

APPENDIX C

MOVEMENTS OF THE WRIST, FINGERS AND THUMB

Table C.1. Movements at the wrist joint (from Romanes, 1976).

Movement	Muscles	Nerve supply
Wrist flexion	Flexor carpi ulnaris	Ulnar
	Flexor carpi radialis	Median
	Flexor digitorum profundus	Median and ulnar
	Flexor digitorum superficialis	Median
	Flexor pollicis longus	Median
	Palmaris longus	Median
	Wrist extension	Extensor carpi ulnaris
	<i>Extensor carpi radialis longus and brevis</i>	Radial
	Extensor digitorum communis	Radial
	Extensor digiti minimi	Radial
	Extensor pollicis longus	Radial
	Extensor indicis	Radial
Wrist abduction	<i>Extensor carpi radialis longus and brevis</i>	Radial
	<i>Flexor carpi radialis</i>	Median
	Abductor pollicis longus	Radial
Wrist adduction	Flexor carpi ulnaris	Ulnar
	<i>Extensor carpi ulnaris</i>	Radial

Note. Terms in italics indicate the principal muscles producing a given movement.

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Table C.2. Movements of fingers (from Romanes, 1976).

Movement	Muscles	Nerve supply
Flexion		
All fingers all joints	Flexor digitorum profundus	Median (index & middle) Ulnar (ring & little)
MCP & PIP joints all fingers	Flexor digitorum superficialis	Median
MCP only all fingers	Lumbricals	Median (index & middle) Ulnar (ring & little)
CMC & MCP little finger	Flexor digiti minimi	Ulnar
CMC little finger	Opponens digiti minimi	Ulnar
Extension		
All fingers all joints	Extensor digitorum	Radial
Index only	Extensor indicis	Radial
Little finger	Extensor digiti minimi	Radial
MCP only all fingers	Extensors digitorum, indicis & digiti minimi if MP fully extended	Radial
IP only all fingers	Lumbricals	Median (index & middle) Ulnar (ring & little)
Abduction at MCP		
All fingers except little	Interossei, dorsal	Ulnar
Abduction at MCP		
Little finger	Abductor digiti minimi	Ulnar
Adduction at MCP		
All fingers except middle	Interossei, palmar	Ulnar
Opposition at CMC		
Little finger only	Opponens digiti minimi	Ulnar

Note. MCP = metacarpal; CMC = carpometacarpal.

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Table C.2 shows:

1. Little finger movements are seriously disturbed by destruction of the ulnar nerve, but flexion at the MCP (metacarpal phalangeal) and PIP (proximal interphalangeal) joints persists (using flexor digitorum superficialis).
2. Extension at the MCP joint is lost if the radial nerve is destroyed, but IP joint extension is not (by using the lumbricals and interossei).
3. Abduction and adduction at the MCP joints are lost when the ulnar nerve is obliterated.
4. When the median and ulnar nerves do not function at the level of the wrist, the extensors act without resistance and pull the MCP joints into full extension. When the MCPs are in full extension these same long forearm extensors can not extend the IP (interphalangeal) joints. When the lumbricals and interossei are paralysed the IP joints are pulled into flexion by the passive insufficiency of the long flexor muscles (Flexor Digitorum Profundus and Flexor Digitorum Superficialis) producing a 'claw hand'.

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Table C.3. Movements of the thumb (from Romanes, 1976).

Movement	Muscles	Nerve supply
Flexion		
All joints	Flexor pollicis longus	Median
CM and MP	Flexor pollicis brevis	Median
CM only	Opponens pollicis	Median
Extension		
All joints	Extensor pollicis longus	Radial
CM and MP	Extensor pollicis brevis	Radial
CM only	Abductor pollicis longus	Radial
IP only	Abductor pollicis brevis	Median
Abduction		
CM only	Abductor pollicis longus	Radial
CM and MP	Abductor pollicis brevis	Median
Adduction		
CM and MP	Adductor pollicis	Ulnar
MP only	1 st palmar interossei	Ulnar
Opposition		
Medial rotation CM	Opponens pollicis	Median

APPENDIX D

EDINBURGH HANDEDNESS INVENTORY

Adapted Edinburgh Handedness Inventory with 10 Items (EHI₁₀) given to all participants

The following instructions were given verbally to the teenagers in class groups.

