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# Shoulder strength, flexibility and injury profiles of high school water polo players

**Devine, Gareth**

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# Appendix A:

ST JOHN'S COLLEGE

23 March 2012

Dr Kerith Aginsky
kerith.aginsky@wits.ac.za

Mr Gareth Devine
gareth.dev@gmail.com

Dear Dr Aginsky and Mr Devine

**WATER POLO RESEARCH**

This letter grants you permission to carry out your research at St John's College on Water Polo players once they have given their permission for this. I understand the scope of your research and that it consists of an injury questionnaire and a physical assessment. I understand that your actual study will take place off the campus and I am willing to support your research.

Obviously this is subject to you obtaining the requisite permission from the boys' parents.

Yours sincerely

R D T Cameron
Headmaster

ISASA
St David Road Houghton Johannesburg 2198
Tel +27 11 645-3000 or 087 550 0470 ▪ Fax 27 11 645-3001 ▪ e-mail: headmaster@stjohnscollege.co.za ▪ Website: www.stjohnscollege.co.za
Headmaster: Roger Cameron MA (UCT) BD (London) Sec. T. Dip. (UCT)

# Appendix B:

Tel: (011) 642-4531/2
Fax: (011) 642-9212




Wellington Road
Parktown 2193
Private Bag X15
Parkview 2122

**PARKTOWN BOYS' HIGH SCHOOL**

28 March 2012

Dr Kerith Aginsky
Kerith.aginsky@wits.ac.za

Mr Gareth Devine
Garethdev@gmail.com

Dear Dr Aginsky/Mr Devine

**Waterpolo Research**

This letter grants you permission to carry out your research at Parktown Boys' High School on waterpolo players, once they have given their permission for this. I understand the scope of your research and that it consists of an injury questionnaire and a physical assessment. I understand that your actual study will take place off the campus and I am willing to support your research.

Obviously this is subject to you obtaining the requisite permission from the boys' parents.

Yours in Education

Mr CWP Niemand
**Headmaster**

# Appendix C:

**Participants Information Sheet for Minors**

Title: **Shoulder strength, flexibility and injury profiles of high school water polo players**

Dear Participant

My name is Gareth Devine and I'm completing my Masters at the University of the Witwatersrand. I would like to invite you to take part in my research study to investigate the role of flexibility and strength in high school water polo players shoulders. After the completion of my masters I will have an MSC in Biokinetics. The testing will be taking place at the "Centre for Exercise Science and Sports Medicine at the University of the Witwatersrand Education campus". As part of my degree I need to do a research study. I have chosen to look at the flexibility and the strength of the muscles that are around the shoulders. This is important as the differences in strength and flexibility of the shoulder muscles could maybe lead to injuries and problems when playing water polo.

You will be needed to complete the following if you decide to be in the research study:

1. Injury Questionnaire
   You will need to answer some questions on any injuries that you have had in the past. Completing this questionnaire will take you about 10 to 15 minutes. The questionnaire will ask questions on injuries that you may have or experience before, during or after water polo. The questionnaire will be done in a comfortable setting and you will be allowed as much time as you are comfortable to complete.

2. Shoulder Flexibility
   You will then be asked to lie on your back on a physiotherapy bed (plinth) to have the flexibility of both your shoulders measured. I will take your arm and hold it at 90° while you move your arm forwards and backwards to see the flexibility of the different muscles of the shoulder. Both of your arms will be tested.

3. Shoulder strength
   The strength of your shoulder muscles will be measured using a machine called a Biodex isokinetic machine. You will be strapped into the machine to allow you to have the correct muscles of the shoulder tested. The test will include 3 different speeds, the first speed is a slower speed and you will need to perform 5 repetitions at 60°/sec to measure the strength of shoulder internal and external rotation muscles. The second part of the testing will be at a faster speed and will tell us how fast your muscles get tired. You will need to do 10 repetitions at a speed of 180°/sec. the last speed is even faster, as it is closer to the speed that your arms move at when you are playing water polo. You will need to do 15 repetitions at a speed of 300°/sec. For all of these tests you will have to move your arm as hard as you can through the whole movement. This is important, as the results of the test are better if you perform them as hard as you can.

What makes you able to participate in the research?

1. You are involved in the first team water polo side at St John's College or Parktown Boys High School.
2. You have no shoulder injuries that have stopped you playing water polo.

