

# HAND AND UPPER EXTREMITY RESEARCH: THE MGH-AMC (NETHERLANDS) COLLABORATION

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## INTRODUCTION

In 2003, as a result of the decision to pursue a clinical PhD with us, Dr. Job Doornberg established a fruitful research collaboration between the MGH Orthopaedic Hand and Upper Extremity Service in Boston and the Academic Medical Center (AMC), Amsterdam, and now expanding to include other institutions in the Netherlands. The international collaboration has already led to dozens of publications, and 3 PhD's, with 3 more under way. It has also enhanced our understanding of the cultural, traditional, and political aspects of orthopaedic practice. This paper reviews the history, achievements, and future of our Dutch – American Research Collaborative.

## “NEW NETHERLANDS”

In 1609, the English Captain Henry Hudson was hired by the “Dutch East India Company” (the VOC) in Amsterdam to explore an alternative route to India and to claim any untaken territories for the Dutch Republic. Hudson and his Dutch crew reached the coast of future New England, found good farmland and wildlife and began trading fur. The region that extends from and beyond today's Cape Cod to New York soon became a colony of the Netherlands and was named “New Netherlands”. Cape Cod itself was called “New Holland”. (Figure 1) Hudson sailed further south and nearby the mouth of a river that was later named after him, he bought Manhattan Island from the Indians for goods worth the value of \$24. Some years later, the city New Amsterdam was founded. Between 1664 and 1674, the city fell into the hands of the British in exchange for the possession of Suriname, and was renamed New York. (1)

## THE NETHERLANDS – BOSTON RESEARCH COLLABORATION

The new trade between Amsterdam and “the New Netherlands” is science rather than fur. A research exchange program between the Orthopaedic Hand and Upper Extremity Service at Massachusetts General Hospital and the Department of Orthopaedic Surgery at the Academic Medical Center in Amsterdam has developed over decades, rapidly accelerating since 2003. It started when Peter Kloen, then an enthusiastic Dutch medical student, left for a research fellowship with Dr. Henry Mankin, which eventually culminated in his PhD degree and completion of the Harvard Combined Orthopaedic Residency Program.

Prior to and simultaneous with this, Peter's mentor Dr. Rene Marti, the former Chief of Orthopaedic Surgery at the Academic Medical Center in Amsterdam and Dr. Jesse Jupiter, then Chief of Orthopaedic Trauma in Boston had established a great friendship and collaboration based upon their involve-

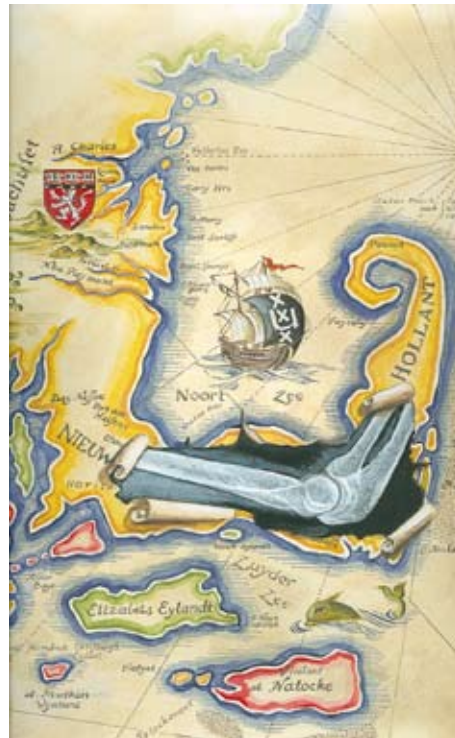


Figure 1. Henry Hudson and his Dutch crew arriving in the “New Netherlands”. Adapted from Johannes Visscher (1587 – 1652) by Marcello Lavallen. Reproduced with kind permission of Marcello Lavallen © 2006.

ment with AO and their devotion to orthopaedic trauma, and resulting in several papers—some of them coauthored by Dr. David Ring when he was a resident. (2-5)

Years later, when Peter became Chief of Orthopaedic Trauma in Amsterdam following a trauma fellowship with David Helfet at the Hospital for Special Surgery in New York, the collaboration became more intense. (6-8) As an enthusiastic supervisor of medical students during their research internships, he encouraged student Job Doornberg to pursue a research elective with his former colleague, co-resident, and friend David Ring at the Orthopaedic Hand and Upper Extremity Service at MGH in Boston. Job decided to extend his initial five-month research elective an additional two years to pursue a PhD degree to be awarded by the University of Amsterdam and based upon collaborative clinical research between Amsterdam and Boston.