1. “Which hand do you use for writing? Put a + in the right column if you use your right hand, or a + in the left column if you use your left hand. Regarding writing, if you always use this hand unless absolutely forced to or asked to use the other hand put another + in the same column as above. If you are very happy to use either hand for writing put a + in the other column.”
2. As for question 1, but substitute the underlined word with drawing
3. As for question 1, but substitute the underlined word with throwing
4. As for question 1, but substitute the underlined word with cutting with scissors
5. As for question 1, but substitute the underlined words with holding your toothbrush to brush your teeth.
6. As for question 1, but substitute the underlined words with using a knife, as in cutting up a fish or chopping up vegetables.
7. As for question 1, but substitute the underlined words with using a spoon
8. “Imagine you are sweeping the centre of a floor with a broom and see which hand you place uppermost on the broom handle. Put a + in the right hand...(as for question 1)
9. As for question 1, but substitute the underlined words with holding a match whilst you are striking the match against a box.
10. As for question 1, but substitute the underlined words with open the lid of a box when you are holding the box in one hand?

How to calculating the Laterality Quotient (LQ)

Add all the + for each hand separately, subtract the left total from the right total, divide the new total by 20 and multiply this figure by 100. Right handed people will have a positive LQ, left handed people will have a negative LQ. Possible LQs range from +100 to -100.

APPENDIX D

Copy of the form given to the participants for the initial and the repeat EHI₁₀

Student code:		Left hand	Right hand
1	Writing		
2	Drawing		
3	Throwing		
4	Cutting		
5	Tooth brushing		
6	Knife		
7	Spoon		
8	Sweeping		
9	Holding match		
10	Open lid		
	L.Q.		

APPENDIX D

Copy of the form given to all participants for the initial and the repeat EHI₁₄

As for Questions 1 to 10 in the original instructions, then

11. As for question 1, but substitute the underlined words with holding a hammer to hammer a nail into wood?
12. As for question 1, but substitute the underlined words with holding a racquet, such as a tennis, or squash racquet?
13. As for question 1, but substitute the underlined words with holding a screwdriver when you are screwing a screw?
14. Which shoulder do you rest a bat on when you are getting ready to hit a ball?

	L.Q.	Date:	
Name:		Left hand	Right hand
1	Writing		
2	Drawing		
3	Throwing		
4	Cutting		
5	Tooth brushing		
6	Knife		
7	Spoon		
8	Sweeping		
9	Holding match		
10	Open lid		
11	Hammer		
12	Racquet		
13	Screwdriver		
14	Shoulder for resting bat		

APPENDIX E

ADULT BIO-DATA FORMS

Sign displayed in waiting area of combined Physiotherapy & Hand Injury Clinic

VOLUNTEERS WANTED

Anita Clerke, our Hand Therapist, is conducting a survey on handedness as part of her PhD research thesis. If you would care to take 5 minutes to fill in a survey form please ask Anita for a copy. It would be greatly appreciated.

Unfortunately patients with hand injuries are excluded from the study.



APPENDIX E



The University of Sydney

School of Biomedical Sciences

Faculty of Health Sciences

RESEARCH STUDY

The Repeatability of the Modified Edinburgh Handedness Inventory for Adults

INFORMATION SHEET

You are invited to take part in a research project to investigate the reliability of a handedness inventory. This in turn will help with rehabilitation issues for hand-injured people.

The study is being conducted by Anita Clerke, Occupational Therapist, as fulfilment of the requirements of a Masters Degree by Research in Biomedical Sciences at the University of Sydney, Cumberland Campus. Anita is a local, Brisbane, Occupational Therapist studying externally.

