2011

COMPARISON OF MUSCLE ACTIVATION AND KINEMATICS DURING THE DEADLIFT USING A DOUBLE-PRONATED AND OVERHAND/UNDERHAND GRIP

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ABSTRACT OF THESIS

COMPARISON OF MUSCLE ACTIVATION AND
KINEMATICS DURING THE DEADLIFT USING A
DOUBLE-PRONATED AND OVERHAND/UNDERHAND GRIP

This study examined muscle activation and relative joint angles during a conventional deadlift while using either a double-pronated or overhand/underhand (OU) grip. Ten weight-trained individuals performed the deadlift with 60% and 80% of their 1-repetition maximum, with three different grip variations. EMG recordings were taken of the left and right biceps brachii, brachioradialis, upper trapezius, and upper latissimus dorsi. Motion capture was used to measure angles of the wrist, elbow, knee, and hip. With an OU grip, significant bilateral asymmetry was seen in EMG activity of biceps brachii and brachioradialis. Mean wrist and elbow angle also showed significant bilateral asymmetry when using an OU grip. Training recommendations for the OU grip deadlift should emphasize the need to vary which hand is supinated/pronated to avoid muscle imbalances and possible injury. Furthermore, it may be preferential to use a double-pronated grip to avoid asymmetric training altogether.

KEYWORDS: deadlift, electromyography, kinematics, grip, asymmetry

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02/03/2011

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THESIS

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The Graduate School

University of Kentucky

2011

COMPARISON OF MUSCLE ACTIVATION AND KINEMATICS DURING THE DEADLIFT USING A DOUBLE-PRONATED AND OVERHAND/UNDERHAND GRIP

THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science
in the College of Education
at the University of Kentucky

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2011

ACKNOWLEDGEMENTS

While this thesis is very much an individual work, it could not have been completed without the help of many people. My thesis chair, Dr. Yates, has contributed the guidance and assistance needed to complete this work. Dr. Mullineaux, who has served as a committee member, has also been instrumental in learning the techniques needed for this research. Dr. Abel, another thesis committee member, is also greatly appreciated for his insight and direction.

More importantly, I cannot express enough thanks for the help and motivation I have had from my family and friends. I would like to especially thank my brother Jake Beggs for his time, assistance, and inspiration for this project. I cannot thank my girlfriend Emily Chappelle enough for her support and motivation. I would also like to acknowledge the generosity and help of everyone at the Underground Fitness Center, especially Rob Sinnott. Their help and involvement have been fundamental in the completion of this work.

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Introduction

Many resistance training regimens, with goals ranging from competitive powerlifting to rehabilitation to bodybuilding, recommend the deadlift as an important exercise to incorporate in a training program. The National Strength and Conditioning Association (NSCA) describes the deadlift as being performed with a barbell starting on the floor and the lifter in a squat position with feet flat on the floor and the bar positioned slightly in front of the shins. Hands are placed on the bar slightly wider than shoulder-width apart with the elbows fully extended. The bar is then lifted off the floor by extending the hips and knees until the body reaches a fully erect torso position. Although in concept it simply involves picking a barbell up from the floor to a standing position, this exercise is difficult to master and requires practice to execute properly.

Along with the bench press and squat, the deadlift is one of the three lifts in a powerlifting competition. However, this exercise is used by people of all fitness levels and goals because it is a multijoint exercise with a wide range of benefits. It is essentially a whole-body exercise, effective at working muscles of the legs, back, hips, arms, and shoulders. Many consider this lift to be primarily a leg and lower back exercise because these muscles are dynamically contracting during the lift. However, the muscles of the core, arms, shoulders, and upper back are also greatly activated by the isometric contractions needed to stabilize the body and grip the bar. In fact, by using electromyography (EMG) latissimus dorsi activity has been reported to be as high as 70% of its maximum activity in both normal and trained individuals when performing an isokinetic deadlift (21). It has been well documented that even isometric contractions such as these can be effective in eliciting muscle strength and size increases (4,10,19).

The deadlift is often considered to be the ultimate measure of total-body strength because of the way many muscles work in conjunction to perform the lift. As such, very heavy loads can often be used. However, the lifter's ability to hold the barbell (i.e. their grip strength) is often a limiting factor in the amount of weight that can be lifted. To compensate, many lifters utilize an "alternate" or "over-underhand" (OU) grip in which the bar is grasped with one hand supinated and the other pronated. The opposing rotational forces keep the bar from rolling out of the lifter's hands and typically increase the amount that can be lifted. This asymmetry is quite unique, however, and similar asymmetric lifting techniques are not found in other common exercises.

Because of the handedness of humans, people performing the deadlift with an OU grip most often pronate and supinate the same hand every time they perform this exercise. While previous research has shown that asymmetric activity may lead to the development of muscle asymmetry and injury (13,14), it is unclear if training using an OU grip for the deadlift produces bilateral asymmetries. Most teaching resources for the deadlift do little to mention the preferred grip style to use, nor do they mention a need to vary which hand is supinated/pronated if an OU grip is used. Although many fitness magazines and professionals may advocate varying the grip, or to not use an OU grip because it puts undue strain on the biceps tendon (17), no research exists to support these claims. It is common knowledge in competitive powerlifting that an OU grip can, in some cases, cause enough strain on the supinated arm that the biceps tendon may strain or even rupture. However, because these athletes are not allowed to use lifting straps or gloves, most employ the OU grip (because of the increase in their ability to hold the bar), despite the risk of injury. This risk of injury to the biceps brachii shows its extensive role in radiohumeral support during the deadlift (11), and leads to the question of whether there may be significant bilateral asymmetry occurring as a result of using an OU grip.

No studies to date have analyzed the muscle activation of the upper-body muscles and joint angles during the deadlift. It would be beneficial to know if an OU grip creates any bilateral asymmetries. It has been previously shown that pronation/supination of the hand significantly changes muscle myoelectric activity during specific lifts. One study was able to measure a two-fold increase in biceps brachii activity during a bench press when the hand was supinated as compared to a typical forward grip (15). Another study showed how different hand positions change muscle activity during the lat pulldown (25). In a different study researchers compared muscle activation using various hand positions during the push-up, finding that hand placement caused significant changes in muscle activation (3). Therefore it would seem self-evident that if the hand position is changed on one side only (as is the case with the OU grip), then any changes in the relative contributions of different muscles would only occur on that side.

If significant amounts of bilateral asymmetry occur when using an OU grip, the recommendations for using this grip may need to be modified to emphasize varying which hand is over/under, especially for bodybuilders. It may also be beneficial to advise lifters to utilize a double-pronated grip when possible. If grip strength becomes a limiting factor, an ergogenic aid, such as lifting straps, gloves, and/or chalk could be used if the situation allows.

Purpose

The purpose of this research was to investigate whether or not employing an overhand/underhand grip during the deadlift causes bilateral asymmetries in muscle activity and/or kinematics, as determined by EMG and motion capture, respectively.

Hypotheses

1. An OU grip will cause significantly more bilateral asymmetry in upper-body muscle activity than a double-overhand grip with equivalent weight. This will be evident via greater/less activation of certain muscles without concurrent increases/decreases in activation on the contralateral side.
2. Lifting kinematics will be significantly more asymmetric when using an OU grip, compared to the double-overhand variation.

Significance of the Study

While it is fairly well-known anecdotally, no scientific research exists to back the claims of fitness professionals that an OU grip deadlift works the left and right sides of the body differently. With research backing these claims, better training recommendations can be made on how to safely and properly employ grip variations of the deadlift.

Delimitations

The following factors were controlled for as delimiting factors:

1. Only male subjects with a deadlift 1-repetition maximum of at least 1.5 times their bodyweight and that have been regularly training with the deadlift for at least 1 year were used
2. A sample of convenience was used in this study
3. Motivation of the subjects
4. Identification of specific events during the lift
5. Only a limited number of muscles and kinematic variable will be addressed

Limitations

1. The effect of marker placement on joint angle measurement
2. Performance anxiety due to testing environment

Assumptions

1. EMG and motion capture system were properly calibrated
2. The testing environment adequately reproduced a typical training situation, with minimal influence by the researcher or testing equipment

Chapter 2: Literature Review

It is of great interest to athletes, coaches, recreational lifters and rehabilitation patients alike to know how different exercises—and variations of them—activate muscles differently. It is also beneficial to know the movement patterns of an exercise to a degree greater than what can be seen by the naked eye. It is for these reasons that a great deal of research has been dedicated to examining a myriad of different exercises using electromyography (EMG) and motion capture. Using these techniques training recommendations have changed and become more refined, resulting in safer and more effective weight training.

Kinematic and Myographic Analysis of the Deadlift

Although the deadlift is a fairly commonly performed exercise, there have been relatively few research studies published in which either kinematic or myographic methodologies were used in conjunction with the deadlift. The majority of previous research on the deadlift has focused on comparing the sumo and conventional-style deadlift, both for kinematic and muscle activation pattern differences. These are the two main variations of the deadlift, and while the choice of a particular style is typically according to personal preference and/or goals, the conventional deadlift is much more commonly seen both in competition and in an everyday gym setting. In the sumo deadlift the feet are spaced farther apart with toes pointed slightly outward, and the bar is grasped with the arms medial to the legs. In a conventional deadlift, the feet are spaced closer together (approximately shoulder-width apart) and the bar is grasped with the arms on the outside of the legs. Because the main difference in the sumo and conventional-style deadlift is foot placement, the emphasis in previous research has been on the lower body (7,9,20).

Some of the most comprehensive biomechanical and myographic research on the deadlift is the work of Escamilla and coworkers in which the sumo and conventional-style deadlift were compared. In 2000, they conducted a three-dimensional biomechanical analysis of each style, using competitive powerlifters as subjects as they were competing in a national masters powerlifting competition (9). A similar study was published in 2001 in which Escamilla *et al*. used subjects who were competing in the 1999 Special Olympic Games. Several significant differences were found in joint and segment angles, mechanical work, and ankle, knee, and hip moments and moment arms between the two lifting style (8).

Of the measurements taken, the authors found no significant differences between bilateral measurements. However, no mention is made of the grip used. Because this study was done on subjects in a powerlifting competition, one would assume an OU grip was used (lifting straps are not allowed), but there is no indication of whether lifters used a right-overhand, left-underhand grip (ROLU), or a left-overhand, right-underhand grip (LORU). Because they only found minimal bilateral differences, this study states that the lift is assumed to be symmetrical. However, if one lifter used ROLU and the next LORU, it is conceivable that when comparing right against left, any kinematic differences may be masked by the fact that this variable was not controlled.

Additionally, this study only analyzed the concentric phase of the lift for a single, maximum-effort repetition. This represents a 'competition' setting, but does not carry over to the more common 'training' setting. In training, it is much more common for lifters to perform several repetitions at submaximal intensities, with the eccentric phase of the lift playing a large role.

In 2002, a paper was published by Escamilla *et al.* in which they again compared the sumo and conventional-style deadlift, this time investigating the electromyographic differences between the two variations. For this study, a 12-RM intensity was used with collegiate football players. Because the primary difference in the two styles is foot placement, again the emphasis was placed on the lower body. Because bilateral symmetry had been shown in their previous research, measurements were only made on one side of the body. In the sumo deadlift, overall EMG activity from the vastus medialis, vastus lateralis, and tibialis anterior were significantly greater, whereas in the conventional deadlift overall EMG activity was significantly greater in the medial gastrocnemius (7). While no mention was made of the grip variation used, it could be assumed that the subjects employed an OU grip or used lifting straps. These studies by Escamilla *et al*. (7,8,9) showed that a slight change in foot position during the deadlift could significantly change both kinematics and muscle activity of the legs. If this is the case, then it is likely that a change in hand position could affect muscle activity and kinematics of the arms and upper body as well. In a similar study to Escamilla *et al.*, Cholewicki *et al*. compared the lumbar spine loads during the sumo and conventional deadlift using a 2-dimensional sagittal plane analysis. It was found that significantly greater L4-L5 shear forces and moments occurred in the conventional deadlift group (2). This study states that the lift is assumed to be symmetrical, however no evidence or research exists to indicate such.