This inspired many medical students to devote some time to research with Peter in Amsterdam and David in Boston, and several other students to pursue a PhD. Job convinced Dr. Ring to pursue a PhD degree in recognition of his clinical research. In October 2006, Job and David successfully defended their theses and received their PhD degrees from Professor Niek van Dijk at the University of Amsterdam. (Figure 2) Job's thesis was titled,



Figure 2. David Ring (l) and Job Doornberg after successful defense of their PhD theses in Amsterdam.

“Complex Elbow Trauma” and David’s was titled “Psychosocial Aspects of Arm Pain”. In addition, Dr. Santiago Lozano-Calderon, a research fellow from Colombia, was also recruited to earn a PhD from the University of Amsterdam as part of our MGH/AMC Collaborative, to be defended later this year.

Three additional PhD students (one of whom—Dr. Marjolijn Henket—decided to finish her PhD degree during her residency and returned to the Netherlands), solidified the collaboration. With new Dutch PhD students already waiting to succeed them, a permanent exchange has been established. Meanwhile, the exchange has gained name and popularity in the Netherlands, which has led to an increasing stream of short-term researchers from the University of Amsterdam and other Dutch Universities that cross the ocean to visit the MGH

Orthopaedic Hand and Upper Extremity Service for research electives. So far, fourteen Dutch students and young doctors have visited the department for a few months or several years.(Table 1)

In addition to the experience of living abroad for a while, students get exposed to all aspects of clinical research, get more comfortable with statistics, and get the chance to present their research at national and international meetings in Europe and throughout the United States.(62-169)(Figure 3) Furthermore, it may help them to get accepted into an orthopaedic residency program back home in The Netherlands. The way research is organized at the MGH Orthopaedic Hand and Upper Extremity Service guarantees that there is always sufficient work. After all, nearly every patient that comes in can be enrolled in one of the many active research protocols in our department. For the PhD fellows specifically, this, in combination with the highly specialized character of the department (less frequently seen in a small country as the Netherlands), ensures a fast enrollment in studies and consequently shortens the time they need to spend on their PhD research.

The Dutch research students get funded in three ways: by unrestricted research gifts from foundations and industry to the MGH Orthopaedic Hand and Upper Extremity Service; by multiple private Dutch funds, usually founded out of inheritances and supporting students that go abroad to pursue medical research; and from private loans. In addition, the so-called “Harvard University – University of Amsterdam Orthopaedic Exchange Program” was recently awarded with a \$30,000 grant by the Netherlands –American Foundation, an associate of the Fulbright Program.

	2003	2004	2005	2006	2007	2008
PhD	Job Doornberg	Job Doornberg	Job Doornberg			
		Santiago Lozano	Santiago Lozano	Santiago Lozano	Santiago Lozano	
			Anneluuk Lindenhovius	Anneluuk Lindenhovius	Anneluuk Lindenhovius	
			Sebastiaan Souer	Sebastiaan Souer	Sebastiaan Souer	Sebastiaan Souer
			Marjolijn Henket	Marjolijn Henket		
					Kim Brouwer	Kim Brouwer
					Thierry Guitton	Thierry Guitton
						Geert Buijze
Short-Term		Durk Linzel	Joppe van Duijn	Quinten Felsch	Alexandra Schnellen	
		Inge de Jong	Aleid Ruijs	Geert Buijze	Pieter-Bas Witte	
			Marijn Rutgers	Koen van de Luytgaarden	Gijs Helmerhorst	
				Gijs Iordens	Esther Rust	
					Hans de Vries	

Table 1. Research Fellows MGH Orthopaedic Hand Service - Netherlands Collaboration

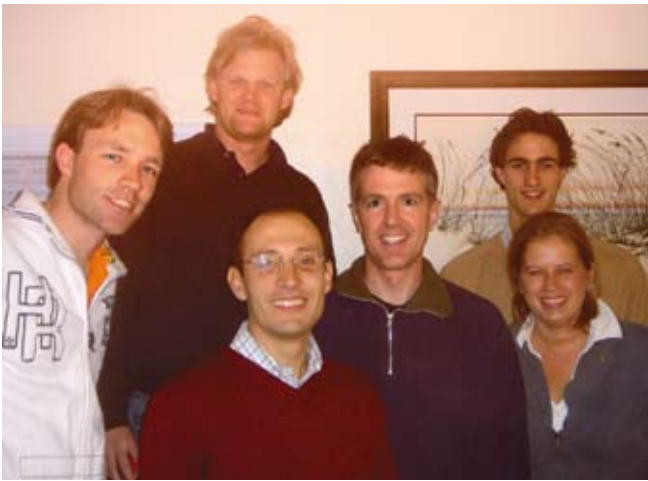


Figure 3. The Dutch-American research team during the AAOS 2007 in San Diego. Left to right: Marijn Rutgers, Sebastiaan Souer, Santiago Lozano-Calderon, David Ring, Geert Buijze and Anneluuk Lindenhovius.