After you have finished all the tests, I will look at the results and you will get a report of these results. All of your results will be kept in a safe place and no one will know that you were a part of the study or what your results were. All results will be kept confidential. The results will not be shown to parents or coaches at the school.

If during the test there is any pain/injury sustained the participant will be referred to an appropriate health practitioner at no extra expense. If appropriate treatment is biokinetics, I (Gareth Devine) will treat the pain at no expense to the participant or parent/legal guardian.

It is up to you to participate in the research. If you do decide to take part, you will be given an assent form to sign. Your parents have also been given information about this study. So if you would like to be part of the study, your parents will have to sign that they allow you to participate. If you decide to take part in this study you are still free to withdraw at any time without giving a reason and without detriment to yourself.

Should you or your parents have any questions please do not hesitate to contact, me, Gareth Devine on:
083 288 7203
garethdev@gmail.com

# Appendix D:

**Parent's Information Sheet**

Title: **Shoulder strength, flexibility and injury profiles of high school water polo players**

Dear Parent/Guardian

I would like to invite your son to take part in a research study to investigate the role of flexibility and strength in high school water polo players shoulders. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please ask if there is anything that is not clear or if you would like more information. Take time to decide whether or not you would like your son to be involved in the research. Thank you for reading this.

The research will be conducted by, myself, Gareth Devine a student completing a Masters degree at the Centre for Exercise Science and Sports Medicine at the University of the Witwatersrand Education campus, under the supervision of Dr Kerith Aginsky and Mrs Estelle Watson. After the completion of my masters I will have an MSC in Biokinetics.

The aim of the research is to look at possible deficiencies in shoulder strength and flexibility and the effect this may have on high school water polo players. I would also like to get information on shoulder injuries that may need further attention to help in injury prevention.

The reason your son has been selected is that your son is involved in the first team water polo side at St John's College or Parktown Boys High School.

The following tests will be performed:

1. Injury History Questionnaire:
   Your son will be given a questionnaire that will take about 10 to 15 minutes to complete. The questionnaire will ask questions on your son's history of injury and current level of activity. All the information gathered in the questionnaire will be confidential and kept safe and in a secure place.
2. Shoulder Flexibility
   Flexibility testing will be done looking at the flexibility of your son's shoulder during internal and external rotation while your son is lying on his back (supine) on a plinth. The shoulder will be lifted to 90 degrees (shoulder joint will be 90 degrees perpendicular to the bed with the elbow bent to 90 degrees) and rotated externally till maximal range of motion is reached when rotation ceases with a firm capsular end feel or before appreciable motion of the scapular. The capsular end feel is when the shoulder is not able to rotate any further due to the shoulder joint being in its maximal internal or external rotation. The maximal external rotation will be reached once the shoulder cannot rotate any further or the shoulder joint lifts to compensate for the rotation. The same will be done moving the arm into internal rotation. This is measured with an inclinometer. The measurements will be taken from the inclinometer once the arm in in maximal external rotation or maximal internal rotation. These tests will take +/- 5 minutes. Both the right and left shoulders will be tested.

3. Shoulder Muscle Strength
   A maximal strength test of the shoulder internal and external rotator muscles using a Biodex isokinetic machine will be performed. The test will include 5 repetitions of 60°/sec to measure strength of shoulder internal and external rotation muscles. Muscle endurance will then be assessed by testing at a faster speed of 180°/sec over 10 repetitions. The third test will involve 15 repetitions at a speed of 300°/sec to assess the shoulder muscle strength at a similar speed is used during water polo. The tests will take about 15 to 20 minutes. The test is a maximal strength test therefore during the strength test your son will be expected to use maximal energy to attain the best strength results. Both the right and left shoulders will be tested.

Once the results have been analyzed, your son will receive a report with all his results. Due to the confidentiality of the information it is your son's or your choice to provide it to the coaches or the school. All the results will be collected and kept in a safe place. All participants will be kept anonymous. The information will be kept confidential and analyzed as a group.

If during the test there is any pain/injury sustained the participant will be referred to an appropriate health practitioner at no extra expense. If appropriate treatment is biokinetics, I (Gareth Devine) will treat the pain at no expense to the participant or parent/legal guardian.

Transport will need to be provided by parents for testing done at Centre for Exercise Science and Sports Medicine at the University of the Witwatersrand Education campus.