Noe *et al*. used EMG to examine myoelectric activity during a floor-to-knuckle-height isokinetic lift (essentially a deadlift) in 4 weight lifters and 11 control subjects. EMG recordings were made of the latissimus dorsi, erector spinae, gluteus maximus, and quadriceps. Comparisons were not made for left vs. right, and the grip used was not mentioned (21). The deadlift is very often assumed to be a leg-dominant exercise, and as such, much of the research on this exercise has focused on the lower body. However, this study demonstrates that the latissimus dorsi and erector spinae are also greatly activated during the lift. The researchers found latissimus dorsi activity reaching about 70% of max integrated EMG (IEMG) and erector spinae activity up to 60% of max IEMG for both untrained and trained subjects. Quadriceps activity only reached about 50% of max IEMG and gluteus maximus about 75%. These data are evidence that muscles besides those of the legs are greatly activated during this lift.

EMG has also been used to compare muscle activation during the deadlift to other lower body resistance training exercises (5). In one study, EMG measurements were made of the vastus lateralis, biceps femoris, and rectus femoris during five different exercises. Significant findings were made indicating that the deadlift, squat, lunge, leg extension, and step-up have varying levels and patterns of muscle activation, although they are all essentially knee extension-dominant movements. As for the deadlift in this study, subjects used an OU grip, and measures were only taken from one side of the body. In a similar study, Nuzzo *et al*. compared trunk muscle activity (longissimus and multifidus) during stability ball and free weight exercises (squat and deadlift). It was concluded that back extensor muscle activity was greater in squats and deadlifts when compared to stability ball exercises designed to stimulate the same muscles (22). However, only one side of the body was analyzed and only activity of the trunk musculature was recorded.

A kinematic analysis has also been used to compare the conventional deadlift to the powerlifting style squat, in an attempt to determine if there is a cross-over effect between the two lifts (12). In this study, athletes at a powerlifting competition were filmed using four synchronized cameras to quantify the 3-dimensional analysis. The authors of this study concluded that while the two lifts may seem very similar to the naked eye, when using sophisticated motion analysis instrumentation, they are, in fact, quite different. The deadlift is a more sequential or segmented movement, while the squat is a more synergistic or simultaneous movement. The "sticking point" of each lift also occurred at different points of the lift. This kinematic analysis of the deadlift was, however, somewhat restricted and less-detailed because it was performed at a powerlifting meet, and therefore reflective markers could not be used and the joint centers and podiatric landmarks had to be manually digitized. While it may be assumed that lifters at a powerlifting competition used an OU grip, no mention of this is made. Also, this analysis examined hip, knee, and ankle relative angles; trunk, thigh, and shank absolute angles; and bar velocity, but did not examine upper body (elbow, wrist, shoulder, etc.) angles and mechanics because the arms are only used for stabilizing the bar in the squat, and not for actually moving the weight as they are in the deadlift.

There are two main limitations to the majority of the aforementioned research on the deadlift. For one, because the deadlift in often thought of as a leg and lower-back exercise, and the main variation that has been studied is foot placement, most of the deadlift research has focused on the lower body. However, muscles of the forearms, biceps brachii, deltoid, and upper back are all greatly involved in this lift, even though there may not be a great deal of shortening and lengthening of these muscles. It is well-known that even isometric contractions (especially with under heavy loads such as those used for a deadlift), are enough to elicit significant gains in strength and muscle size (10,19). The second limitation to the current deadlift research is that most studies have only focused on the concentric phase of the lift (22). This makes sense because in competitive powerlifting the lift is only judged on the lifter being able to reach lockout with the weight (standing erect with knees locked in a straight position and shoulders back). There is no major concern for the lowering of the weight as long as the hands are kept in contact with the bar. However, powerlifters only make up a small majority of those who use the deadlift as part of a resistance training regimen. For most lifters (including many powerlifters), the eccentric phase of the lift is also of great importance. It is well known that eccentric contractions are extremely effective at eliciting muscle strength and size gains. To only examine the concentric phase of an exercise is to leave out what many consider the most important part.

Forearm Pronation/Supination and Myoelectric Activity

A deadlift can be performed using a double-overhand grip—in which both hands are pronated—or an OU grip—in which one hand is supinated and the other pronated. The problem with using a double-overhand grip is that as heavier loads are used, it becomes increasingly more difficult to hold the weight. This can be overcome by using an OU grip because the opposing rotational forces keep the bar from slipping out of the lifter's hands. However, research has shown that pronation and supination of the forearm produce significant differences in myoelectric activity of certain upper-body muscles, most notably the biceps brachii (15,16,23).

One study investigated in influence of grip on upper body myoelectric activity during the flat bench press. It was found that a supinated grip resulted in increased activity for the biceps brachii (despite it not being a primary mover for the flat bench press exercise) and the clavicular portion of the pectoralis major (15). In another study published by the same researcher (16) variations in muscle activation levels during traditional latissimus dorsi weight training exercises were examined. Average muscle activity was measured for the latissimus dorsi, biceps brachii, and middle trapezius/rhomboid during the wide-grip pulldown, reverse-grip pulldown, seated row with retracted scapula, and seated row with non-retracted scapula. The authors found that supinating the hands (reverse-grip) during the pulldown did not significantly affect muscle activation of the latissimus dorsi or the biceps brachii. Significant differences were found, however, when comparing the ratio of latissimus dorsi to biceps brachii activity across exercises. The wide-grip lat pulldown had a significantly higher ratio than the reverse-grip pulldown, as did the seated row with protracted scapula. This is explained by the fact that there were slight non-statistically significant decreases in latissimus dorsi activity coupled with insignificant increases in biceps brachii activity when going from the wide-grip to reverse-grip pulldown. It should also be noted that subjects used an intensity equivalent to their *perceived* 10-12 rep max. Therefore subjects chose their own weight (which they may have underestimated), and were not lifting at a very high intensity. These slight changes may be more (or possibly less) exaggerated at higher intensities.

Upper-limb surface EMG has also been used to examine the effect of elbow and forearm angle on maximum supination and pronation torques (23). It was found that there was a significant effect of direction, forearm angle, elbow angle, and the interactions on maximum forearm torque. The biceps brachii was found to be active during supination torques, but not during pronation torques. The brachioradialis was found to be active during both. At 0° elbow flexion and neutral forearm angle (similar to that seen in a deadlift), the biceps brachii produced EMG activity of 50% of maximum voluntary exertion (MVE) during maximum supination torque, and 7% during pronation. The brachioradialis data show 27% during supination and 37% during pronation. This study again shows that the muscles of the arm are activated differently depending on whether the forearm was pronated or supinated.

Changes in positioning have also been shown to cause changes in muscle activation in the lower body as well (18,26). In the hamstrings, data have shown that during lower limb exercises (hamstring curl, hamstring bridge, and one-legged deadlift) internal foot rotation increases the medial-lateral hamstring activation ratio, while external rotation decreases this ratio. In the quadriceps, medial rotation of the foot during a leg extension produced greater activation of the vastus lateralis and vastus medialis. Lateral rotation produced greater activation in the rectus femoris. Position of the foot can, therefore, be changed to help selectively activate one area over the other. This may have implications in various knee injury situations, as well for bodybuilders and athletes who may seek to selectively increase the size or performance of a specific area or muscle. These data show that slight modifications of the same exercise can produce variations in muscle activation even within a single muscle group. While it was not examined, it could be assumed that if only one foot were internally or externally rotated, these changes would only occur on that side. This is just the case in an OU-grip deadlift, in which the arms are rotated essentially 180° from one another. This study aims to determine if this difference of rotation creates bilateral asymmetries between the left and right sides of the body while performing the deadlift.

Chapter 3: Methods

Study Design and Subjects

This study utilized a within-group pre-experimental design in order to investigate the differences in muscle myoelectric activity and kinematics caused by an overhand/underhand (OU) versus a double-overhand (DO) grip while performing a conventional deadlift. To investigate this, motion capture and surface electromyography (EMG) were used to measure kinematics and muscle activity in 10 weight-trained individuals while they performed the deadlift with each of the different grip variations. This study was reviewed and approved by the University of Kentucky's Institutional Review Board. Signed informed consent (Appendix 1) was obtained for all subjects prior to all testing procedures.

The inclusion criteria were: 1) weight-lifters with at least 1 year resistance training experience specifically with the deadlift; 2) apparently healthy and have no injuries or other limitations that could be negatively affected by performing a deadlift; 3) between the ages of 18 and 39 years; 4) available and willing to complete the study; 5) all races and ethnicities; 6) male or female. Subjects were excluded if: 1) they are unable to understand the study or unwilling to sign consent; 2) were unable to execute the deadlift with correct form; 3) were unable to deadlift at least one and a half times their own bodyweight for 1 repetition; 4) were unable to deadlift 60% of their 1-repetition maximum without straps using a double-overhand grip; 4) had a resting blood pressure higher than 160/100 mmHg; or 5) any other reason that may have affected the wellbeing of the subject or the integrity of the research, as determined by the investigator. This study involved 10 male weight-trained subjects, recruited from the University of Kentucky community. Subject demographics are presented in Table 3.1. No female subjects that fit the inclusion/exclusion criteria were recruited for this study. Nine of the subjects were right-handed and one was left-handed. Six of the subjects reported that their preferred grip while performing a deadlift was "left-overhand/ right underhand" (LORU), 3 subjects preferred DO, and 1 subject preferred "right-overhand/ left underhand" (ROLU).

Table 3.1 Subject Demographics

Subject Demographics	
Age (yrs)	21.2 ± 2.1
Body Mass (kg)	86 ± 11.6
Training Experience (yrs)	5.0 ± 3.3
Deadlift 1-RM (kg)	202.5 ± 32
1-RM % of Body Mass	237 ± 34.5

Procedures

Each subject participated in two testing sessions. The first session lasted approximately 30 minutes and the second session lasted approximately 2 hours. Subjects were asked beforehand to refrain from any intense exercise for at least 2 days before each testing session that may affect performance in the deadlift. Each session was separated by about 2 weeks. For the first session subjects wore standard athletic attire. For the second session subjects were asked to wear comfortable, but minimal clothing, due to the motion-tracking markers and EMG electrodes: short, close-fitting athletic shorts; a tank top or sleeveless shirt; and low-top athletic shoes.

The purpose of the initial session was to determine each subject's 1-repetition maximum (1-RM) with the conventional deadlift. After brief instruction on the deadlift by the researcher, the subjects closely followed the guidelines for determining a 1-RM (1): The subject warmed up with light resistance that easily allowed 5-10 repetitions. Subject rested for 1 minute. The subject then warmed up with 3-5 reps by adding 30-40 lbs or 10-20% of the initial weight. The subject then rested for 2 minutes. Then the subject estimated a conservative near-max load that allowed them to complete 1-2 reps by adding 30-40 lbs or 10-20% of the previous load. A 2-4 minute rest period was then provided. A load increase of 30-40 lbs or 10-20% was then made and the subject was instructed to attempt a 1-RM. If it was successful, a 2-4 minute rest period was provided and then another load increase was made after which the subject attempted another repetition. If the subject failed, a 2-4 min rest was taken, and then the load was decreased by subtracting 15-20 lbs or 5-10%. A 1-RM was then again attempted. Subjects continued increasing or decreasing until they could complete a 1-RM with proper technique, ideally within 3-5 testing sets. This amount was then used to calculate testing loads for the second testing session. Subjects were allowed to use their preferred grip style for 1-RM testing. They were also allowed to use a lifting belt and straps if they chose. These aids minimized risk to the subject and more closely mimicked how they would typically perform a maximal effort deadlift. They were not allowed to wear a deadlift/squat suit or knee wraps, as these items may increase the amount of weight that can be lifted through specialized fabrics, but are not commonly used outside of elite-level powerlifting competitions.

During the second session recordings of muscle myoelectric activity (via EMG) and motion capture were made. Initially, the subject's skin was prepped for EMG recording by shaving, abrading, and cleaning. Only the minimal amount of shaving and abrasion (with cotton gauze) was done in order to ensure conductance of the electrode. Disposable surface electrodes (Ambu Blue Sensor M, Ballerup, Denmark) were placed in pairs along the longitudinal axis of each muscle tested, with an inter-electrode distance of 2 cm. Electrodes were placed on both the left and right sides of the body. Similar to previous studies (3,15,16,21), one electrode pair was placed at each of four locations: 1) biceps brachii, on the line between the medial acromion and the fossa cubit at 1/3 from the fossa cubit; 2) the upper trapezius, on the line and halfway between the acromion and the C7 vertebrae; 3) the teres major/upper latissimus dorsi, immediately lateral to the lateral scapular border and parallel to the top of the axillary line; and

4) the brachioradialis, immediately distal from the fossa cubit, in line with the belly of the muscle.   A common reference electrode was placed on the anterior iliac crest. The EMG electrodes were connected to the computer using a 16-bit NI-USB-6229 A-D board (National Instruments, Austin, TX) and amplified with a MyoSystem 1400 (Noraxon, Scottsdale, AZ) amplifier in conjunction with the Cortex v 2.0.0.900 software (Motion Analysis Corporation, Santa Rosa, CA). EMG data were sampled at a rate of 1000 Hz. The gain was adjusted individually for each subject to give the maximal possible signal without cutting off the data.