## WORK TO DATE

### THE AMC AO TRAUMA DATABASE

The trauma database established decades ago by Dr. Rene Marti and his colleagues at the Academic Medical Center in Amsterdam has been a priceless resource for long-term outcome studies. Virtually all patients that presented to the AMC with a fracture between 1974 and 1994 were included in this database and organized according to the AO classification. We have only begun to tap this great resource. (31, 34, 36, 34) Once we come up with a new idea, there is usually an enthusiastic Dutch student ready to call the patients back—something that is much more easily done in the Netherlands than in the United States.

### THE 3D CT LABORATORY

In the 3D CT Laboratory we convert two-dimensional computed tomography (2D CT) images to high quality three-dimensional CT (3D CT) reconstructions that we use in many studies to learn more about the osseous anatomy of the arm, to study specific fracture patterns, to measure the volume of fragments in certain fracture patterns, and to prove the usefulness of 3D CT in the evaluation of fractures. Special software is used to process the scans and to perform all kind of measurements. For instance, guidelines for optimal screw insertion in the scaphoid through a volar percutaneous approach were quantified with use of 3D CT reconstructions, and in another study we illustrated the vulnerability of the anteromedial facet of the coronoid process by quantifying its shape and size. In addition, CT scans and reconstructions of distal humerus and distal radius fractures were used in inter-observer studies that demonstrated the added value of 3D CT for these fractures. We recently joined an international research group called COAST that directs web-based outcome and inter-observer studies, an initiative from Mohit Bhandari at McMaster University in Ontario, Canada. Two-dimensional and 3D CT images are exported to the COAST website as simple videos, thereby facilitating all sorts of time- and user-friendly web-based studies with a high number of observers from all over the world.

## IN VIVO KINEMATICS

In collaboration with Dr Guoan Li, head of the Bioengineering Laboratory of the Orthopedic Department of the Massachusetts General Hospital, we utilize new Magnetic Resonance (MR) and dual-orthogonal fluoroscopy imaging techniques to investigate *in vivo* joint kinematics and soft tissue deformation of the wrist and the forearm. MR images are imported into modeling software to construct 3D anatomic models of the forearm. In addition, orthogonal fluoroscopic images of the patient's forearm are obtained in different positions while loaded with a fixed weight. By matching the images a 3D model of the forearm during *in vivo* activities is generated.

Through this model, six degree of freedom kinematics of the forearm can be measured, points of cartilage contact can be quantified, and elongation of the soft tissues, for instance the interosseous ligament, can be accurately measured. This model provides accurate baseline functional data to which pathologic conditions, such as both bone forearm fracture, radial head excision, Essex-Lopresti lesions, or other problems may be compared using paired computer models. It will also help to identify energy conserving motions that may be preferentially used in human activities.

## ELBOW CAPSULES

One of our main research interests is posttraumatic elbow stiffness. In addition to many clinical studies that focus on this topic, we use fibrotic elbow capsules in basic science studies to elucidate and better understand the pathophysiology underlying capsular fibrosis. Several aspects that may contribute to scarring of joint capsules have been related to an increased expression of transforming growth factor Beta (TGF- $\beta$ ). TGF- $\beta$  activates signaling intermediates called Smads through a serine/threonine kinase system. In animal models, local administration of Smad3 inhibitors has shown to reduce the fibrotic response in lung, liver, kidney and radiation-induced fibrosis, rendering the role of Smads and TGF- $\beta$  in fibrotic elbow capsules of high interest. Contracted elbow capsules that are collected during operative release of stiff elbows in Boston are analyzed at the AMC in Amsterdam and at the Hospital for Special Surgery in New York, under supervision of Peter Kloen.

## PROSPECTIVE AND RETROSPECTIVE PROTOCOLS

There are numerous retrospective and prospective protocols at both the MGH and AMC investigating all aspects of treatment of shoulder, elbow, wrist and hand fractures. The collaboration has been very fruitful over the past years and resulted in twenty-eight publications(2-29), twenty-five articles in the pipeline(30-53), hundred-and-five podium and poster presentations(60-164) to date and many more projects underway.

## THE FUTURE

With new Dutch PhD research fellows ready to spend the next couple of years in Boston, we expect the exchange to keep on flourishing. In May 2007, there was a record number of six Dutch short- and long-term researchers here at MGH at the same time, in an office with three attending surgeons. Both in Amsterdam as in Boston, it is the supervisors' goal to encourage these students to pursue academic research as a life-long devotion.