Participation is voluntary .If your son does decide to take part, he will be given an assent form to sign and you will be required to sign parental consent. If your son decides to take part he is still free to withdraw at any time without giving a reason and without detriment to him.

Should you have an queries please do not hesitate to contact, me, Gareth Devine on:
083 288 7203
garethdev@gmail.com

# Appendix E:

**Participants Information Sheet**

Title: **Shoulder strength, flexibility and injury profiles of high school water polo players**

Dear Participant

I would like to invite you to take part in a research study to investigate the role of flexibility and strength in high school water polo players' shoulders. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please ask if there is anything that is not clear or if you would like more information. Take time to decide whether or not you would like to be involved in the research. Thank you for reading this.

The research will be conducted by, myself, Gareth Devine a student at the Centre for Exercise Science and Sports Medicine at the University of the Witwatersrand Education campus, under the supervision of Dr Kerith Aginsky and Mrs Estelle Watson. After the completion of my masters I will have an MSC in Biokinetics.

The aim of the research is to look at possible deficiencies in shoulder strength and flexibility and the effect this may have on high school water polo players. I would also like to get information on areas that may need further attention to help in injury prevention in water polo.

The reason you have been asked to participate is that you are involved in the first team water polo side at St John's College or Parktown Boys High School.

The study involves the following testing:

1. Injury History Questionnaire:
   You will be given a questionnaire, which will take about 10 to 15 minutes to complete. The questionnaire is to gain information of your history of injury and current level of activity. All the information gathered in the questionnaire will be confidential and kept safe and in a secure place.
2. Shoulder Flexibility:
   Flexibility testing will be done looking at the flexibility of your shoulder during internal and external rotation while you are lying on your back on a plinth. The shoulder will be lifted to 90 degrees and rotated externally until maximal range of motion is reached when rotation ceases with a firm capsular end feel or before appreciable motion of the scapular. The capsular end feel is when the shoulder is not able to rotate any further due to the shoulder joint being in its maximal internal or external rotation. The same will be done moving the arm into internal rotation. This is measured with an inclinometer. These tests will take +/- 5 minutes. Both your right and left shoulders will be tested.
3. Shoulder Muscle Strength
   This is a maximal strength test of the shoulder internal and external rotator muscles using a Biodex isokinetic machine. The test will include 5 repetitions of 60°/sec to

measure strength of shoulder internal and external rotation muscles. Muscle endurance will then be assessed by testing at a faster speed of 180°/sec over 10 repetitions. The third test will involve 15 repetitions at a speed of 300°/sec to assess the shoulder muscle strength at a similar speed is used during water polo. The tests will take about 15 to 20 minutes. The test is a maximal strength test. During the strength test you will be expected to use maximal energy to attain the best strength results. Both your right and left shoulders will be tested.

Once the results have been analyzed, you will receive a report with all your results. All the results will be collected and kept in a safe place. All participants' names will remain anonymous so that all data and results are confidential. The results will not be shown to parents or coaches at the school.

If during the test there is any pain/injury sustained the participant will be referred to an appropriate health practitioner at no extra expense. If appropriate treatment is biokinetics, I (Gareth Devine) will treat the pain at no expense to the participant or parent/legal guardian.

It is up to you to participate in the research. If you do decide to take part, you will be given a consent form to sign and are still free to withdraw from the study at any time without giving a reason and without detriment to yourself.

Should you have any queries please do not hesitate to contact, me, Gareth Devine on:
083 288 7203
garethdev@gmail.com

# Appendix F:

**PARENT / GUARDIAN CONSENT FORM**

**Title of the study:** Shoulder strength, flexibility and injury profiles of high school water polo players

Dear Parent / Guardian,
We would like to invite your son to be involved in the study to look at the flexibility and strength of high school water polo players' shoulders. This study will look at the flexibility and strength of the shoulder.

I as the parent of the participant want to confirm:

1. I am aware of the procedures of the research and a research member has made me aware of the nature and risks involved during the research.
2. I have also been provided with a written information sheet explaining the study and have been given the time to discuss the research with a member of the research team.
3. I as the parent of the participant am aware that the results of the research will be kept confidential, and the results will be put into the study report and may be written up into academic reports.
4. I am also aware that I my son can withdraw from the study at any time without prejudice, from any further study.