A total of 31 reflective tracking markers were placed on the subject and barbell to observe the kinematics of the lift. This model consisted of markers on the left and right sides of the subject at the following locations: the acromion process, upper arm, olecranon process, distal radius and ulna, 2nd and 5th distal metacarpal, greater trochanter, mid-thigh, lateral knee joint center, mid-shank, and lateral malleolus. There were also 3 markers on the top of the head along the midsagittal line and one on the spinous process of the C7 vertebrae. Markers were also placed on left and right ends as well as the middle of the barbell. The markers were tracked using a 15 camera (7 *Eagle-4* cameras and 8 *Eagle* cameras) 3D optical motion capture system (Motion Analysis Corporation, Santa Rosa, CA) at a frame rate of 100 Hz. The 3-D orthogonal axis was defined as the X-axis pointing parallel to the direction the subjects were facing, the Y-axis pointing laterally (perpendicular to the x-axis, but parallel to the ground), and the z-axis pointing vertically. An example of the marker, camera, EMG, and system set-up can be seen in Figures 3.1 and 3.2. In Figure 3.1, an anterior view of the subject is shown at the start position using a LORU grip. In Figure 3.2, a lateral view of the subject is shown, also at the start position. The camera set-up, lifting platform, and coordinate system (Z- and Y-axes only for Figure 3.1, Z- and X-axes for Figure 3.2) are also shown in each figure.

Figure 3.1 Anterior view of testing set-up

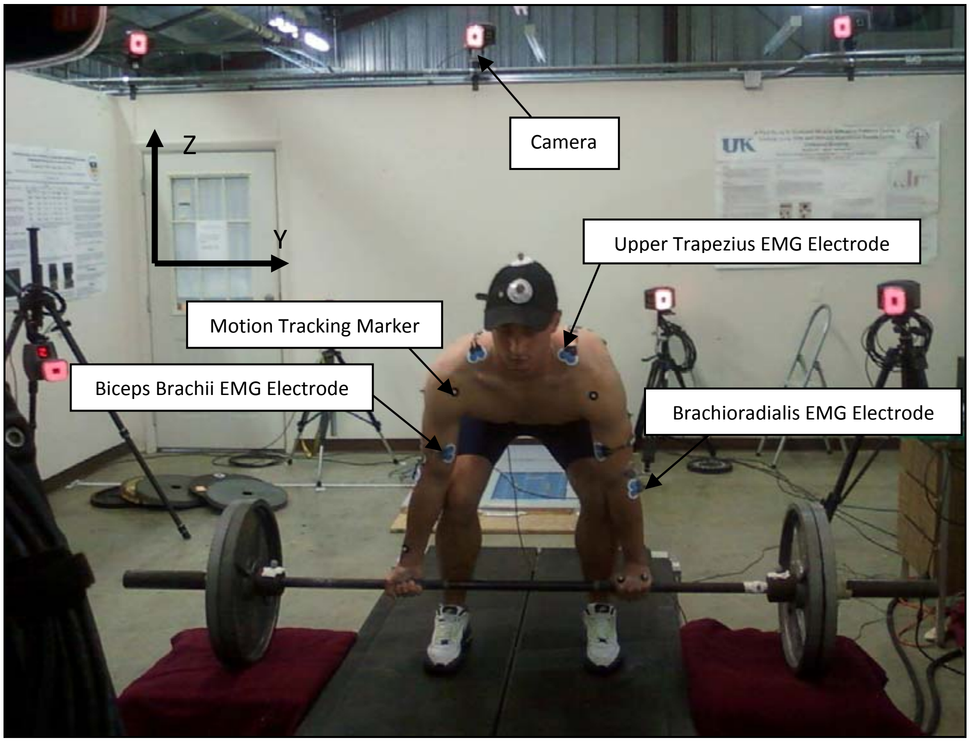
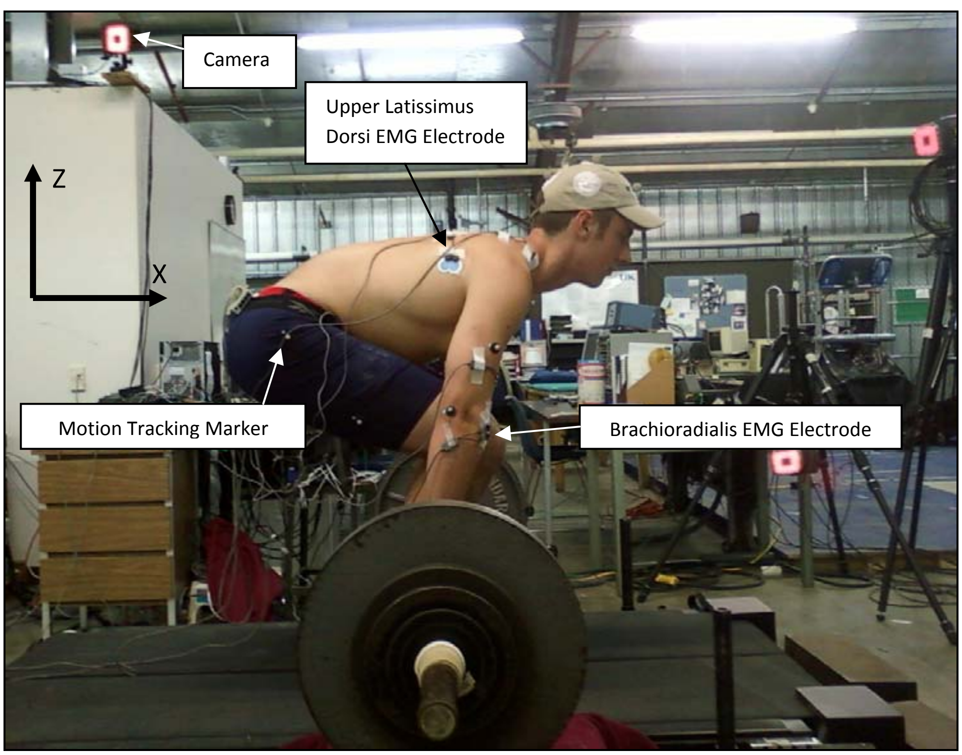


Figure 3.2 Lateral view of testing set-up



After being outfitted with EMG electrodes and reflective markers, the subject performed a warm-up, consisting of 1-3 sets of a few repetitions (3-5) with progressively heavier weight until they reached their first testing weight. During this warm-up, it was ensured that proper form for the conventional deadlift was being employed at all times, and instruction was given as needed. The subjects then lifted 60% of their predetermined 1-RM for three separate trials of two repetitions per trial. The three trials were performed with each grip variation: DO = double-overhand grip (both hands pronated); LORU = left overhand (pronated), right underhand (supinated) grip; ROLU = right overhand (pronated), left underhand (supinated). Each grip variation was chosen in randomized order, and sufficient rest (about 5 minutes) was given between sets to avoid fatigue. The subjects then performed three sets of two repetitions with each grip variation at 80% of their 1-RM, in the same manner.

For all trials, after the first repetition, the subject completely unloaded the weight but maintained grip and foot position for the next repetition. The subject sat the weight down completely on the supports and then executed the next lift from a dead stop. This ensured proper form of each repetition. Subjects were instructed to perform the repetitions with a moderate cadence, similar to how they would during a typical workout. Subjects were not allowed to use lifting straps for the 60% trials. They were, however, allowed to use lifting straps for the double-overhand 80% trial (80DO) only. Pilot data and anecdotal evidence showed that often a lifter does not have adequate grip strength to hold the bar at this intensity with this type of grip. If a subject could not lift 60% of their 1-RM without straps using a double-overhand grip, they were excluded from the study (no participants were excluded for this reason). Because the subject was lifting at submaximal intensities, a lifting belt was not necessary.

These intensities were chosen because they are similar to what many lifters would normally use in training, but the number of repetitions and total volume of work performed was much lower. This avoided fatigue and greatly decreased the likelihood of injury. Fatigue was negligible due to the submaximal weight lifted, the submaximal lifting intensity, the low number of repetitions and sets compared with a typical training session, sufficient rest between trials, and the high fitness level of the subjects. All subjects acknowledged that fatigue did not adversely affect their ability to perform any of the exercise variations. Two repetitions were used in order to observe both the concentric and eccentric phases, more closely replicating how this lift would be used in a typical training program.

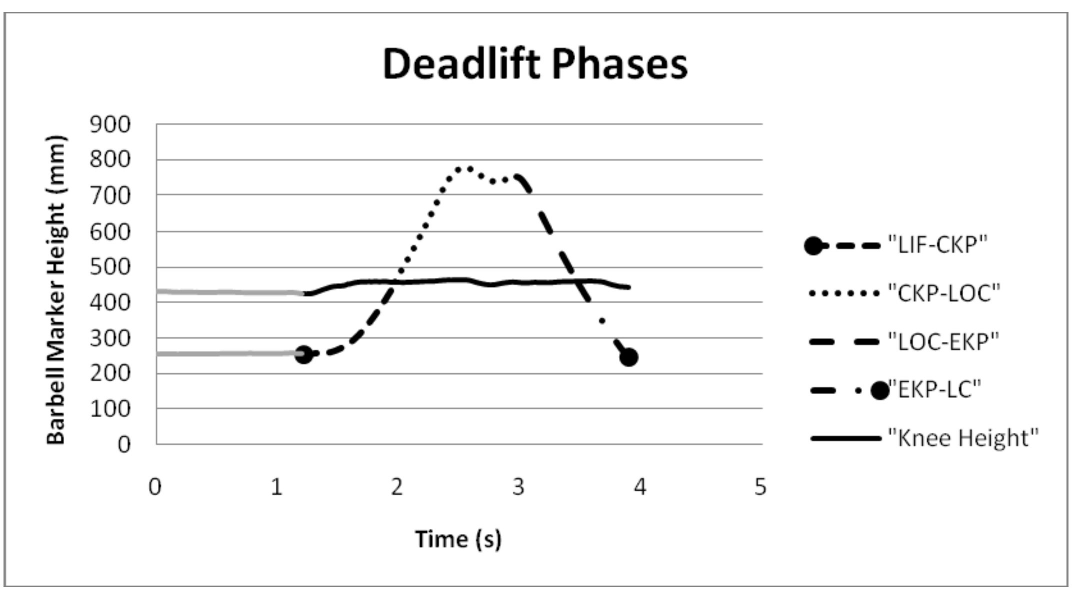
Data collection began 1 second before the lift began and continued for 1 second after the final repetition. Myoelectric activity and kinematics were examined from the time of barbell liftoff to the time the barbell returned to the ground. The time from barbell liftoff to return and EMG activity were monitored and synchronized using the Motion Analysis Corporation (MAC) on-line motion capture system (Santa Rosa, CA).

Data Analysis

Five events were defined for each repetition of the deadlift using the motion capture data of the knee and barbell markers. The first event was barbell liftoff (LIF), which was defined as the last frame in which there was an inflexion in the vertical velocity of the barbell marker before a rapid and steady increase in barbell height. The second event was concentric knee passing (CKP). CKP was defined as the first frame in which the barbell marker was higher than the same-side knee marker. The third event was lockout (LOC), which was defined as the last frame in which there was an inflexion of the vertical velocity of the barbell marker before there was a rapid, steady decrease in marker height. The fourth event was eccentric knee passing (EKP), which was defined as the last frame in which the barbell marker was higher than the knee marker. Lift completion (LC) was the final event. It was defined as the first frame in which there was an inflection in vertical bar velocity after a steady decrease in barbell height. All data were averaged for the first and second repetition for each trial. A Butterworth filter with a cutoff frequency of 5Hz was applied to all raw data to remove noise and smooth the data. A cutoff frequency of this magnitude has previously been demonstrated to be adequate during the lifting of heavy loads with slow movements (6, 20).