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83. **Rutgers M, Shin R, Jupiter JB, Ring D, Mudgal CS et al.** Combined fractures of distal radius and scaphoid. Annual Meeting of the New England Orthopaedic Society, Boston, November 2005
84. **Lozano Calderón SA, Ring D, Zurakowski D, Blazar P, Lee S.** Inter and Intraobserver reliability in the diagnosis of displacement in scaphoid fractures. Annual Meeting of the New England Orthopaedic Society, November 2005
85. **Doornberg J.N., van Duijn P.J., Linzel D.S., Jupiter J.B., Ring D., Raaymakers E., Marti R.K., Kloen P.** Intra-Articular Distal Humerus Fractures: 12-30 Year Follow-up. Annual Meeting of the Dutch Orthopaedic Association, Amsterdam, the Netherlands, January 2006
86. **Linzel D.S., Doornberg J.N., Ring D and Jupiter J.B.** Comparison of Elbow Contracture Release in Patients with and without Heterotopic Ossification. Annual Meeting of the Dutch Orthopaedic Association, Amsterdam, the Netherlands, January 2006 (*Nominated for Orthomed Award*)
87. **Doornberg J.N., Kloen P. and Ring D.** Fractures of the Coronoid Process. Annual Meeting of the Dutch Orthopaedic Association, Amsterdam, the Netherlands, January 2006
88. **Lindenhovius A.L.C., Doornberg J.N., Mudgal C., Forthman C., Jupiter J.B. Kloen P., van Dijk C.N., Ring D.** Reliability and Accuracy of Three Dimensional Computed Tomography in the Classification and Management of Distal Humerus Fractures. Annual Meeting of the Dutch Orthopaedic Association, Amsterdam, the Netherlands, January 2006
89. **Rutgers M, Ruijs A, Torrano JP, Jupiter JB, Ring D.** Transposition vs release and protection of the ulnar nerve in treatment of distal humerus fractures. Annual Meeting of the Dutch Orthopaedic Association, Amsterdam, the Netherlands, January 2006
90. **Lindenhovius A.L.C., Doornberg J.N., Mudgal C., Raaymakers E., Marti R.K., Ring D., Kloen P.** Long Term Outcome of Complex Olecranon Fractures. Annual Meeting of the Dutch Orthopaedic Association, Amsterdam, the Netherlands, January 2006
91. **Doornberg J.N., Linzel D.S., Ring D and Jupiter J.B.** Comparison of Elbow Contracture Release in Patients with and without Heterotopic Ossification. Open Meeting of the American Shoulder and Elbow Society, Chicago, March 2006
92. **Lindenhovius A.L.C., Doornberg J.N., Mudgal C., Raaymakers E., Marti R.K., Kloen P.** Long-Term Outcome of Operatively Treated Complex Olecranon Fractures. Open Meeting of the American Shoulder and Elbow Society, Chicago, March 2006
93. **Ring D. and Doornberg J.N.** Varus Posteromedial Rotational Elbow Injuries Open Meeting of the American Shoulder and Elbow Society, Chicago, March 2006
94. **van Duijn P.J., Doornberg J.N., Linzel D.S., Jupiter J.B., Ring D., Raaymakers E., Marti R.K., Kloen P.** Intra-Articular Distal Humerus Fractures: 12-30 years Follow Up. Open Meeting of the American Shoulder and Elbow Society, Chicago, March 2006
95. **Doornberg J.N., Linzel D.S., Ring D. and Jupiter J.B.** Comparison of Elbow Contracture Release in Patients with and without Heterotopic Ossification. 72nd Annual Meeting of the American Academy of Orthopaedic Surgeons, Chicago, March 2006
96. **Doornberg J.N., van Duijn P.J., Linzel D.S., Jupiter J.B., Ring D., Raaymakers E., Marti R.K., Kloen P.** Intra-Articular Distal Humerus Fractures: 12-30 years Follow Up. 72nd Annual Meeting of the American Academy of Orthopaedic Surgeons, Chicago, March 2006
97. **Lozano Calderón SA, Ring D, Zurakowski D, Blazar P, Lee S.** Inter and Intraobserver reliability in the diagnosis of displacement in scaphoid fractures. 72nd Annual Meeting of the American Academy of Orthopaedic Surgeons, Chicago, March 2006