I as the parent/guardian understand the information gained from my son during the research will be kept safe and private.

If you could please sign the consent form below. If there are any questions or concerns they will be answered by the researchers.


Mr Gareth Devine 083 288 7203, garethdev@gmail.com
Dr Kerith Aginsky kerith.aginsky@wits.ac.za
Mrs Estelle Watson Estelle.watson@wits.ac.za


Please return the form by getting your son to return the completed form to the coach/master in charge. All data collected will be kept in a safe, locked environment so to maintain confidentiality of the information provided.

Thank you again for the opportunity to allow your son to be involved in this research.

I have read the above and understand all the information about the research that is being done to investigate the role of flexibility and strength in high school water polo players shoulders. Participation is voluntary and there will be no prejudice if consent is not given.

1. I consent to giving my son permission to participate in this study.
Signature of parent / guardian: _____ Date: _____

Signature of witness: _____ Date: _____

# Appendix G:

**MINORS' ASSENT FORM**

**Title of the study:** Shoulder strength, flexibility and injury profiles of high school water polo players

The aim of the study is to look at the flexibility and strength of high school water polo player/s shoulders.

I as the participant want to confirm:

1. I am aware of the procedures of the research and the research member has made me aware of the nature, benefits and risks involved during the research.
2. I have also been provided with a written information sheet explaining the study and have been given the time to discuss the research with a member of the research team.
3. I am aware that the results of the research will be kept confidential, and the results will be put into the study report and may be written up into academic reports.
4. I am also aware that I can withdraw from the study at any time without prejudice.

The information that is attained from me during the testing procedure will be kept private and safe.

If you could please sign the consent form below. If there are any questions or concerns they will be answered by the researchers.


Mr Gareth Devine 083 288 7203, garethdev@gmail.com
Dr Kerith Aginsky kerith.aginsky@wits.ac.za
Mrs Estelle Watson Estelle.watson@wits.ac.za


Please return this form to the researcher, Gareth. All data collected will be kept in a safe, locked environment so to maintain confidentiality of the information provided.

Thank you again for the opportunity to being involved in this research.

I have read the above and understand all the information about the research that is being done to investigate the role of flexibility and strength in high school water polo players shoulders. Participation is voluntary and there will be no prejudice if consent is not given.

I therefore consent to participate in this study.

Signature of child: _____ Date: _____

Signature of Witness: _____ Date: _____

# Appendix H:

**OVER 18 CONSENT FORM**

**Title of the study: Shoulder strength, flexibility and injury profiles of high school water polo players**

Dear Participant,

The aim of the study is to look at the flexibility and strength of high school water polo players shoulders.

I as the participant want to confirm:

1. I am aware of the procedures of the research and a research member has made me aware of the nature, benefits and risks involved during the research.
2. I have also been provided with a written information sheet explaining the study and have been given the time to discuss the research with a member of the research team.
3. I as the participant am aware that the results of the research will be kept confidential, and the results will be put into the study report and may be written up into academic reports.
4. I am also aware that I can withdraw from the study at anytime without prejudice, from any further study.

The information that is attained from me during the testing procedure will be kept private and safe.

If you could please sign the consent form below. If there are any questions or concerns they will be answered by the researchers.


Mr Gareth Devine 083 288 7203, garethdev@gmail.com
Dr Kerith Aginsky kerith.aginsky@wits.ac.za
Mrs Estelle Watson Estelle.watson@wits.ac.za


Please return the form by returning the completed form to the researcher (Gareth Devine). All data collected will be kept in a safe, locked environment so to maintain confidentiality of the information provided.

Thank you again for the opportunity for being involved in this research.

I have read the above and understand all the information about the research that is being done to investigate the role of flexibility and strength in high school water polo players shoulders. Participation in voluntary and there will be no prejudice if consent is not given.