The EMG data were split into 4 phases for each repetition using the synchronized position data and defined events. The four phases therefore were LIF-CKP, CKP-LOC, LOC-EKP, and EKP-LC. Each phase is illustrated graphically in Figure 3.3. The lines represent the vertical position of the barbell and knee marker. The gray lines represent the fact that although data collection began before LIF, these data were not analyzed.

Figure 3.3 Graphical illustration of the four defined phases



The root-mean-square (RMS) of the EMG activity was first calculated from the raw signal for each phase. To calculate the RMS, the raw EMG signal was first squared for each data point. The squares were then summed for each phase, and this total was then divided by the number of data points of the phase. The square root of this number was then taken, giving the RMS of the phase. RMS values were averaged for the two repetitions. This gave the average muscle activation throughout the range of motion. This value was then normalized by expressing it as a proportion of the 60DO trial for that muscle and side (left/right). For example, the *60LORU Left*, *60ROLU Left*, *80DO Left*, *80LORU Left*, and *80ROLU Left* trials are all normalized to the *60DO Left* trial for the same muscle. Normalizing to this task allows for a comparison across subjects and between tasks and phases. Because the element of interest was merely the ratio of activity of the same muscle with different grips, normalizing to a maximal voluntary contraction (MVC) was not necessary.

Using the Cortex software, relative joint angles were measured for the elbow, knee, wrist, and hip. These angles were then analyzed at each of the 5 defined events (LIF, CKP, LOC, EKP, and LC). Comparisons were then made between the different trials to determine if there were significant bilateral asymmetries caused by a change in grip.

Statistical Analysis

For the statistical analysis, a general linear model was created which modeled the data for all the variables involved (left/right, grip, intensity, and phase/point of interest). Using repeated measures ANOVA testing, it was determined which variables were statistically significant in the model. A post-hoc analysis was then performed to determine the interaction of the variables. A repeated measures ANOVA test with post-hoc analysis (LSD) was used to determine if there were significant differences between the various trials. Significance for all statistical analyses was set at a p-value < 0.05.

Chapter 4: Results

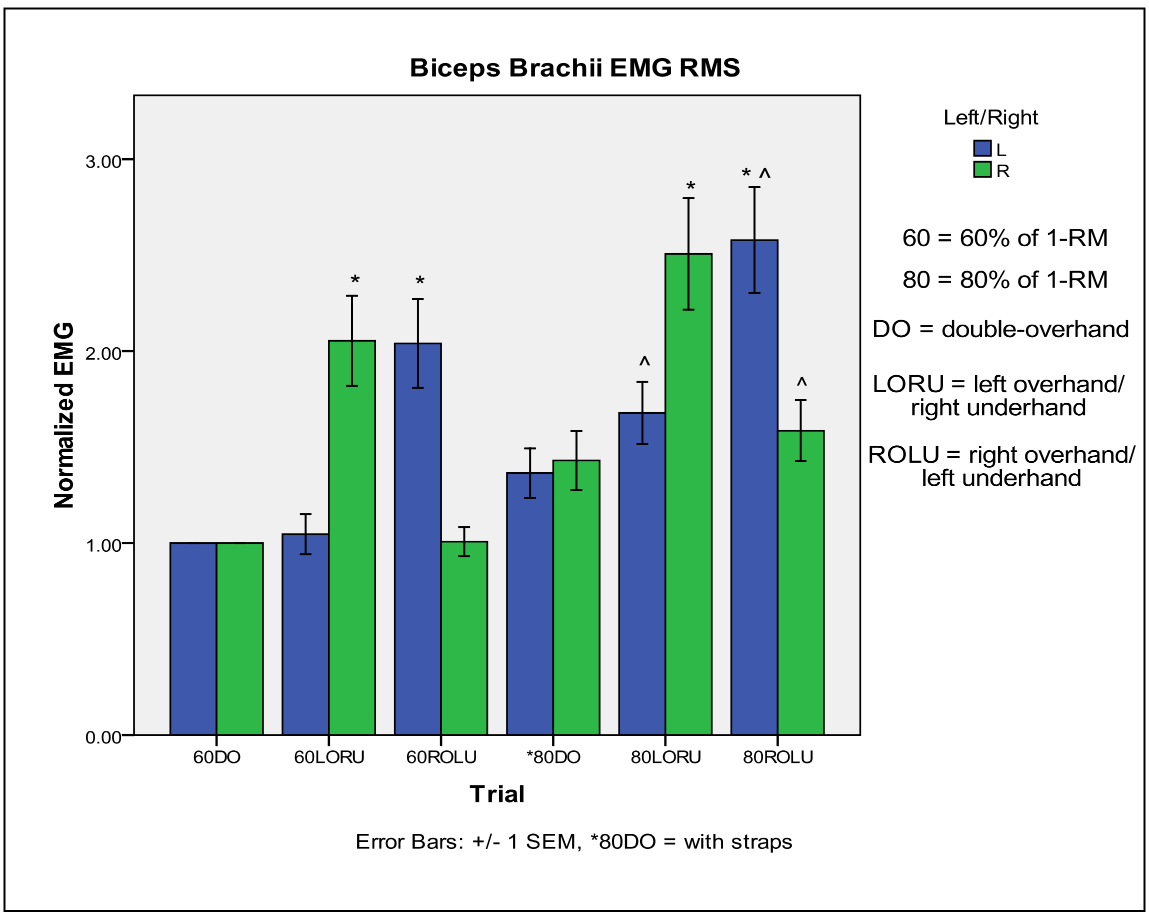
This chapter describes the results from the motion capture and EMG data collection. Because 'phase' was not found to be a significant factor in the general linear statistical model, data have been collapsed across all four phases for the EMG and motion capture data. Therefore, the data presented are representative of the entire range of motion of the lift (from liftoff to lift completion).

Muscle Myoelectric Activity

Biceps Brachii

Figure 4.1 presents the EMG RMS for the left and right biceps brachii, at both the 60% and 80% intensity. Data presented represent normalized RMS. Error bars represent ± 1 standard error of the mean (SEM).

Figure 4.1 Biceps Brachii EMG



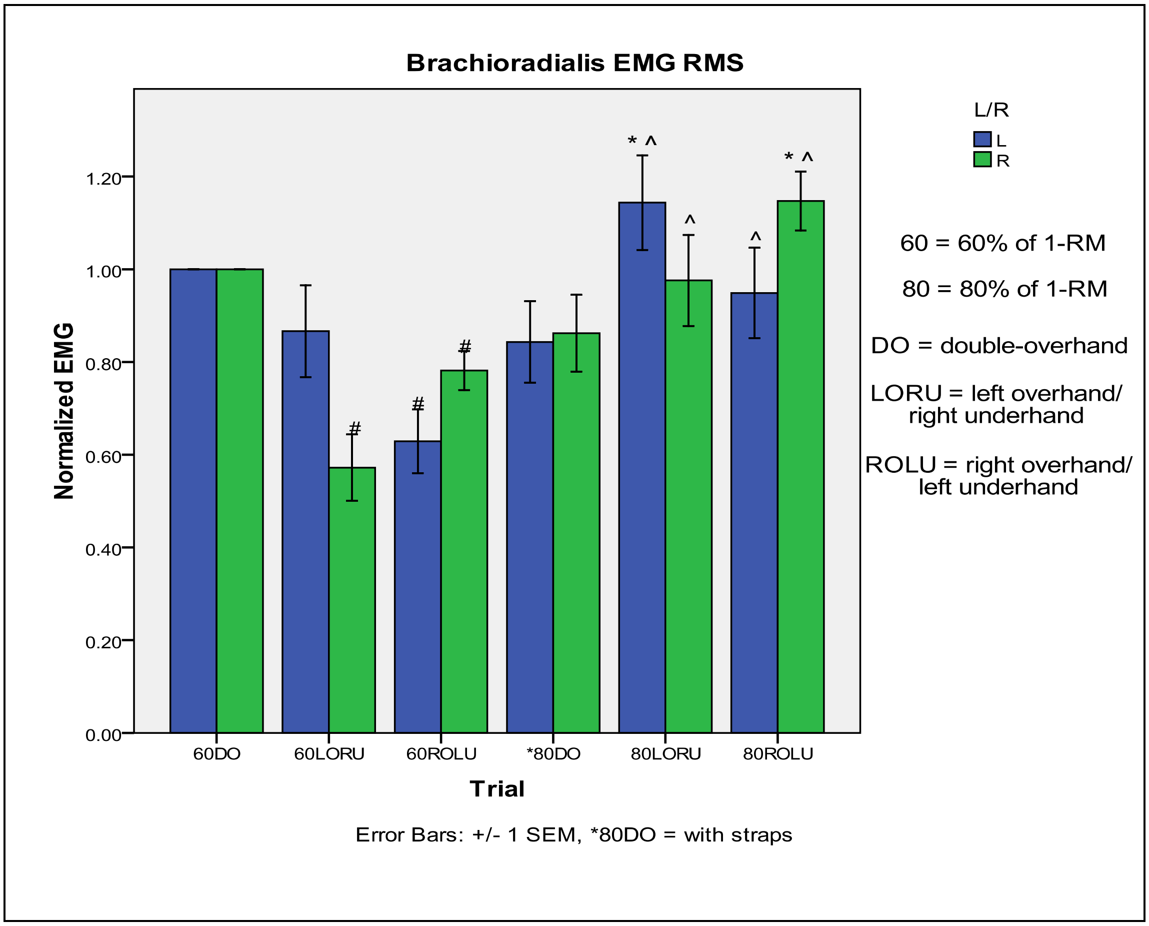
significantly greater than **ALL pronated-hand conditions (at equivalent intensity), ^significantly greater than equivalent 60% trial and side*

Supinating the hand (right hand during LORU trials, left hand during ROLU trials) significantly increased biceps brachii myoelectric activity at both 60% and 80% intensities, as compared to all other pronated-hand conditions. Therefore, the left biceps brachii EMG RMS was significantly higher with a ROLU grip than the left biceps brachii during the LORU- and DO-grip trials. Right biceps brachii EMG RMS was significantly higher with a LORU grip than it was with either the DO or ROLU grip. Additionally, EMG RMS was significantly greater at 80% intensity (as compared to equivalent 60% side and trial) for the left and right sides for the ROLU trial and for the left side only for the LORU trial. Although it was higher, the right side for the LORU trial was not significantly higher at 80% compared to 60% (p-value=0.073). It was not significantly higher for either side for the DO trial.

Brachioradialis

Figure 4.2 presents the EMG RMS for the left and right brachioradialis, at both the 60% and 80% intensity. Data presented represent normalized RMS. Error bars represent ± 1 standard error of the mean (SEM).

Figure 4.2 Brachioradialis EMG



*#significantly **less** than DO trial (at equivalent intensity), *significantly **greater** than DO trial (at equivalent intensity), ^significantly greater than equivalent 60% trial and side*