If you agree to participate in the research, it will not cost you any money, only 5 minutes of your time. You will be asked to fill in a handedness inventory and some brief personal details about your age, gender etc., and contact details for a brief follow up.

Participation in this study is entirely voluntary; you are not obliged to participate. You are permitted to withdraw your consent to follow up and your participation or non-participation will not alter or influence in any way the relationship you have with any of the investigators.

Anita's hand injured patients are excluded from the study.

All aspects of this study will be strictly confidential and only investigators directly involved will have access to information on participants. A report of this study will be submitted for publication but individual participants will not be identified in such a report.

If you have any questions about this research, please contact one of the researchers below for clarification and/or further information, or ask Anita when she is in the clinic.

Anita Clerke (07) 3264 5561

Ron Balnave (02) 9351 9350

Any person with concerns or complaints about the conduct of the research study can contact the Secretary of Human Ethics Committee, University of Sydney on (02) 9351 4474

APPENDIX E



The University of Sydney

School of Biomedical Sciences

Faculty of Health Sciences

RESEARCH STUDY

The Repeatability of the Modified Edinburgh Handedness Inventory for Adults

CONSENT FORM TO BE FILLED OUT BY VOLUNTEER

I voluntarily consent to participate in the study of the repeatability of the Modified Edinburgh Handedness Inventory conducted by Mrs Anita Clerke and Dr Ron Balnave of the University of Sydney. I hereby give permission for the information I am supplying to be part of a research project, but that my right to privacy will be maintained (i.e., my personal details will not be revealed).

The procedures as set out in the attached information sheet have been understood by myself.

I acknowledge that I have the right to question any part of the procedure, to terminate data collection at any time and to withdraw my consent without compromising my relationship with any of the researchers.

Signed:

Date

APPENDIX E



The University of Sydney

School of Biomedical Sciences

Faculty of Health Sciences

RESEARCH STUDY

**The Repeatability of the Modified Edinburgh Handedness Inventory
for Adults**

GENERAL INFORMATION TO BE FILLED OUT BY VOLUNTEER

First name: _____ Surname: _____

Age today: _____ Date of Birth: _____

Address: _____
Home Phone: _____

Do you consider yourself to be left or right handed?

Right handed/ left handed (*please circle your answer*)

Have you had any hand injuries which have **permanently necessitated** you to change the hand in which you perform skilled tasks such as writing or using a carving knife?

Yes/No (*please circle your answer*)

If yes please give details:

Would you be happy to fill in the handedness survey again in one to two weeks, at a time when you are visiting our clinic again?

Yes/No (*please circle your answer*)

APPENDIX F

SCHOOL CONSENT AND INFORMATION FORMS



The University of Sydney

School of Biomedical Sciences

Faculty of Health Sciences

RESEARCH STUDY

The Repeatability of the Grip Strength Ratio for Teenagers

STUDENT AND PARENT/GUARDIAN INFORMATION SHEET

With the written permission of the parent or guardian, the students of Albany Creek High School are invited to take part in a research project to investigate teenagers grip strength. The project aims to find out how strongly your teenagers can squeeze a handle. The project also wants to find out whether the grip strength of teenagers changes over time, or whether it is stable. This information will be used to help therapists understand how the normal hand works. Thus leading to a greater understanding of how the injured hand works. This in turn will help with rehabilitation and compensation issues.

The study is being conducted by Anita Clerke, Occupational Therapist, as fulfilment of the requirements of a Masters Degree by Research in Biomedical Sciences at the Sydney University, Cumberland Campus. Anita is a local Occupational Therapist studying externally.

The research will not cost any money, only a little of your teenagers time. All testing will be conducted at the school during school hours. All Year 8 and Year 12 students who have returned a signed consent form will be requested to fill in a general health and sporting activity survey and a handedness questionnaire. This will take 20 minutes of class time. Then students will be randomly picked to be grip strength tested. Testing will be conducted in the presently unused photograph-developing laboratory of the school. One student will be tested at a time. Appointment times will be given out in home groups at the beginning of the day Anita has organised to test these students.