1. I consent to participate in this study.

Signature of participant: _____ Date: _____

Signature of witness: _____ Date: _____

# Appendix I:

## Data Sheet

**SHOULDER STRENGTH, FLEXIBILITY AND INJURY PROFILES OF HIGH SCHOOL WATER POLO PLAYERS**

Subject number: _____

Age: _____

Grade: _____

Weight: _____

Height: _____

**Shoulder Flexibility:**

| | 1st Trial | 2nd Trial | Average |
|---|---|---|---|
| **Internal rotation** | | | |
| **External rotation** | | | |

**Shoulder Strength:**

| | Left | Right | Antagonist/Agonist |
|---|---|---|---|
| **Peak Torque 60°/sec** | | | |
| **Peak Torque 180°/sec** | | | |
| **Peak Torque 300°/sec** | | | |

# Appendix J:

**SHOULDER STRENGTH, FLEXIBILITY AND INJURY PROFILES OF HIGH SCHOOL WATER POLO PLAYERS**

Subject number: _____
Date of birth: _____
Age: _____
School: _____
Grade: _____
Dominant arm: L☐ R☐

**Please read the questions carefully and tick the answer that applies to you.**
**General Information (Please tick the correct answer):**

1. What position do you play in water polo (Please choose position you play mostly)?

a) Wing ☐
b) Pivot ☐
c) Hole man ☐
d) Hole marker ☐

2. How many times a week do you train?

a) 1 ☐
b) 2 ☐
c) 3 ☐
d) 4 ☐
e) 5 ☐
f) >5 ☐

3. How many hours do you train per session?

a) <30 minutes ☐
b) 30 minutes ☐
c) 30 minutes to 1 hour ☐
d) 1 hour to 1 ½ hours ☐
e) 1 ½ hours to 2 hours ☐
f) >2 hours ☐

4. How many hours do you do training other than for water polo?

a) 1 hour ☐
b) 1 hour to 1 ½ hour's ☐
c) 1 ½ hours to 2 hours ☐

d) 2 hours to 2 ½ hours ☐
e) 2 ½ hours to 3 hours ☐
f) > 3 hours ☐

Specify what training this includes:

_____

_____

5. What other sport/s do you participate in?

a) Rugby ☐
b) Soccer ☐
c) Cricket ☐
d) Swimming ☐
e) Hockey ☐
f) Other ☐

If other please specify:

_____

_____

6. What time do you spend playing matches every week?

a) <30 minutes ☐
b) 30 minutes ☐
c) 30 minutes to 1 hour ☐
d) 1 hour to 1 ½ hours ☐
e) 1 ½ hours to 2 hours ☐
f) >2 hours ☐

7. Have you had any injuries in your sporting career If yes please clarify by ticking the area where the injury occurred?

a) No history of injury ☐
b) Neck Right ☐ Left ☐
c) Shoulder Right ☐ Left ☐
d) Arm Right ☐ Left ☐
e) Back Right ☐ Left ☐
f) Leg Right ☐ Left ☐
g) Ankle Right ☐ Left ☐
h) Other ☐

If other please state what this was:

_____

_____

8. If you were injured how long ago did it occur?

a) Past 3 months ☐
b) 3 – 6 months ☐
c) 6 months to a 1 year ☐
d) 1 – 2 years ☐
e) 2 – 5 years ☐
f) > 5 years ☐

9.1. How did the injury occur?

a) Through collision with another player ☐
b) Non-contact injury ☐
c) Over training ☐
d) Unknown ☐
e) Other ☐

If "Other" please specify.

_____
_____

9.2. Did the injury occur during water polo?

Yes ☐ No ☐

If "No" what sport?

a) From playing rugby ☐
b) From playing cricket ☐
c) From playing soccer ☐
d) From doing athletics ☐
e) From swimming ☐
f) Other sport ☐

If "Other" please clarify:

_____
_____

9.3. If an injury occurred during water polo what action caused the injury?

a) Shooting ☐
b) Passing ☐
c) Swimming ☐
d) Contact with another player ☐
e) Contact with the ball ☐
f) Contact with goals or side of pool ☐

9.4. If your injury occurred during water polo, how did occur?

a) Before playing water polo ☐
b) Before and during playing water polo ☐
c) During water polo ☐
d) During and after water polo ☐
e) Before, during and after water polo ☐

9.5. What did you do to assist in the treatment of the injury?

a) Nothing ☐
b) Ice ☐
c) Heat ☐
d) Rehabilitation ☐
e) Rest ☐
f) Operation ☐
g) Other ☐

If "Other" please specify.

_____

_____

9.6. Did you consult with someone for the injury? If so, who?

Yes ☐ No ☐

a) Doctor ☐
b) Physiotherapist ☐
c) Chiropractor ☐
d) Biokineticist ☐
e) Other ☐

If "Other" please specify:

_____

_____

9.7. Have you been provided with a diagnosis?

a) No ☐
b) Yes ☐

If "Yes" please provide diagnosis?