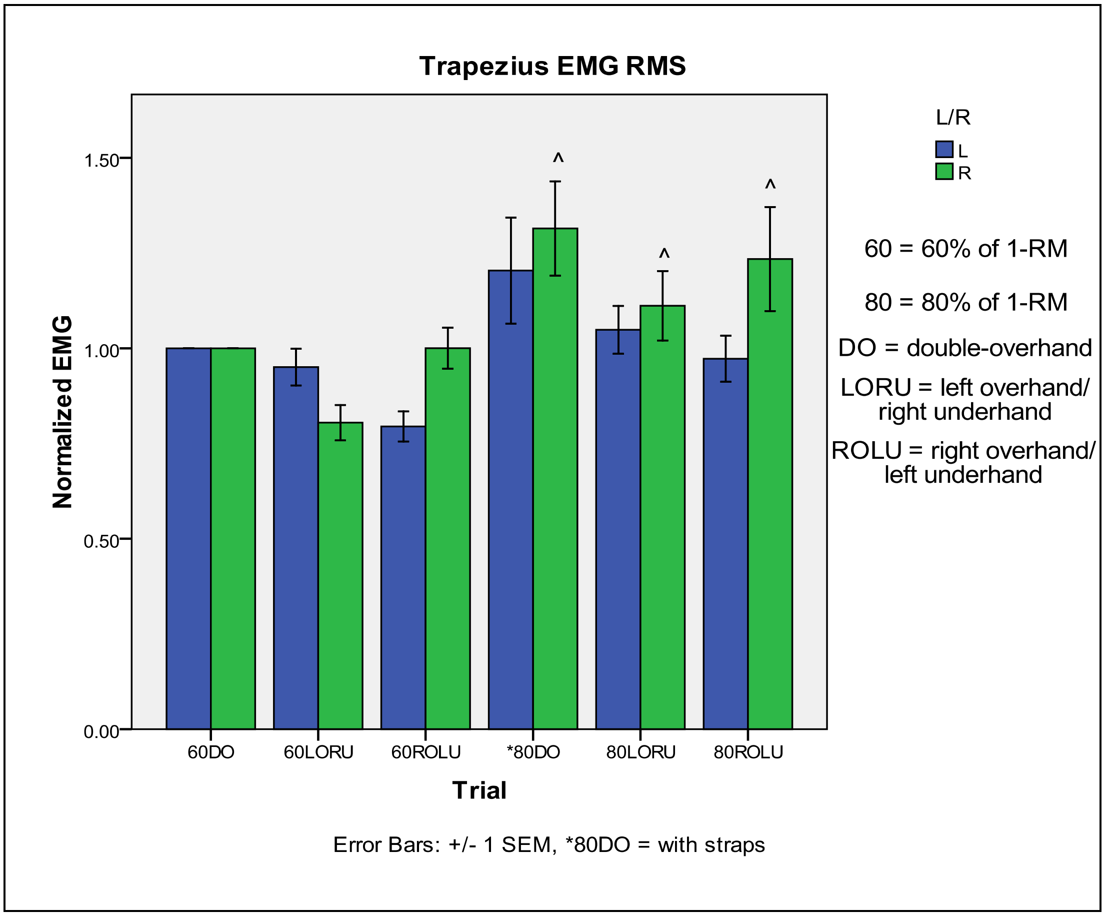
For the brachioradialis, at 60% of 1-RM, EMG activity of the supinated-hand side (right side for LORU trial, left side for ROLU trial) was significantly lower than during the DO trial. Additionally, the brachioradialis of the pronated hand during both OU-grip trials was also lower than during the DO trial, but only the right side ROLU trial was statistically significant. At 80% of 1-RM, the results were different. The pronated hand during the OU-grip trials was significantly *higher* than during the DO trial at the equivalent intensity. This difference can be explained by the use of lifting straps for the 80DO trial, but not for the 60DO trial.

In comparing the 80% trials to their corresponding 60% trials, EMG RMS was significantly higher at 80% intensity for both left and right sides of both overhand/underhand trials (LORU and ROLU). EMG RMS was not significantly higher at 80% for the DO trial for either side.

Trapezius

Figure 4.3 presents the EMG RMS for the left and right trapezius, at both the 60% and 80% intensity. Data presented represent normalized RMS. Error bars represent ± 1 standard error of the mean (SEM).

Figure 4.3 Trapezius EMG



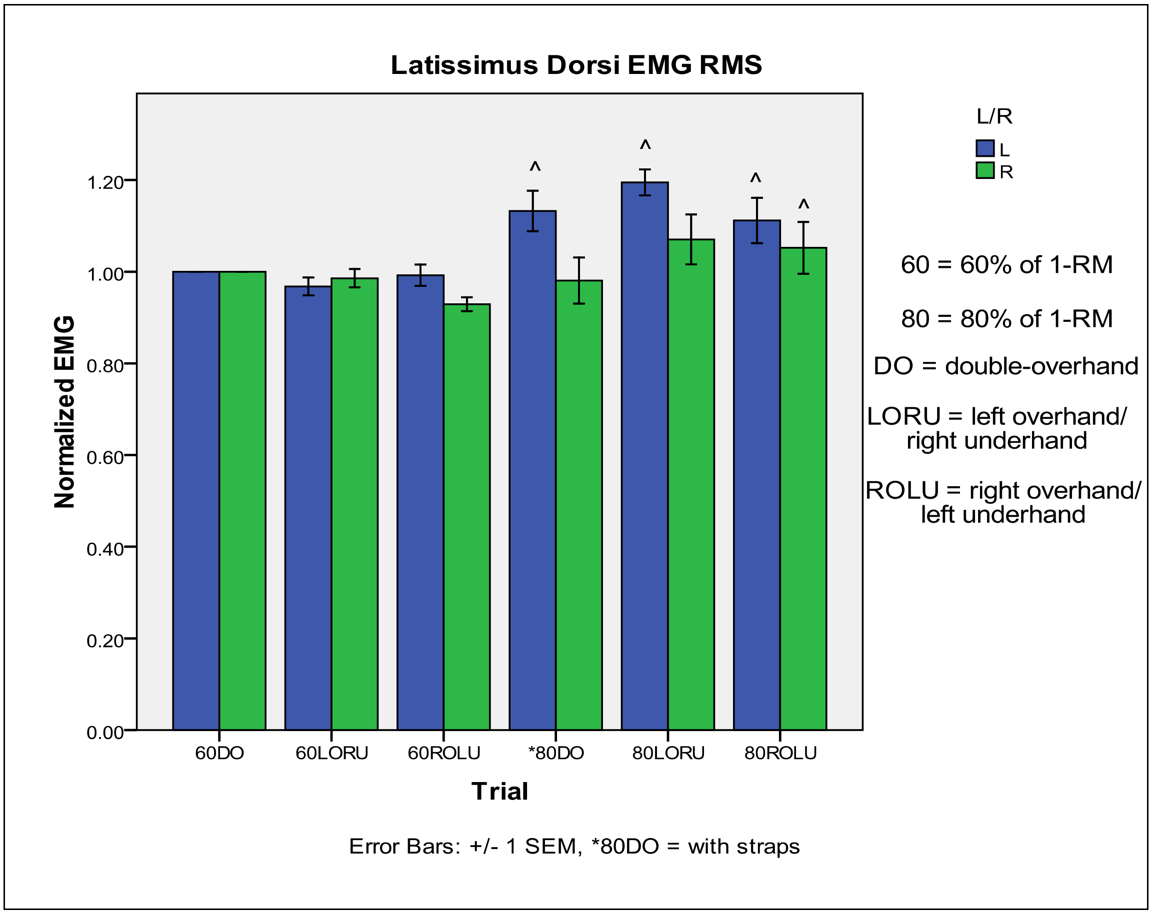
^significantly greater than equivalent 60% trial and side

There were no statistically significant findings with respect to grip for the upper trapezius EMG activity when comparing data from trials at the same intensity. EMG RMS for the 80% trials was significantly higher than the corresponding 60% trials for DO right, LORU right, and ROLU right. Although the left side was higher at 80% than 60% for all trials, it was not statistically significant.

Latissimus Dorsi

Figure 4.4 presents the EMG RMS for the left and right latissimus dorsi, at both the 60% and 80% intensity. Data presented represent normalized RMS. Error bars represent ± 1 standard error of the mean (SEM).

Figure 4.4 Latissimus Dorsi EMG



^significantly greater than equivalent 60% trial and side

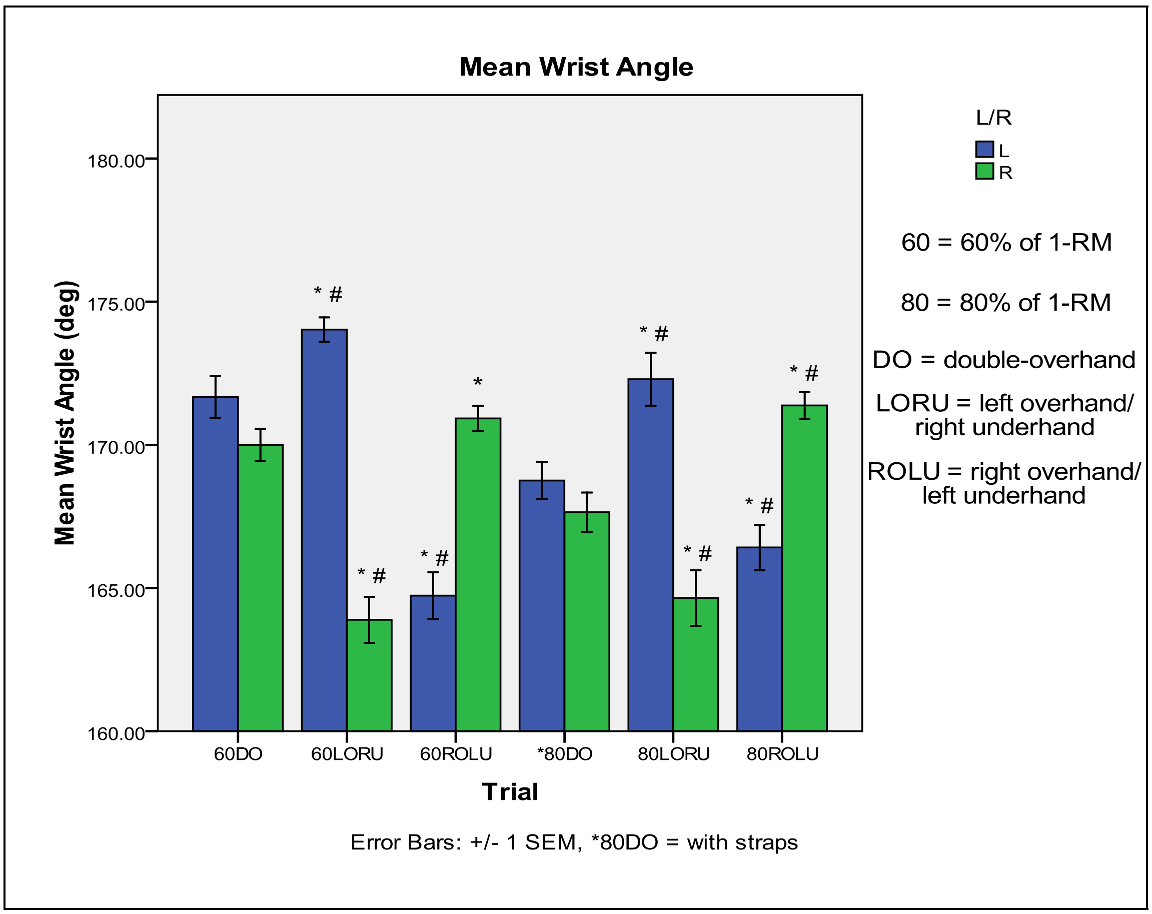
There were no statistically significant findings for upper latissimus dorsi EMG activity, with respect to changes in grip. At 80% intensity, as compared to 60%, EMG RMS was significantly higher for the left side only for DO and LORU and for both the left and right side for ROLU.

Relative Joint Angles

<u>Wrist Angle</u>

Wrist angles are presented in Figure 4.5 for the left and right sides, at both 60% and 80% of 1-RM. Wrist angle was measured from motion tracking markers of the olecranon process, distal ulna, and 5th distal metacarpal, and the angle presented represents the anterior side of the wrist (i.e., a smaller angle is equivalent to *greater* wrist flexion).

