Investigating bilateral symmetry of the human wrist joint and clinical relevance

Published: 16-09-2009
Last updated: 06-05-2024

The aim of this study is to investigate the bilateral symmetry of the human wrist joint and its clinical applicability. The analysis of the bilateral symmetry of the wrist is of great clinical relevance. If there appears to be a high grade of...

Ethical review	Approved WMO
Status	Pending
Health condition type	Joint disorders
Study type	Observational invasive

Summary

ID

NL-OMON33772

Source
ToetsingOnline

Brief title
Bilateral Symmetry Wrist

Condition

- Joint disorders
- Bone and joint therapeutic procedures

Synonym
Wrist Anatomy, Wrist Pathology

Research involving
Human

Sponsors and support

Primary sponsor: Academisch Medisch Centrum
Source(s) of monetary or material Support: Ministerie van OC&W,NWO-STW Samenwerking met Philips Medical Systems

Intervention

Keyword: Anatomy, Bilateral Symmetry, Wrist Joint

Outcome measures

Primary outcome

The bilateral symmetry of the wrist joint is going to be described by grade of symmetry (in percentage). Differences between the left and right forearm are described by differences in length, width (both in mm), angles (in degrees) and rotations (in degrees).

From this study acquired information would create a basis for further research in studies on various wrist pathology and surgical techniques. We expect to find a grade of bilateral symmetry between the left and right forearm in the same person, that can be useful in several new surgical techniques.

Secondary outcome

Nvt

Study description

Background summary

Wrist problems are responsible for a significant social-economic problem for employers and the community. Complaints about the wrist are a reason for long absence periods from work. This has substantial financial consequences due to workers compensation, medical expenses, and productivity losses. Malfunctioning of the wrist often leads to reduced quality of life and has profound consequences for the involved patients. Due to the complex anatomy, treatment of wrist injuries is often very difficult. Treatment outcomes are variable by lack of quantitative data. Therefore it is of great importance for the patient and the medical doctor to have a clear understanding of the exact anatomy for ensuring optimal patient care.

The anatomy of the wrist joint is probably the most complex of all the joints

in the body. It consists of two long bones (the radius and the ulna) and two rows of four small bones (the eight carpal bones). Hand surgeons are just beginning to realize in how many ways the wrist can be injured. In the literature there are already numerous studies that report anatomical databases, including in vivo kinematic data as well as the bone anatomy. Different morphologic patterns of anatomy in the wrist bones have been identified and classified. Still there is unknown data that requires further research for the sake of new techniques in treating wrist problems. One of the new techniques in wrist surgery is computer-assisted correction osteotomy for malunions of the distal radius.

Fractures of the distal radius constitute about one sixth of all fractures seen in the emergency room. Union with deformity (malunion) is the most common complication after a distal radius fracture. This can cause pain, arthrosis, reduced range of motion, reduced grip strength, carpal instability, cosmetic deformity, late neuropathy, or tendon rupture. Sometimes a corrective osteotomy is required to restore normal function. This procedure involves cutting the distal radius near its original fracture site, improve the position of the radius, followed by fixation of this new situation. Often this new situation is supported by a bone graft and a fixation plate. A corrective osteotomy should correct all components of the malunion, not only the angular deformities and the shortening but also the distal fragment shifts. There is a clear correlation between the accuracy of reconstruction of the anatomy of the wrist and its eventual function. For optimal outcome, proper planning is important.

Lately, patient-specific treatment techniques for malunions of the distal radius are introduced in the literature, in which the malunited wrist is realigned to match the unaffected wrist. For this technique computer-assited three-dimensional modelling is used. One advantage of using three-dimensional modelling is planning of rotations in three dimensions. A preoperative plan is made by obtaining CT scans of both forearms. A computer provides three-dimensional reconstruction and creates virtual models of both radii. By comparison of the deformed distal end of the radius with a similar model of the uninjured wrist, values are calculated for the angles and lengts to be corrected by osteotomy. By using the preoperative planner a virtual osteotomy can be conducted and the malunited distal radius fragment is realigned to best fit the surface geometry of the unaffected template wrist. In this way the hand surgeon can calculate the displacements which need to be achieved.