The randomly selected students who attend grip strength testing will have their grip strength, height, weight, hand length and hand circumference measured by Anita in the unused photography developing lab. To measure their grip strength they will be asked to squeeze a computer linked metal handle, 15 times with the right hand and fifteen times with their left hand. They will be given a 15 second rest break in-between each squeeze. They will be told their best score at the end of their test. The test will take a total of 10 minutes.

APPENDIX F

The Repeatability of the Grip Strength Ratio for Teenagers Over Two Different Time Intervals

An adverse reaction may be:

The most adverse reaction would be for the teenager to have a sore hand for a few minutes after squeezing the handle 15 times, because the handle is a solid, unpadded metal. Many people have performed this test in the past. They report that the discomfort is transient.

Participation in this study is entirely voluntary; your teenager is not obliged to participate and if you or the teenager chooses to, they can withdraw at any stage. While this research is intended to further knowledge into the hand strength of teenagers, it may not directly benefit your teenager.

The students' scores will not be given to anybody else at the school. All the gathered information will be strictly confidential and only the researcher and associate staff will have access to the results. The results from this study may be submitted for publication but individual participants will not be identifiable in such reports.

Students who do not wish to participate in the study may receive a pass from their teachers to study in the library for the 20 minutes that the group form filling is in progress, or they may continue individual studying in the class room if they wish.

If you have any questions about this research, please contact one of the researchers below for clarification and/or further information.

Anita Clerke (07) 3264 5561

Ron Balnave (02) 9351 9350

Any person with concerns or complaints about the conduct of the research study can contact the Secretary of Human Ethics Committee,
University of Sydney of (02) 9351 4474

APPENDIX F

PARENT/GUARDIAN CONSENT FORM FOR THE HAND GRIP STRENGTH TESTING BEING CONDUCTED AT ALBANY CREEK HIGH SCHOOL

Please see the separate information sheet for details of the research

(PLEASE RETURN THIS FORM TO YOUR STUDENT'S HOME GROUP TEACHER AS SOON AS POSSIBLE)

I am the parent/guardian of

..... (Grade) who attends Albany Creek High School. I hereby give permission for him/her to participate in the grip strength research.

Date

APPENDIX G

PERSONAL PROFILE FORMS

1. Date:			3. Male/Female	
2. Name:			Hand Circumference*	
4. Suburb & Post code			Hand Length*	
5a	0 < 1	1 to 4	4 to 8	>8
5b	0 < 1	1 to 4	4 to 8	>8
6	0 < 1	1 to 4	4 to 8	>8
7				
8. Yes/No		9. Hand R/L		Arm R/L
		Shoulder R/L		Neck R/L
10. Yes/No		11.		
12. Arthritis Yes/No				
13. Ops Yes/No When Body part				
14. #s Yes/No When Body part				
Height* cm		BMI*		
Weight* kg		EHI LQ*		

Verbal instructions for filling in the Personal Profile Form.

1. Write today's date
2. Write your name and date of birth.
3. Circle whether you are a male or female.
4. Write the suburb and post code of your main home.
- 5a. Circle the number of hours of regular exercise you do per week in the summer time.
- 5b. Circle the number of hours of regular exercise you do per week in the winter time.
6. Circle the number of hours of bicycling you do, on average per week.
7. Name the types of regular exercise you do.
8. Do you have any arm, shoulder or neck pain? Circle yes or no.
9. Circle where the pain is.
10. Do you currently take any prescribed medication, apart from the contraceptive pill?
11. List the medications.
12. Do you have juvenile arthritis?
13. Have you had any operations on arms, shoulder or neck at any stage in your life?
14. Have you had any fractured/broken bones in your arms, shoulder or neck at any stage in your life?