Figure 4.5 Mean Wrist Joint Angles



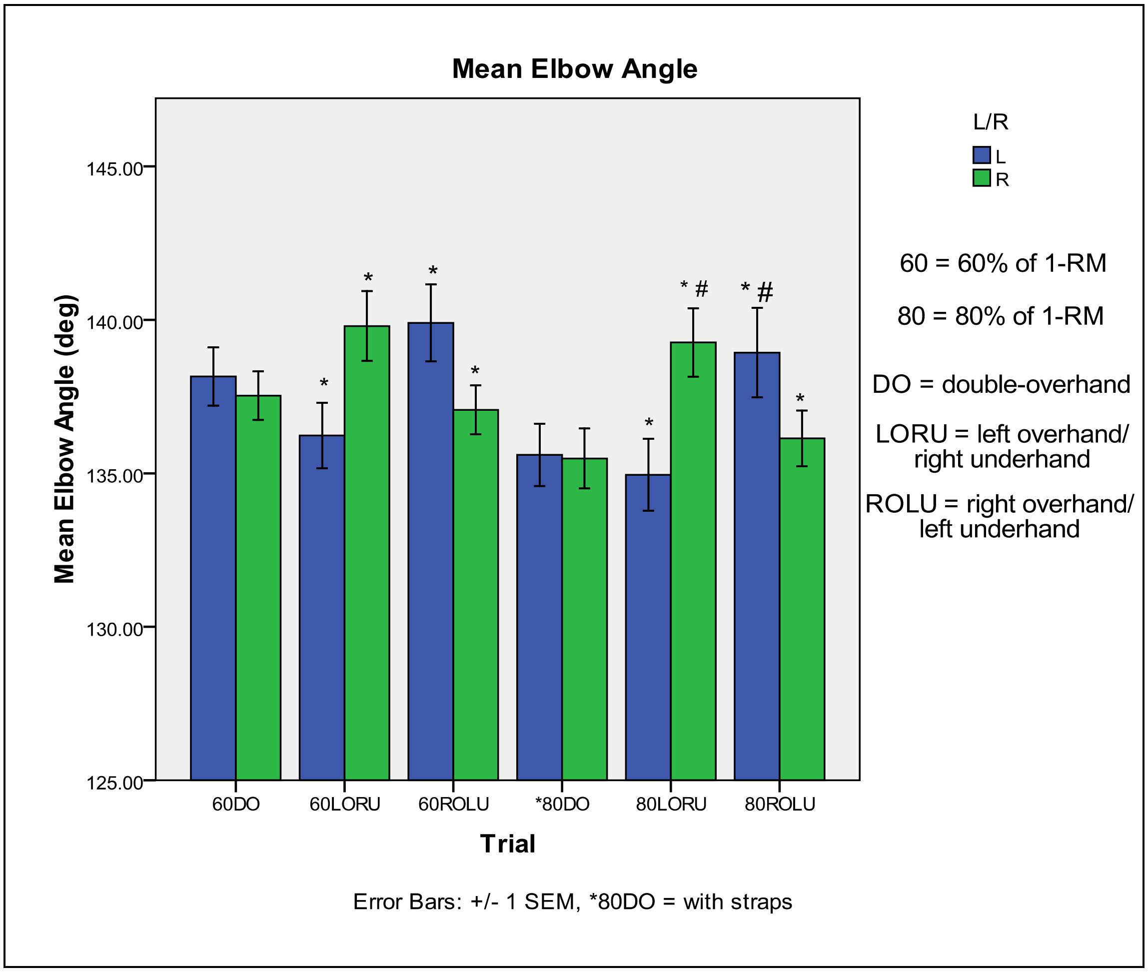
**significantly different from contralateral side, #significantly different from DO trial*

When using either a LORU or ROLU grip, left and right wrist angles were significantly different from one another. This was true at both 60% and 80% of 1-RM. Supination of the arm resulted in significantly lower wrist angle, as compared to the pronated side (for example *right* LORU < *left* LORU). With a DO grip, left and right wrist angle were not significantly different from one another. Each joint angle for the LORU and ROLU trials were also compared to the same side during the DO trial (for example *left* LORU vs. *left* DO). It was found that in all cases except for one (60ROLU right) the mean wrist angles for the OU grip trials were significantly different from their corresponding DO trial.

Elbow Angle

Elbow angles are presented in Figure 4.6 at both 60% and 80% of 1-RM. Elbow angles were measured from motion tracking markers of the acromion process, olecranon process, and distal ulna. The angle presented represents the anterior side of the arm (i.e., a smaller angle is equivalent to *greater* elbow flexion).

Figure 4.6 Mean Elbow Joint Angles



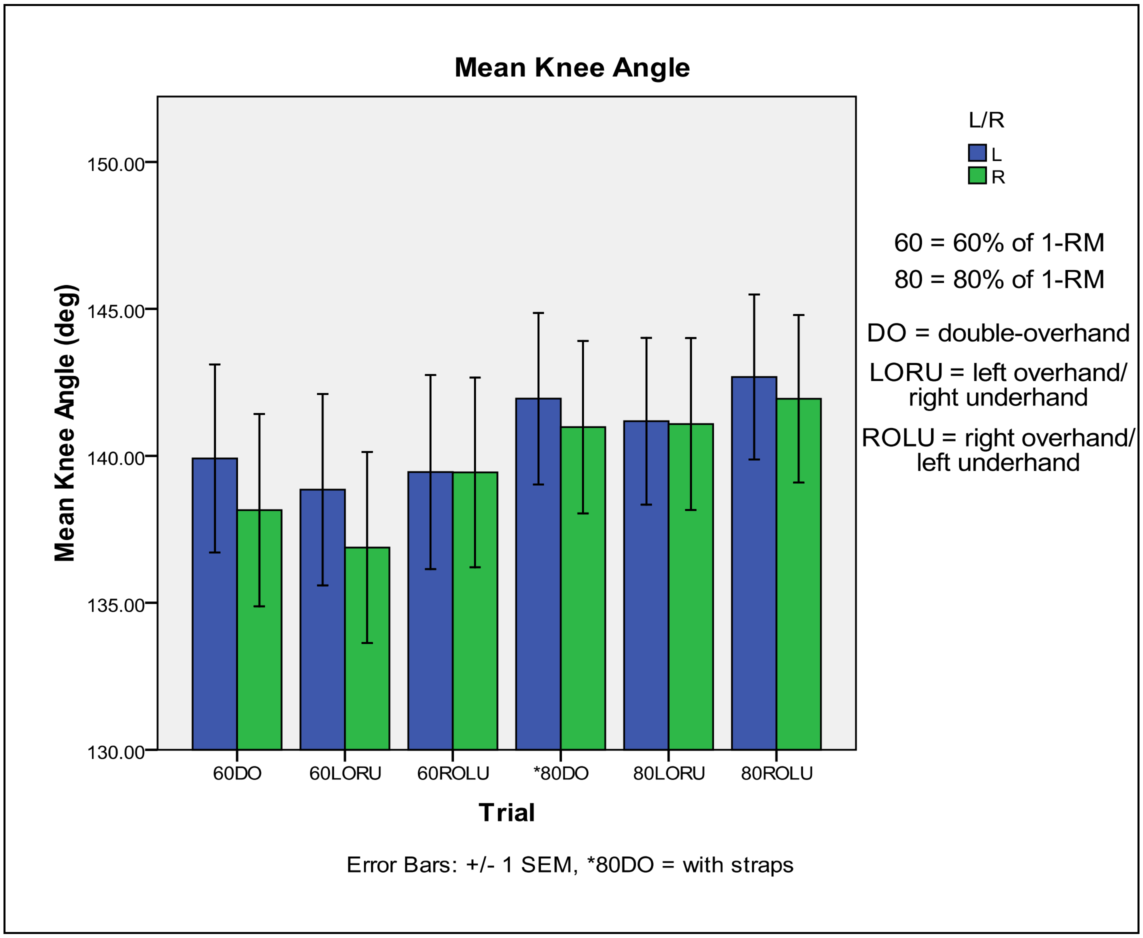
**significantly different from contralateral side, #significantly different from DO trial*

When using an OU grip (either LORU or ROLU), left and right elbow angles were significantly different from one another. This was true at both 60% and 80% of 1-RM. Supinating the arm caused the elbow angle to be significantly higher (i.e. less elbow flexion), compared to the pronated side. Left and right elbow angle were not significantly different from one another for either the 60DO or 80DO trial. Each mean joint angle for the OU-grip trials were also compared to the same side during the DO trial. No significant differences were found for the 60% trials. However, at 80% the right elbow angle was significantly greater when using LORU, as compared to DO. Similarly, the left elbow angle was significantly greater when using ROLU, as compared to DO. Taken together, when using an OU grip at 80% of 1-RM, the elbow angle of the supinated hand side is not only greater than the contralateral side, but also significantly greater than what it would be if one were using a DO grip.

Knee Angle

Knee angles are presented in Figure 4.7. Knee angle was measured from motion tracking markers of the greater trochanter, lateral knee joint center, and lateral malleolus, and represents the relative angle of the posterior side of the leg.

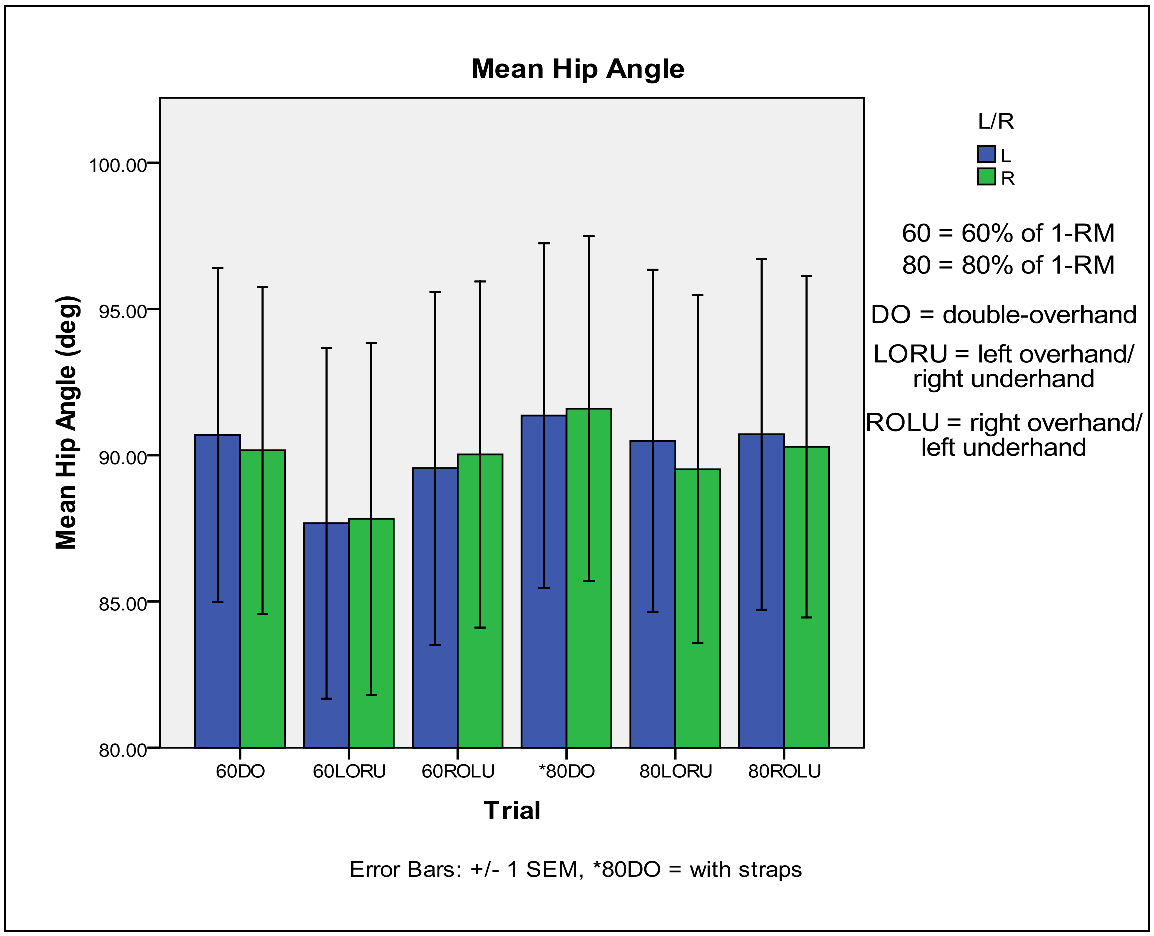
Figure 4.7 Mean Knee Joint Angles



Hip Angle

Hip angles are presented in Figures 4.8. Hip angle was measured from motion tracking markers of the acromion process, greater trochanter, and lateral knee joint center, and represents the relative angle of the anterior side of the hip (i.e. a smaller angle is equivalent to more hip flexion).

Figure 4.8 Mean Hip Joint Angle



Neither knee nor hip angles were significantly different at any point between the three grip variations at either 60 or 80% of 1-RM. Note that because the knee and hip angle change greatly throughout the lift (whereas the wrist and elbow remain relatively constant), the standard error for the mean is much larger. However, this did not affect the statistical significance of the data.

Chapter 5: Discussion

The belief that using an overhand/underhand (OU) grip when performing the deadlift causes the left and right sides of the body to be trained asymmetrically is supported by this study. The greatest differences in muscle activation between the different trials were seen in the biceps brachii. This is not surprising given that one of the functions of the biceps brachii is to supinate the hand. As would be expected, the greatest EMG activity in the biceps brachii was seen when the hand was supinated, which occurred on the right side for left-overhand/right-underhand (LORU) trials and the left side for right-overhand/left-underhand (ROLU) trials. Muscle activation was significantly greater than all other pronated conditions. The results from this study show that EMG activity is approximately twice as high as compared to when the hand is pronated. This is true for both side (left, right) and intensity (60%, 80%). However, the pronated hand during either OU-grip trial had no significant increases in activity. Therefore, when performing an OU-grip deadlift, the biceps brachii of one side is being worked to a much larger degree than the other. This is not surprising to many powerlifters, as it is not all that uncommon to rupture the biceps tendon of the supinated arm when performing the deadlift with extremely heavy loads.