_____
_____

10. Are you taking any supplements?

Yes ☐ No ☐

If "Yes" please tick adequate box?

a) USN protein shakes ☐
b) Glucosamine ☐
c) Evox protein shakes ☐
d) Other ☐

If "Other" please specify

_____
_____

**Thank you for participating in this study!**

# Appendix L:

**FLEXIBILITY**

| ***INTERNAL ROTATION*** | | ***EXTERNAL ROTATION*** | |
|---|---|---|---|
| *LEFT* | *RIGHT* | *LEFT* | *RIGHT* |
| 83 | 102 | 86 | 75 |
| 71 | 62 | 117 | 93 |
| 76 | 72 | 93 | 107 |
| 80 | 60 | 96 | 116 |
| 50 | 56 | 109 | 95 |
| 81 | 60 | 135 | 126 |
| 82 | 86 | 104 | 85 |
| 84 | 82 | 110 | 121 |
| 73 | 50 | 91 | 113 |
| 50 | 54 | 97 | 90 |
| 49 | 80 | 123 | 100 |
| 60 | 56 | 96 | 109 |
| 70 | 40 | 118 | 120 |
| 66 | 60 | 116 | 101 |
| 67 | 61 | 108 | 120 |
| 86 | 60 | 100 | 119 |
| 70 | 71 | 111 | 115 |
| 61 | 71 | 100 | 106 |
| 76 | 55 | 94 | 95 |
| 75 | 71 | 111 | 96 |
| 74 | 57 | 98 | 109 |
| 76 | 65 | 87 | 91 |
| 67 | 55 | 91 | 94 |
| 41 | 65 | 104 | 111 |
| 64 | 72 | 105 | 110 |
| 60 | 60 | 92 | 105 |
| 71 | 51 | 102 | 105 |
| 71 | 42 | 101 | 115 |
| 1 934 | 1 776 | 2 895 | 2 942 |
| 69 | 63 | 103 | 105 |

**Strength:**

| 60 °/SEC | | | |
|---|---|---|---|
| ***INTERNAL ROTATION*** | | ***EXTERNAL ROTATION*** | |
| *LEFT* | *RIGHT* | *LEFT* | *RIGHT* |
| 47,5% | 47,3% | 52,9% | 61,8% |
| 42,1% | 50,8% | 61,7% | 72,8% |
| 52,0% | 52,7% | 67,4% | 72,8% |
| 45,0% | 43,3% | 53,0% | 61,6% |
| 54,3% | 51,3% | 89,1% | 73,2% |
| 51,0% | 44,3% | 59,5% | 50,7% |
| 38,9% | 36,5% | 67,9% | 59,1% |
| 42,5% | 42,9% | 65,9% | 63,3% |
| 49,1% | 44,3% | 78,0% | 78,1% |
| 39,0% | 40,7% | 71,5% | 63,1% |
| 31,1% | 38,0% | 45,7% | 66,7% |
| 42,0% | 44,9% | 69,4% | 72,3% |
| 38,7% | 46,0% | 57,4% | 73,4% |
| 34,4% | 39,4% | 63,2% | 79,0% |
| 48,2% | 50,1% | 72,2% | 88,9% |
| 35,4% | 53,5% | 59,6% | 69,5% |
| 42,1% | 51,3% | 77,0% | 79,1% |
| 47,7% | 52,5% | 68,7% | 65,7% |
| 47,2% | 48,6% | 61,8% | 71,6% |
| 46,6% | 42,1% | 62,7% | 72,0% |
| 54,3% | 46,8% | 83,8% | 77,2% |
| 50,7% | 50,1% | 86,1% | 82,0% |
| 44,9% | 44,9% | 61,8% | 69,4% |
| 47,5% | 44,7% | 69,3% | 69,0% |
| 52,8% | 55,5% | 82,9% | 85,3% |
| 40,9% | 42,2% | 68,8% | 67,7% |
| 38,6% | 41,1% | 46,2% | 49,9% |
| 44,6% | 48,3% | 63,5% | 58,4% |
| 1249,1% | 1294,1% | 1867,0% | 1953,6% |
| 44,6% | 46,2% | 66,7% | 69,8% |