Appreciation and knowledge of the patient-specific anatomy of the wrist is crucial for pre-operative planning in the treatment of distal radius malunion.

Despite of the growing knowledge about the anatomy of the human wrist joint, little is known about its bilateral symmetry. Naturally there is an anatomical variation in wrists between individuals. But lately, in literature the assumption is made that there could be a symmetry between the right and left forearm in each individual. Obviously, the idea of using the correct

measurements of the patients own healthy wrist seems better than using the common standardized measurements for the angles and length of the radius. An anatomic study is necessary since the question if there is a high grade of bilateral symmetry of the wrist joint is of great clinical relevance.

Aforementioned studies on new techniques in correction osteotomy for malunions of the distal radius propose methods where the uninjured wrist could serve as a model for the affected wrist. This new approach could mean a break-through in the research on treatment of distal radius malunions. However, the assumption that there is indeed a symmetry between the left and right radius is not based on scientific evidence. Since the analysis about the bilateral symmetry of the radius is valuable information, we would like to perform an anatomical study to examine if the assumption is justly.

Because not only the radius, but all the other bones in the wrist joint are important too in various wrist injuries, we plan on analysing the whole forearm, including also the ulna and carpal bones. In this way we can collect important data and create a basis for further research in future studies on treating distal radius malunion and other surgical procedures as well. The information about bilateral symmetry is also useful to evaluate changes in anatomy that occur during trauma or other diseases of the wrist, next to distal radius malunion. In addition we can study if there is an influence of right- or left-handedness on the final length and shape of the wrist bones.

Relevance for science, technology or society
This research will contribute to a greater understanding of the anatomy and common changes in the anatomy of the wrist. This is crucial for the design and execution of new improved surgical procedures for various wrist abnormalities. The goal of this study is to investigate the bilateral symmetry in the human wrist and it*s clinical applicability. Todays hand surgeon has to remain up to date on the expanding information base, this information will allow for a better understanding and treatment of injuries of the wrist. Better operative techniques will improve the quality of care, the quality of life for the involved patients, and will reduce the lost working time. In the end, this will reduce the societies expenses due to workers compensation, medical expenses, and productivity losses. Since the functionality of the hand is essential in almost any professional environment, improvement of wrist functionality will have a direct impact on the economic value as well as the social functioning of the patient involved.

Study objective

The aim of this study is to investigate the bilateral symmetry of the human wrist joint and its clinical applicability. The analysis of the bilateral symmetry of the wrist is of great clinical relevance. If there appears to be a high grade of bilateral symmetry, it could mean a break-through in the research on treatment of various wrist abnormalities. We hope to gain valuable

anatomical information and to create a basis for further research in studies on various wrist pathology and surgical techniques.

Study design

This study is a descriptive laboratory study and anatomical study. The aim is to gain valuable anatomical information about the wrist joint. Regular dose CT scans of both forearms are obtained (2 scans in total). Then scans will be compared with 3D matching software to evaluate the bilateral symmetry of the forearm.

Study burden and risks

The radiation exposure of scans is estimated to be 0,26 mSv for each participant. This is comparable to 6 weeks background exposure to the natural radiation in The Netherlands.

Contacts

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Trial sites

Listed location countries

Netherlands

Eligibility criteria

Age
Adults (18-64 years)
Elderly (65 years and older)

Inclusion criteria

Good health
Over the age of 18 years
Both wrists are unaffected

Exclusion criteria

Injury or disorders of the wrist in history
Familiar with skeletal and/or connective tissue diseases
Pregnancy
Not able to understand the written informed consent

Study design

Design

Study type: Observational invasive

Masking:	Open (masking not used)
Control:	Uncontrolled
Primary purpose:	Basic science

Recruitment

NL

Recruitment status:	Pending
Start date (anticipated):	01-01-2009
Enrollment:	20
Type:	Anticipated

Ethics review

Approved WMO

Application type:	First submission
Review commission:	METC Amsterdam UMC

Study registrations

Followed up by the following (possibly more current) registration

No registrations found.

Other (possibly less up-to-date) registrations in this register

No registrations found.

In other registers

Register	ID
CCMO	NL25659.018.08