication to the Workshop helped ensure the continued quality of this annual event. From the initial mailing of the Call For Papers to the final preparation and mailing of these Proceedings, her assistance has proven invaluable.

I would also like to thank Karen Mong and Sharon Carreyn from the Society of Automotive Engineers for providing the meeting room and advertising for the Workshop. Although the Workshop is always scheduled around the Stapp Car Crash Conference, papers presented are neither sanctioned nor approved by the Stapp Advisory Committee. Contents of these papers have not been screened for accuracy by a peer review process, thus they should not be referenced in the scientific literature.

I thank everyone who attended this Workshop, and especially all of the presenters and authors, for making this Workshop a tremendous success. The Twenty-Fifth International Workshop on Human Subjects for Biomechanical Research is tentatively scheduled for Saturday, November 15, 1997 at the Walt Disney World Hilton in Lake Buena Vista, Florida.

Thank You,



Michael Kleinberger, PhD
Chairman