The results for the brachioradialis were not consistent between the two intensities. As previously stated, an OU grip is commonly used for the deadlift because of the difficulty in holding large amounts of weight with a double-overhand grip. Because of this, subjects used lifting straps for the 80% DO trial. The results show that the use of lifting straps affected the activation of the brachioradialis. At 60% of 1-RM, where no straps were used, switching to an OU grip decreased activity of the brachioradialis of *both the supinated and pronated* side, as compared to the DO trial. It was significantly lower in the supinated arm of both OU-grip trials, and the pronated arm in the ROLU trial. It was also lower in the pronated arm of the LORU trial, but it was not statistically significant. This shows that an OU grip takes stress off of the brachioradialis, especially of the arm which is supinated. The brachioradialis must work harder when both hands are pronated, as in the DO trial, because it is more difficult to keep the bar from rolling out of the lifter's hands. The counter-rotational force produced when using an OU grip makes the barbell much easier to hold, decreasing the muscle activity of the brachioradialis, especially in the supinated arm. The supinated side is likely affected to a greater degree because in this position the brachioradialis is not in its most mechanically advantageous position.

Interestingly, at 80% of 1-RM, the only significant difference was that activity in the pronated arm of the OU-grip trials was significantly *greater* than during the DO trial. This explained by the use of lifting straps for the 80DO trial. The straps are wrapped around the bar in the opposite direction of the hand and are attached at the wrist. This creates a counter-rotational force (similar to an OU grip) within each hand, which takes a large amount of stress off of the forearms. Therefore, the activation of the brachioradialis in the 80DO trial is greatly reduced compared to what it would be if the subjects were able to perform the deadlift at this intensity without straps. In fact, the data show that activation of the brachioradialis was lower at 80% than at 60%, although it was not statistically significant.

In summary, the greatest activation of the brachioradialis is seen with a DO grip. However, as grip strength becomes a limiting factor at higher intensities, and lifting straps must be used with a DO grip, this does not hold true. The expected proportional increase in activation from using heavier weight is not seen because the straps allow some of the stress to be taken off of this muscle. In comparing a DO grip w/ straps to an OU grip, the brachioradialis of the pronated hand is significantly more active, but the supinated hand is not.

Although no differences were found in the activation of the upper latissimus dorsi or upper trapezius between the different grips, functional differentiation has been shown within the latissimus dorsi (24). Functional differentiation within skeletal muscle refers to the central nervous system's ability to control individual subunits of a muscle during a particular muscle contraction. Although no significant differences were found in either of these muscles, this cannot be extrapolated to the entire muscle. Both are large muscles with multiple functions. It may be the case that supination/pronation of the arm does cause changes in activation during the deadlift that were not seen using the electrode placement of the current study. However, no bilateral asymmetries were seen for either of these two muscles using this study's electrode placement.

In comparing the 80% intensity trials to their corresponding 60% trial, in general it was found that EMG RMS was higher at 80%. This makes sense because muscles are typically activated to a greater degree when placed under a greater load. However, this finding was not consistent throughout the muscles studied and grips used. For the biceps brachii and brachioradialis, no significant differences were found between the 60% and 80% trials. This is likely due to the lifting straps used for the 80% DO trial. As mentioned previously, the straps make it much easier to maintain a grip on the bar. This is especially evident in the brachioradialis, where the 80DO myoelectric activity was actually *lower* than 60DO (although not statistically significant). The straps may also affect the biceps brachii to some degree, leading to the insignificant increase in myoelectric activity seen in these data. As for the trapezius and latissimus dorsi, some significant increases were seen when in the 80% trials over 60%, but the findings were not consistent. This is likely attributed to the fact that when studying these large muscles are more stabilizers than primary movers, and the jump from 60% to 80% did not affect them to a great degree. It is curious that for the latissimus dorsi the left side was always higher at 80%, but the right side was always higher at 80% for the trapezius. This may possibly be due to the handedness of the subjects, as 9 of the 10 subjects were right-handed. The skewed handedness did not likely affect the question of bilateral asymmetry, as both variations of the overhand/underhand grip were investigated, but it may play a role in these inconsistent increases in muscle activity. This question of handedness is beyond the scope of this study, but may provide direction for future research.

Bilateral asymmetries were seen in the mean relative joint angles of the wrist and elbow, but not of the knees or hips. This is not surprising as the difference between trials was a change in hand placement but not foot placement. When using an OU grip, there is significantly more wrist flexion in the supinated arm than the pronated side. This was true for either OU grip and at both intensities. There was approximately a 5-10° difference in wrist angle between arms with an OU grip, and only about a 1° difference with a DO grip. This study was limited in that no wrist flexor muscles were analyzed using EMG. However, one can assume that the supinated arm has more wrist flexion because the wrist flexors are being used to a greater degree and are in a more mechanically advantageous position. Future research should include EMG analysis of these muscles to determine if this theory holds true.

There was also significant bilateral asymmetry in the relative elbow joint angle. The elbow followed an opposite pattern to the wrist. With an OU grip, the supinated arm had significantly *less* elbow flexion (arm is straighter) than the contralateral side (approximately a 3-5° difference). With a DO grip, however, there were no significant differences between sides. Taking the kinematic and electromyographic data together, there is an increase in biceps brachii activity and a simultaneous straightening of the arm when the arm is supinated. Typically it is assumed that a muscle would be more active when shortened, but this is not the case here. This result is likely due to the mechanically advantageous position of the biceps brachii when the hand is supinated, allowing it to be activated to a greater degree. This increase in activity while the muscle is lengthened may account for the increased risk of injury to the biceps tendon. Because lifting straps are not allowed in powerlifting competitions, these athletes must use an OU grip in order to lift the greatest amount of weight possible. Future research needs to investigate the prevalence of injury to the biceps brachii in powerlifting and determine if there is an increased risk of using an OU grip. While this study does show that significant bilateral asymmetries exist at the elbow joint, it does not prove that these asymmetries result in injury.

No significant differences were found for the knee or hip joint angles. A conventional deadlift was used for all trials, and although it was not measured, it was assumed that foot position remained relatively constant between the trials. While there is a great deal of research focusing on the lower body during the deadlift, measures are often only made of one side. The conventional- and sumo-style deadlift have been shown to differ in their knee and hip angles, but they have also been shown to both be symmetrical with regard to left vs. right (9). This study is in agreement with that finding and goes on to show that a change in hand position does not affect the symmetry of the knee and hip. Relative joint angles of the knee and hip found in this study were, in general, consistent with those found in previous research on the conventional deadlift. Previous research has examined these angles at liftoff and at concentric knee passing, and the knee and hip angle results from this study are in line with those found previously (7,8,9). However, this study also examined these joint angles, in addition to those of the wrist and elbow, and measured them throughout the range of motion of the lift.

This study, like many others, has shown that with weightlifting, small variations in positioning can produce significant differences in muscle activation. It has been previously shown that altering foot positioning during standard lower limb can help selectively activate certain muscles or areas of a muscle group. With the deadlift, Escamilla *et al*. (7) have found that employing a sumo-style, which involves widening one's stance and slight external rotation of the feet, results in greater activation of the vastus medialis, vastus lateralis, and tibialis anterior. Kinematically, they have also shown differences in joint angles between the two lifts. In a much more subtle exercise variation, Lynn and Costigan (18) showed an increase in medial-lateral hamstring activation ratio when the foot was internally rotated. Similarly, it has been shown in the leg extension exercise that medial foot rotation produces greater muscle activation for the vastus lateralis and vastus medialis, whereas lateral rotation produces the greatest activation in the rectus femoris (26). As for the upper body, changes in muscle activation have been shown in the ratio of latissimus dorsi to biceps brachii activity when comparing an overhand- and reverse-grip lat pulldown exercise. Although the changes were small, it was seen that a reverse grip increased activity of the biceps brachii, and decreased activity of the latissimus dorsi (16). This study adds to these findings by showing that rotation of the hand can also influence muscle activation, even in lifts in which the arms and upper body are not considered the primary movers. In previous research it is common for only one side to be analyzed, or for the same changes to be made to both sides simultaneously. However, this study is different in its approach because the changes in position are only on one side. Nonetheless, similar results were seen. When one hand was supinated while the other pronated, changes in muscle activity of the biceps brachii only affected the supinated-hand side. Conversely, the brachioradialis of both sides were affected by the OU grip, albeit the supinated-hand side seemed to be affected to a greater degree.

Future research should include longitudinal intervention studies to determine if and how the asymmetries seen here may manifest themselves over time. Although it is generally accepted that asymmetries between antagonistic muscle groups, most notably the quadriceps and hamstrings, can increase the risk of injury, very little research exists examining *bilateral* asymmetry during exercise. It may be possible that consistently training with the same OU grip over time, as many people do, could cause greater hypertrophy of one side over the other, or even result in injury. This would be of great interest to athletes in many sports in which the deadlift is a regular part of the training. This is especially true for bodybuilding, a sport which is judged in part on the muscular symmetry of the athletes. These data are also of interest to powerlifters. Although they may not be allowed to use lifting straps, making a DO-grip somewhat impractical for training at high intensities, it may still be of benefit to train with each OU grip variation (ROLU and LORU).

Chapter 6: Summary and Recommendations

Summary

In summary, this study has shown that bilateral asymmetries do exist when performing the deadlift with an overhand/underhand grip. The data support both hypotheses stated in Chapter 1. Hypothesis 1 is supported in that muscle activity of the biceps brachii and brachioradialis was significantly more asymmetric when performing the deadlift with an overhand/underhand grip as compared to a double-overhand grip. Hypothesis 2 was supported because the data show that wrist and elbow joint angles were significantly more asymmetric with an overhand/underhand grip compared to a double-overhand grip.

The biceps brachii of the supinated hand with this type of grip is significantly more active than when it is pronated. This was shown by comparing both the left and right sides during an OU-grip deadlift and by comparing data from an OU-grip trial to a double-overhand one. Despite increases in biceps brachii activity when the arm is supinated, there is actually significantly less flexion of the elbow, as seen illustrated by the kinematic data. In addition to the biceps brachii, the brachioradialis also exhibits changes in muscle activation when using an OU grip compared to a double-overhand one. At a lower intensity, using an OU grip caused the brachioradialis to be less activated than when a DO grip is used. At higher intensities, most experienced lifters cannot deadlift with a DO grip unless lifting straps are used. When comparing a DO grip with straps to an OU grip, the highest EMG is seen in brachioradialis of the pronated arm when using the OU grip. At the wrist joint, significantly greater wrist flexion was seen in the supinated-hand side of the OU-grip trials. This study was limited in that the primary wrist flexors/extensors were not analyzed, although this would be a good direction for future research. No significant differences were found in the trapezius or latissimus dorsi with either type of grip. However, with these muscle groups being much larger and multifunctional, a different electrode placement may produce different results.

Recommendations

From this study it was found that using an OU grip for the deadlift does produce some bilateral asymmetries in muscle activation and joint angles of the upper body. Whether these asymmetries translate to the asymmetric hypertrophy, injury, etc. is yet to be determined. However, it may be of benefit to use a double-overhand grip to avoid these possibilities altogether. When heavy loads are used, and grip becomes a limiting factor, ergogenic aids such as lifting straps, chalk, and gloves can be used to increase the ability to grip the barbell. However, if strengthening of the forearms is a primary goal, lifting straps should be avoided, as they do decrease the stress on the musculature of the forearms. In situations where lifting straps are not allowed, “flip-flopping” which hand is pronated/supinated in an OU grip is a good training recommendation. The handedness of humans will often make trainees want to use the same OU grip each time, but switching between ROLU and LORU regularly will help to prevent any left/right imbalances from forming. Clearly the left and right arms are not trained symmetrically with an OU grip, and this must especially be considered when utilizing the deadlift as part of a rehabilitation program.

Appendix 1: Informed Consent

Consent to Participate in a Research Study

Comparison of Muscle Activation and Kinematics During the Deadlift Using a Double-Pronated and Alternate Grip

WHY ARE YOU BEING INVITED TO TAKE PART IN THIS RESEARCH?