APPENDIX H

ANTHROPOMETRIC NORMS AND OUTLIERS FOR ANTHROPOMETRIC COMPARISONS

Table H.1. CDC Growth Chart Heights (cm) for 13 and 17-year-olds

Age & Gender	5 th percentile	50 th percentile	95 th percentile
13-year-old males	144	156	169
13-year-old females	145	157	167
17-year-old males	163	175	186
17-year-old females	152	163	173

Table H.2. CDC Growth Chart Weights (kg) for 13 and 17-year-olds

Age & Gender	5 th percentile	50 th percentile	95 th percentile
13-year-old males	33.5	45.5	66.0
13-year-old females	34.5	46.0	67.0
17-year-old males	51.0	65.0	88.5
17-year-old females	44.5	55.0	79.5

Table H.3. Over-weight and Obese Body Mass Index Cut-off Points (from Cole et al., 2000)

Age	Over-weight		Obese	
	Males	Females	Males	Females
13.5 years	22.27	22.98	27.25	28.2
17.5 years	24.73	24.85	29.7	29.84

APPENDIX H

OUTLIERS FOR ANTHROPOMETRIC MEAN COMPARISONS

Outliers for height, weight and BMI who were deleted from the mean and *SD* calculations for these parameters:

One 13-year-old female at a height of 138.5 cm was more than 3 *SD* below the mean height ($M = 158.46$ cm, $SD = 6.21$).

One 17-year-old male at a height of 195.0 cm tall was more than 3 *SD* above the mean height ($M = 177.90$ cm, $SD = 5.66$).

One 13-year-old male at a weight of 92.5 kg was more than 3 *SD* above the mean weight ($M = 50.61$ kg, $SD = 12.73$).

One 13-year-old female at a weight of 92.4 kg was more than 3 *SD* above the mean weight ($M = 53.09$ kg, $SD = 12.37$).

One 13-year-old female at a BMI of 35.21 was more than 3 *SD* above the mean BMI ($M = 21.08$, $SD = 4.49$).

One 17-year-old male at a BMI of 33.16 was more than 3 *SD* above the mean BMI ($M = 22.07$, $SD = 3.17$).

One 17-year-old female at a BMI of 34.03 was more than 3 *SD* above the mean BMI ($M = 22.54$, $SD = 3.62$).

APPENDIX I

T TEST RESULTS FOR HEIGHT, WEIGHT AND BMI COMPARISONS

Table H.1. Height Comparison *t* test Results

Groups Compared	<i>t</i>	eta squared
13 y.o. males versus 13 y.o. females ^a	0.413	0.001
13 y.o. males versus 17 y.o. males ^b	14.155	0.627
13 y.o. males versus 17 y.o. females ^c	3.397	0.082
13 y.o. females versus 17 y.o. females ^c	4.494	0.152
17 y.o. males versus 17 y.o. females ^c	13.415	0.610

^a*p* = .681. ^b*p* < .001. ^c*p* = .001.

Table H.2. Body Weight Comparison *t* test Results

Groups Compared	<i>t</i>	eta squared
13 y.o. males versus 13 y.o. females ^a	1.081	0.010
13 y.o. males versus 17 y.o. males ^b	9.176	0.414
13 y.o. males versus 17 y.o. females ^b	4.901	0.159
13 y.o. females versus 17 y.o. females ^c	3.430	0.094
17 y.o. males versus 17 y.o. females ^c	5.370	0.167

^a*p* = .681. ^b*p* < .001. ^c*p* = .001.

APPENDIX I

Table H.3. Body Mass Index Comparison *t* test Results

Groups Compared	<i>t</i>	eta squared
13 y.o. males versus 13 y.o. females ^a	1.838	0.028
13 y.o. males versus 17 y.o. males ^b	3.985	0.118
13 y.o. males versus 17 y.o. females ^b	4.628	0.143
13 y.o. females versus 17 y.o. females ^c	1.899	0.031
17 y.o. males versus 17 y.o. females ^c	0.743	0.005

^a*p* = .069. ^b*p* = .001. ^c*p* = .060. ^d*p* = .459.