98. **Doornberg J.N., Linzel D.S., Ring D and Jupiter J.B.** Comparison of Elbow Contracture Release in Patients with and without Heterotopic Ossification Podium Presentation 5th Biennial AAOS/ASES Shoulder and Elbow Meeting, Orlando, April 2006 (*Mel Post Award For Excellence in Clinical Research*)
99. **Doornberg J.N., Jawa A, Ring D and Jupiter J.B.** Distal Third Diaphyseal Humerus Fractures: Open versus Non-Operative Treatment. 5th Biennial Meeting of the American Academy of Orthopaedic Surgeons / American Shoulder and Elbow Society, Orlando, April 2006
100. **Lindenhovius A.L.C., Doornberg J.N., Mudgal C., Ring D., Kloen P.** Long-Term Outcome of Operatively Treated Complex Olecranon Fractures. 17th Annual Richard J. Smith Day, Boston, May 2006
101. **Souer JS, Jupiter J, Mudgal C.** Plate Fixation In Closed Ipsilateral Multiple Metacarpal Fractures. 17th Annual Richard J. Smith Day, Boston, May 2006
102. **Lindenhovius A.L.C., Doornberg J.N., Mudgal C., Ring D., Kloen P.** Long-Term Outcome of Operatively Treated Complex Olecranon Fractures. 16<sup>th</sup> Annual Meeting of the European Orthopaedic Research Society, June 2006, Bologna, Italy
103. **Doornberg J.N., Kloen P. and Ring D.** Coronoid Fracture Patterns. 16th Annual Meeting of the European Orthopaedic Research Society, Bologna, Italy, June 2006
104. **Doornberg J.N., Ring D.** Varus Posteromedial Rotational Elbow Injuries. 16th Annual Meeting of the European Orthopaedic Research Society, Bologna, Italy, June 2006
105. **Ring D., Lindenhovius A.L.C., Felsch Q., Kloen P.** Long Term Outcome of Mason 2 Radial Head Fractures Treated with Open Reduction and Internal Fixation. Closed Meeting of the American Shoulder and Elbow Society, September 2006, Chicago
106. **Lozano Calderón SA, Mudgal Ch, Jupiter JB, Ring D.** Prospective Randomized Comparison of Early vs. Late Wrist Mobilization after Volar Plate Fixation of Distal Radius Fractures. 61<sup>st</sup> Annual Meeting of the American Society for Surgery of the Hand, Washington DC, September 2006
107. **Souer JS, Rutgers M, Mudgal C.** Combined Fractures of the Distal Radius and the Scaphoid. 61<sup>st</sup> Annual Meeting of the American Society for Surgery of the Hand. Washington DC, September 2006
108. **Cowan J, Lozano Calderón SA, Ring D.** Variation in Quality of Level 1 Scientific Investigations: Lateral Epicondylitis. 61<sup>st</sup> Annual Meeting of the American Society for Surgery of the Hand, Washington DC, September 2006
109. **Dyer G, Lozano Calderón SA, Ring D.** Predictors of Acute Carpal Tunnel Syndrome Associated with Fracture of the Distal Radius. 61<sup>st</sup> Annual Meeting of the American Society for Surgery of the Hand, Washington DC, September 2006
110. **Lindenhovius A.L.C., Felsch Q., Ring D., Kloen P.** Long Term Outcome of Mason 2 Radial Head Fractures Treated with Open Reduction and Internal Fixation. Annual Meeting of the New England Orthopaedic Society, Boston, November 2006
111. **Lindenhovius A.L.C., Henket M., Gilligan B.P., Lozano-Calderon S.A., Mudgal C.S., Jupiter J.B., Ring D.** Corticosteroid Injection For Lateral Elbow Pain: A Randomized Placebo Controlled Clinical Trial. Annual Meeting of the New England Hand Society, Massachusetts, December 2006
112. **Rutgers M, Ruijs A, Torrano JP, Jupiter JB, Ring D.** Transposition vs release and protection of the ulnar nerve in treatment of distal humerus fractures. 73rd Annual Meeting of the American Academy of Orthopaedic Surgeons, San Diego, February 2007
113. **Lozano Calderón SA, Mudgal CS, Jupiter JB, Ring D.** Prospective Randomized Comparison of Early vs. Late Wrist Mobilization after Volar Plate Fixation of Distal Radius Fractures. 73rd Annual Meeting of the American Academy of Orthopaedic Surgeons, San Diego, February 2007