**180 °/SEC**

| ***INTERNAL ROTATION*** | | ***EXTERNAL ROTATION*** | |
|---|---|---|---|
| *LEFT* | *RIGHT* | *LEFT* | *RIGHT* |
| 41,8% | 38,3% | 49,1% | 49,4% |
| 44,1% | 46,3% | 60,6% | 70,5% |
| 43,5% | 48,3% | 56,5% | 69,2% |
| 40,1% | 37,4% | 50,1% | 55,5% |
| 44,6% | 42,5% | 59,4% | 55,0% |
| 50,5% | 36,4% | 47,5% | 44,7% |
| 32,8% | 34,0% | 42,7% | 44,6% |
| 33,6% | 28,3% | 45,3% | 44,2% |
| 40,9% | 49,8% | 59,2% | 59,8% |
| 30,8% | 35,1% | 51,6% | 45,1% |
| 40,6% | 40,1% | 36,0% | 42,2% |
| 43,3% | 40,5% | 59,1% | 61,5% |
| 32,8% | 38,1% | 43,3% | 51,7% |
| 33,7% | 37,0% | 48,6% | 64,5% |
| 42,5% | 44,0% | 69,4% | 76,3% |
| 41,1% | 44.8% | 57,3% | 57,7% |
| 38,9% | 40,0% | 61,9% | 60,0% |
| 38,0% | 47.6% | 57,7% | 61,0% |
| 37,8% | 42.1% | 49,3% | 55,7% |
| 47,7% | 39.4% | 53,4% | 61,8% |
| 43,0% | 42.8% | 70,3% | 63,5% |
| 40,2% | 39.7% | 71,0% | 77,1% |
| 37,7% | 32.1% | 52,4% | 57,3% |
| 38,7% | 39.1% | 61,5% | 53,9% |
| 47,2% | 50.4% | 73,3% | 78,1% |
| 32,1% | 34.3% | 49,3% | 56,7% |
| 30,3% | 34,0% | 43,0% | 42,8% |
| 33,7% | 38,7% | 53,0% | 47,6% |
| 1102,0% | 708,8% | 1531,8% | 1607,4% |
| 39,4% | 39,4% | 54,7% | 57,4% |

**300 °/SEC**

| ***INTERNAL ROTATION*** | | ***EXTERNAL ROTATION*** | |
|---|---|---|---|
| *LEFT* | *RIGHT* | *LEFT* | *RIGHT* |
| 39,7% | 37,5% | 43,1% | 38,4% |
| 50,6% | 42,8% | 54,9% | 58,4% |
| 42,5% | 57,1% | 42,0% | 62,5% |
| 35,7% | 34,9% | 49,0% | 50,4% |
| 41,4% | 35,6% | 56,1% | 57,0% |
| 46,7% | 39,9% | 50,0% | 43,7% |
| 38,1% | 37,2% | 46,5% | 35,3% |
| 41,9% | 37,7% | 43,7% | 42,2% |
| 44,1% | 45,2% | 65,4% | 54,2% |
| 39,5% | 36,8% | 37,3% | 34,7% |
| 42,0% | 49,8% | 29,7% | 28,0% |
| 42,7% | 45,4% | 42,8% | 45,4% |
| 41,3% | 44,5% | 37,7% | 44,9% |
| 43,8% | 43,8% | 44,4% | 52,8% |
| 47,6% | 55,3% | 54,4% | 64,4% |
| 42,7% | 49,1% | 47,5% | 54,3% |
| 46,4% | 47,6% | 51,4% | 52,7% |
| 46,4% | 48,1% | 62,9% | 47,3% |
| 37,1% | 38,1% | 42,9% | 39,2% |
| 54,8% | 48,5% | 58,5% | 61,1% |
| 45,6% | 47,2% | 59,5% | 52,4% |
| 38,3% | 35,9% | 66,7% | 65,1% |
| 37,9% | 41,3% | 44,3% | 47,1% |
| 36,1% | 37,3% | 53,0% | 51,8% |
| 46,3% | 50,1% | 64,5% | 74,0% |
| 35,9% | 39,3% | 42,1% | 45,6% |
| 36,8% | 3,2% | 46,7% | 43,6% |
| 40,3% | 43,0% | 39,3% | 38,1% |
| 1182,2% | 1172,2% | 1376,3% | 1384,6% |
| 42,2% | 41,9% | 49,2% | 49,5% |