114. **Lozano Calderón SA, Scangas G, Ring D.** Quality and Strength of Evidence supporting Occupational Risk Factors for Carpal Tunnel Syndrome. 73rd Annual Meeting of the American Academy of Orthopaedic Surgeons, San Diego, February 2007
115. **Mudgal C.S., Lindenhovius A.L.C., Felsch Q., Doornberg J.N., Ring D., Kloen P.** Fractures around the Elbow – Long Term Outcome. Invited Lecture. 10<sup>th</sup> Triennial Congress of the International Federation of Societies for Surgery of the Hand, Sydney, Australia, March 2007
116. **Mudgal C, Souer JS, Rutgers M, Jupiter J, Ring D.** Perilunate injuries: Kirschner wire Fixation vs. Screw Fixation. 10<sup>th</sup> Triennial Congress of the International Federation of Societies for Surgery of the Hand, Sydney, Australia, March 2007
117. **Mudgal C., Souer JS, Jupiter J.** Plate Fixation In Closed Ipsilateral Multiple Metacarpal Fractures. 2007 Pan Pacific Hand and Upper Limb Trauma Symposium. Queenstown, New Zealand, March 2007
118. **Mudgal C, Souer JS, Rutgers M, Jupiter J, Ring D.** Perilunate injuries: Kirschner wire Fixation vs Screw Fixation. 2007 Pan Pacific Hand and Upper Limb Trauma Symposium. Queenstown, New Zealand, March 2007
119. **Lindenhovius A.L.C., Doornberg J.N., Ring D., Jupiter J.B.** Improved Motion Leads to Improved Health Status after Elbow Contracture Release for Posttraumatic Stiffness. 18th Annual Richard J. Smith Day, Boston, May 2007
120. **Doornberg J.N.** Posttraumatic Contractures after Trauma and Burn Injuries: Causes, Treatment and Rehabilitation. Invited Lecture, University of Groningen, the Netherlands, May 2007
121. **Lindenhovius A.L.C., Doornberg J.N., Jupiter J.B., Mudgal C.S., Ring D.** A Prospective Randomized Controlled Trial of Dynamic vs. Static Progressive Elbow Splinting for Post-Traumatic Elbow Stiffness. 62<sup>nd</sup> Annual Meeting of the American Society for Surgery of the Hand, Seattle, September 2007
122. **Souer JS, Lozano-Calderon S, Ring D, Jupiter J.** Determinants of Health Status and Wrist Function after Operative Fixation of Distal Radius Fractures. 62<sup>nd</sup> Annual Meeting of the American Society for Surgery of the Hand, Seattle, September 2007
123. **Souer JS, Ring D, Audige L, Jupiter J and the AO-Group.** Volar Shearing Fractures of the Distal Radius Are Usually Complete Articular (AO/OTA Type C) Fractures. 62<sup>nd</sup> Annual Meeting of the American Society for Surgery of the Hand, Seattle, September 2007

### Poster Presentations

124. **Doornberg J.N. and Ring D.** Coronoid Fracture Patterns. 71<sup>st</sup> Annual Meeting of the American Academy of Orthopaedic Surgeons, San Francisco, March 2004
125. **Doornberg J.N., Linzel D.S. and Ring D.** Reference Points for Radial Head Prosthesis. How to avoid “overstuffing” the joint? American Society for Surgery of the Hand, New York City, September 2004
126. **Doornberg J.N., Ring D and Jupiter J.B.** Static Progressive Splinting for Post-Traumatic Elbow Stiffness. American Society for Surgery of the Hand, New York City, September 2004
127. **Doornberg J.N., Linzel D.S. and Ring D.** Reference Points for Radial Head Prosthesis: How to avoid “overstuffing” the joint? Annual Meeting of the Orthopaedic Trauma Association, Fort Lauderdale, October 2004
128. **Doornberg J.N., Linzel D.S., Zurakowski D. and Ring D.** Reference Points for Radial Head Prosthesis: How to avoid “overstuffing” the joint? 14<sup>th</sup> Annual Meeting of the European Orthopaedic Research Society, Amsterdam, November 2004
129. **Doornberg J.N. and Ring D.** Coronoid Fracture Patterns. 14<sup>th</sup> Annual Meeting of the European Orthopaedic Research Society, Amsterdam, November 2004
130. **Doornberg J.N., Ring D and Jupiter J.B.** Static Progressive Splinting for Post-Traumatic Elbow Stiffness. 14<sup>th</sup> Annual Meeting of the European Orthopaedic Research Society, Amsterdam, November 2004
131. **Doornberg J.N., Ring D., Fabian L., Zurakowski D and Jupiter J.B.** Pain dominates measurements of elbow function and health status. 14<sup>th</sup> Annual Meeting of the European Orthopaedic Research Society, Amsterdam, November 2004
132. **Doornberg J.N., Linzel D.S., Zurakowski D. and Ring D.** Reference Points for Radial Head Prosthesis: How to avoid “overstuffing” the joint? 72<sup>nd</sup> Annual Meeting of the American Academy of Orthopaedic Surgeons, Washington DC, February 2005
133. **Doornberg J.N., Linzel D.S., Ring D and Jupiter J.B.** Comparison of Elbow Contracture Release in Patients with and without Heterotopic Ossification Poster Presentation. 60<sup>th</sup> Annual Meeting of the American Society for Surgery of the Hand, San Antonio, September 2005
134. **Lozano Calderón SA, Ring D, Zurakowski D, Blazar P, Lee S.** Inter and Intraobserver Reliability in the Diagnosis of Displacement in Scaphoid Fractures. MGH Research Day, Boston, 2005
135. **Lozano Calderón SA, Ring D, Zurakowski D.** Dorsal Shearing Fractures. MGH Research Day, Boston, 2005
136. **Doornberg J.N., Linzel D.S., Zurakowski D. and Ring D.** Reference Points for Radial Head Prosthesis: How to avoid “overstuffing” the joint? 60<sup>th</sup> Annual Meeting of the American Society for Surgery of the Hand, San Antonio, September 2005 (*Best Poster Award*)
137. **Slade J, Merrell G, Ring D, Lozano Calderón SA.** Arthroscopic Assisted Percutaneous Reduction and Fixation in Scaphoid Fractures. 60<sup>th</sup> Annual Meeting of the American Society for Surgery of the Hand, San Antonio, September 2005
138. **Doornberg J.N., Linzel D.S., Ring D and Jupiter J.B.** Comparison of Elbow Contracture Release in Patients with and without Heterotopic Ossification. 21<sup>st</sup> Annual Meeting of the Orthopaedic Trauma Association, Ottawa, Canada, October 2005
139. **Ring D. and Doornberg J.N.** Varus Posteromedial Rotational Elbow Injuries. 21<sup>st</sup> Annual Meeting of the Orthopaedic Trauma Association, Ottawa, Canada, October 2005
140. **Slade J, Merrell G, Ring D, Lozano Calderón SA.** Arthroscopic Assisted Percutaneous Reduction and Fixation in Scaphoid Fractures. 21<sup>st</sup> Annual Meeting of the Orthopaedic Trauma Association, Ottawa, Canada, October 2005
141. **Lindenhovius, A.L.C., Linzel D.S., Doornberg J.N., Ring D and Jupiter J.B.** Comparison of Elbow Contracture Release in Patients with and without Heterotopic Ossification. 72<sup>nd</sup> Annual Meeting of the American Academy of Orthopaedic Surgeons, Chicago, March 2006
142. **Doornberg J.N., Ring D and Jupiter J.B.** The Effectiveness of Static Progressive Splinting for Post-Traumatic Elbow Stiffness. 72<sup>nd</sup> Annual Meeting of the American Academy of Orthopaedic Surgeons, Chicago, March 2006
143. **Ring D. and Doornberg J.N.** Varus Posteromedial Rotational Elbow Injuries. 72<sup>nd</sup> Annual Meeting of the American Academy of Orthopaedic Surgeons, Chicago, March 2006
144. **Lindenhovius A.L.C, Doornberg J.N., Mudgal C., Raaymakers E., Marti R.K. and Kloen P.** Long-Term Outcome of Operatively Treated Complex Olecranon Fractures. 72<sup>nd</sup> Annual Meeting of the American Academy of Orthopaedic Surgeons, Chicago, March 2006
145. **Rutgers M, Shin R, Jupiter JB, Ring D, Mudgal CS.** Combined fractures of distal radius and scaphoid. Federation for European Societies for Surgery of the Hand, Glasgow, June 2006
146. **Doornberg J.N., van Duijn P.J., Linzel D.S., Ring D., Marti R.K., Kloen P.** Intra-Articular Distal Humerus Fractures: 12-30 years Follow Up. 16<sup>th</sup> Annual Meeting of the European Orthopaedic Research Society, Bologna, Italy, June 2006
147. **Doornberg J.N., Lindenhovius A.L.C., de Jong I.M., Ring D.** The Anteromedial Facet of the Coronoid Process; An Anatomical Study. 16<sup>th</sup> Annual Meeting of the European Orthopaedic Research Society, Bologna, Italy, June 2006
148. **Doornberg J.N., van Duijn P.J. and Ring D.** Coronoid Fracture Size in Terrible Triad Injuries. 16<sup>th</sup> Annual Meeting of the European Orthopaedic Research Society, Bologna, Italy, June 2006
149. **Lindenhovius A.L.C., Doornberg J.N., Kloen P., van Dijk C.N., Zurakowski D., Ring D.** Reliability and Accuracy of Three Dimensional Computed Tomography in the Classification and Management of Distal Humerus Fractures. 16<sup>th</sup> Annual Meeting of the European Orthopaedic Research Society, Bologna, Italy, June 2006
150. **Lindenhovius A.L.C., Doornberg, J.N., Linzel D.S., Ring D. and Jupiter J.B.** Comparison of Elbow Contracture Release in Patients with and without Heterotopic Ossification. 16<sup>th</sup> Annual Meeting of the European Orthopaedic Research Society, Bologna, Italy, June 2006
151. **Lozano Calderón S.A., Liebman M., Jupiter J.B.** Distal Radius Osteotomy in the Older Age Patient Using Angular Stable Implants and Norian Bone Cement. 61<sup>st</sup> Annual Meeting of the American Society for Surgery of the Hand, Washington DC, September 2006
152. **Henket M, Gilligan BP, Lozano Calderón SA, Mudgal Ch, Jupiter JB, Ring D.** Corticosteroid Injection for Lateral Elbow Pain. 61<sup>st</sup> Annual Meeting of the American Society for Surgery of the Hand, Washington DC, September 2006
153. **Lozano Calderón SA, Scangas G, Ring D.** Quality and Strength of Evidence supporting Occupational Risk Factors for Carpal Tunnel Syndrome. 61<sup>st</sup> Annual Meeting of the American Society for Surgery of the Hand, Washington DC, September 2006
154. **Nourissat G, Lozano Calderón SA, Ring D.** Radiological Measurements of Appropriate Radial Head Prosthesis Size. 61<sup>st</sup> Annual Meeting of the American Society for Surgery of the Hand, Washington DC, September 2006

155. **Shin R, Bastian P, Lozano Calderón SA, Mudgal Ch, Jupiter JB, Ring D.** Prospective Controlled Randomized Trial of Injection of Dexamethasone vs. Triamcinolone for Idiopathic Trigger Finger. 61<sup>st</sup> Annual Meeting of the American Society for Surgery of the Hand, Washington DC, September 2006
156. **Doornberg J.N., Elsner A., Marti R.K., van Dijk C.N., Kloen.P, Ring D.** Partial Articular Fractures of the Radial Head: Prevalence and Radiographic Evaluation of Displacement. 22<sup>nd</sup> Annual Meeting of the Orthopaedic Trauma Association, Phoenix, October 2006
157. **Nourissat G, Lozano Calderón SA, Ring D.** Radiological Measurements of Appropriate Radial Head Prosthesis Size. 22<sup>nd</sup> Annual Meeting of the Orthopaedic Trauma Association, Phoenix, October 2006
158. **Rutgers M, Ruijs A, Torrano JP, Jupiter JB, Ring D.** Transposition vs release and protection of the ulnar nerve in treatment of distal humerus fractures. 22<sup>nd</sup> Annual Meeting of the Orthopaedic Trauma Association, Phoenix, October 2006
159. **Lozano Calderón SA, Liebman M, Jupiter JB.** Distal Radius Osteotomy in the Older Age Patient Using Angular Stable Implants and Norian Bone Cement. 22<sup>nd</sup> Annual Meeting of the Orthopaedic Trauma Association, Phoenix, October 2006
160. **Dyer G, Lozano Calderón SA, Ring D.** Predictors of Acute Carpal Tunnel Syndrome Associated with Fracture of the Distal Radius. 22<sup>nd</sup> Annual Meeting of the Orthopaedic Trauma Association, Phoenix, October 2006
161. **Lindhovius A.L.C., Felsch Q., Ring D., Kloen P:** Long Term Outcome of Mason 2 Radial Head Fractures Treated with Open Reduction and Internal Fixation. 73<sup>rd</sup> Annual Meeting of the American Academy of Orthopaedic Surgeons, San Diego, February 2007
162. **Souer S, Rutgers M, Andermahr J, Jupiter JB, Ring D.** Perilunate Fracture–Dislocations of the Wrist: Comparison of Temporary Screw Versus K-Wire Fixation. 73<sup>rd</sup> Annual Meeting of the American Academy of Orthopaedic Surgeons, San Diego, February 2007
163. **Rutgers M, Ring D.** Functional fracture bracing of diaphyseal humerus fractures. 73<sup>rd</sup> Annual Meeting of the American Academy of Orthopaedic Surgeons, San Diego, February 2007
164. **Rutgers M, Shin R, Jupiter JB, Ring D, Mudgal CS.** Combined fractures of distal radius and scaphoid. 73<sup>rd</sup> Annual Meeting of the American Academy of Orthopaedic Surgeons, San Diego, February 2007