You are being invited to take part in a research study about how different grips affect the way your muscles are used and how the mechanics of your body work during a submaximal effort deadlift. You are being invited to take part in this research study because you are an experienced (more than 1 year) weight lifter, with no injuries or health issues that may be negatively affected by performing a deadlift. You must also be familiar with the deadlift technique and have been regularly using this exercise as part of your weight training regimen. If you volunteer to take part in this study, you will be one of about 15 people to do so.

WHO IS DOING THE STUDY?

The person in charge of this study is Luke Beggs, a graduate student of the University of Kentucky Department of Kinesiology and Health Promotion. He is being guided in this research by faculty advisors Dr. J.W. Yates, Dr. Mark Abel, and Dr. David Mullineaux. There may be other people on the research team assisting at different times during the study.

WHAT IS THE PURPOSE OF THIS STUDY?

It is thought that a change in hand position on one side only (as is the case with the alternate grip), may cause the body on that side to work differently than the opposite side. By doing this study, we hope to learn whether or not performing a deadlift with an “alternate” or “over-under” grip works the left and right sides of the body differently, compared to the “standard” or “double-pronated” grip.

ARE THERE REASONS WHY YOU SHOULD NOT TAKE PART IN THIS STUDY?

You should not take part in this study if you: 1) are not between the ages of 18 and 39, 2) have less than 1 year of experience with the deadlift, 3) have any injuries or health issues which may be made worse by performing a deadlift, 4) are not able to deadlift at least 1.5X your bodyweight for one repetition, 5) are not able to deadlift 60 and 80% of your 1-repetition maximum (1-RM) with both a standard and alternate grip variation for 3 sets of 2 repetitions each with good form, 6) are not able to deadlift 60% of your 1-RM with a double-overhand grip without lifting straps, 7) have a resting blood pressure greater than 160/100 mmHg, 8) are not available and willing to complete two study sessions of approximately 1 and 2 hours each.

WHERE IS THE STUDY GOING TO TAKE PLACE AND HOW LONG WILL IT LAST?

The research procedures will be conducted at the Biodynamics Laboratory of the Wenner-Gren Research Laboratory on the University of Kentucky campus. You will need to come to the Biodynamics Laboratory 2 times during the study. The first visit will take about approximately 1 hour and the second one will take about 2 hours. The total amount of time you will be asked to volunteer for this study is about 3 hours.

WHAT WILL YOU BE ASKED TO DO?

You will be asked to come to the laboratory wearing athletic shoes, shorts, and a sleeveless T-shirt or tank top for both sessions. The clothing should be comfortable and have minimal coverage of the arms and legs due to the electrodes and markers used in the study.

During the first session you will first be familiarized with the deadlift and what is expected. You will then perform a 1-repetition maximum test (1-RM), following the guidelines of the National Strength and Conditioning Association (NSCA). This test requires you to perform progressively heavier sets of the deadlift with adequate rest (2-4 minutes) between each set. You will be able to use the grip style of your choice. You may also wear a lifting belt and use lifting straps if you choose, but you may not wear a squat/deadlift suit. You will begin with an easy warm-up set of 5-10 repetitions, followed by a second warm-up of 3-5 reps with a heavier weight. You will then perform a set with a near-maximal load for 1-2 reps. After another rest period, you will make progressively heavier attempts of 1 rep each until a 1-repetition maximum is determined. You will be monitored by a certified personal trainer for proper technique. The 1-RM found during this session will be used to determine the weights used in the 2nd testing session.

During the second session, you will be outfitted with electromyographic (EMG) electrodes on the biceps brachii (upper arm), brachioradialis (forearm), trapezius (between shoulder and neck), latissimus dorsi (upper, outer part of the back), and vastus lateralis (front of the thigh) on each side of the body. Skin will be shaved, abraded, and cleaned with rubbing alcohol if needed to ensure a good connection with minimal interference. About 30 reflective markers will also be affixed to you for motion capture. These will be placed on your ankle, knee, hip, shoulder, elbow, wrist, and torso. Athletic tape may be used to ensure markers and electrodes are properly secured.

You will then perform a 10 minute warm-up consisting of stretching and light warm-up sets of the deadlift. Proper form for each grip variation will be demonstrated by the researcher during this time. In random order, you will perform 2 repetitions of the deadlift with 60% of your previously determined 1-RM with each of the following grip variations: 1) double-overhand, 2) right underhand-left overhand, 3) left underhand-right overhand. The weight will then be increased to 80% of your 1-RM and two repetitions with each of the three grip variations will again be performed. Each trial will be separated by approximately 5 minutes to avoid fatigue. Proper deadlift form must be maintained for each repetition. After the first repetition you must completely unload the weight by setting it on the floor, but you must maintain your foot and hand position. You will not be allowed to use a deadlift/squat suit or lifting belt for any trial. You will be allowed to use lifting straps on the double-overhand 80% trial only. Your muscle activity will be measured using EMG and your lifting mechanics will be recorded using the motion capture system and reflective markers. If you cannot lift 60% of your 1-RM without straps you will be excluded from the study. If you cannot perform the deadlift with proper form you will also be excluded from the study.

WHAT ARE THE POSSIBLE RISKS AND DISCOMFORTS?

To the best of our knowledge, the things you will be doing have no more risk of harm than you would experience in a typical workout. There is a certain amount of risk associated with any type of exercise or weight training, but this study requires only 6 total sets of 2 repetitions, a training volume likely much less than you normally perform. It will also closely monitored by a certified personal trainer for proper technique. For these reasons and because you are required to have been regularly weight training and performing the deadlift, this study involves much less risk of harm than a typical workout. The EMG electrodes and athletic tape used in this study may in some cases cause slight skin irritation or discomfort. The skin will be properly cleaned immediately after testing to minimize this risk. In addition to the risks listed above, you may experience a previously unknown risk or side effect.

WILL YOU BENEFIT FROM TAKING PART IN THIS STUDY?

There is no guarantee that you will get any benefit from taking part in this study. Your willingness to take part, however, may, in the future, help society as a whole better understand this research topic. Training recommendations for the deadlift may be improved upon as a result of this study, possibly decreasing the risk of injury.

DO YOU HAVE TO TAKE PART IN THE STUDY?

If you decide to take part in the study, it should be because you really want to volunteer. You will not lose any benefits or rights you would normally have if you choose not to volunteer. You can stop at any time during the study and still keep the benefits and rights you had before volunteering.

IF YOU DON'T WANT TO TAKE PART IN THE STUDY, ARE THERE OTHER CHOICES?

If you do not want to be in the study, there are no other choices except not to take part in the study.

WHAT WILL IT COST YOU TO PARTICIPATE?

You may have to pay for the cost of getting to the study site and a parking fee.

WILL YOU RECEIVE ANY REWARDS FOR TAKING PART IN THIS STUDY?

You will not receive any rewards or payment for taking part in the study.

WHO WILL SEE THE INFORMATION THAT YOU GIVE?

We will make every effort to keep private all research records that identify you to the extent allowed by law.

Your information will be combined with information from other people taking part in the study. When we write about the study to share it with other researchers, we will write about the combined information we have gathered. You will not be personally identified in these written materials. We may publish the results of this study; however, we will keep your name and other identifying information private.

We will make every effort to prevent anyone who is not on the research team from knowing that you gave us information, or what that information is. Data will be stored on password-protected data storage devices. Data other than consent forms will also be coded in a way that subjects will only be identified by a number. Questionnaires and consent forms will be stored in separate locations, both in locked cabinets, within limited-access, locked rooms. Data will be kept for no longer than 5 years, after which it will be destroyed by shredding all hard copies of documents and deletion of all computer files.

We will keep private all research records that identify you to the extent allowed by law. However, there are some circumstances in which we may have to show your information to other people. For example, the law may require us to show your information to a court. Also, we may be required to show information which identifies you to people who need to be sure we have done the research correctly; these would be people from such organizations as the University of Kentucky.

CAN YOUR TAKING PART IN THE STUDY END EARLY?

If you decide to take part in the study you still have the right to decide at any time that you no longer want to continue. You will not be treated differently if you decide to stop taking part in the study.

The individuals conducting the study may need to withdraw you from the study. This may occur if you are not able to follow the directions they give you, if they find that your being in the study is more risk than benefit to you, or if the agency funding the study decides to stop the study early for a variety of scientific reasons.

ARE YOU PARTICIPATING OR CAN YOU PARTICIPATE IN ANOTHER RESEARCH STUDY AT THE SAME TIME AS PARTICIPATING IN THIS ONE?

You may take part in this study if you are currently involved in another research study. It is important to let the investigator/your doctor know if you are in another research study. You should also discuss with the investigator before you agree to participate in another research study while you are enrolled in this study.

WHAT HAPPENS IF YOU GET HURT OR SICK DURING THE STUDY?

If you believe you are hurt or if you get sick because of something that is due to the study, you should seek appropriate medical attention, and then contact W. Scott Black, MD at (859) 323-5823 x291 or w.scott.black@uky.edu immediately to report the adverse event.

It is important for you to understand that the University of Kentucky does not have funds set aside to pay for the cost of any care or treatment that might be necessary because you get hurt or sick while taking part in this study. Also, the University of Kentucky will not pay for any wages you may lose if you are harmed by this study.

Medical costs that result from research related harm cannot be included as regular medical costs. Therefore, the medical costs related to your care and treatment because of research related harm will be your responsibility.

A co-payment/deductible from you may be required by your insurer or Medicare/Medicaid even if your insurer or Medicare/Medicaid has agreed to pay the costs. The amount of this co-payment/deductible may be substantial.

You do not give up your legal rights by signing this form.

WHAT IF YOU HAVE QUESTIONS, SUGGESTIONS, CONCERNS, OR COMPLAINTS?

Before you decide whether to accept this invitation to take part in the study, please ask any questions that might come to mind now. Later, if you have questions, suggestions, concerns, or complaints about the study, you can contact the investigator, Luke Beggs at labegg2@uky.edu or 270-210-3329. If you have any questions about your rights as a volunteer in this research, contact the staff in the Office of Research Integrity at the University of Kentucky at 859-257-9428 or toll free at 1-866-400-9428. We will give you a signed copy of this consent form to take with you

____ ____________

Signature of person agreeing to take part in the study Date

____

Printed name of person agreeing to take part in the study

____ ____________

Name of [authorized] person obtaining informed consent Date

Appendix 2: Screening Questionnaire

(Questionnaire administered by researcher at first testing session)

Subject #: ____________________ Date: ____________________ Researcher's initials: _______

1. Gender: ____________________

2. Age: ____________ (exclude if not 18-39 years old)

3. Height: ____________________

4. Weight: ____________________

5. Race: ____________________

6. Years of weight training experience: ____________________ (exclude if less than 1)

7. Have you been regularly performing the deadlift for at least 1 year and are comfortable with its technique?

[YES] / [NO] (exclude if no)

8. Do you have any current or previous injuries or limitations that may be affected by performing a deadlift?

[YES] / [NO] (exclude if YES)

9. Estimated 1-Repetition Maximum for the Deadlift: ____________ lbs

10. Dominant hand: [RIGHT] / [LEFT] / [NEITHER]

11. Preferred grip style when performing a deadlift:

[DOUBLE-OVERHAND] [LEFT UNDERHAND-RIGHT OVERHAND]

[RIGHT UNDERHAND-LEFT OVERHAND] [OTHER_____________________] (please explain)

12. Date informed consent signed: ____________ (exclude if unsigned or unable to understand)

Appendix 3: Data Capture Sheet

(Data capture sheet used during 1st and 2nd testing sessions)

Subject #: _____________________ Date: _____________________ Researcher's initials: _______

Resting blood pressure: ____________mmHg (exclude if greater than 160/100 mmHg)

Subject's 1-repetition maximum (1-RM): ____________ (determined during 1st testing session)

60% of Subject's 1-RM: ____________

80% of Subject's 1-RM: ____________

**Note: DP = double-pronated grip, LORU=left overhand, right underhand, ROLU = right overhand, left underhand*

Trial Name	Result (Good/Bad)

Appendix 4: EMG Root-Mean-Square Raw Data

Subject	Intensity	Grip	Muscle	Left/Right	Phase	EMG RMS
1	60	DO	BrachRad	L	LIF-CKP	202012
1	60	LORU	BrachRad	L	LIF-CKP	139874
1	60	ROLU	BrachRad	L	LIF-CKP	99954
1	80	DO	BrachRad	L	LIF-CKP	226062
1	80	LORU	BrachRad	L	LIF-CKP	215191
1	80	ROLU	BrachRad	L	LIF-CKP	283515
2	60	DO	BrachRad	L	LIF-CKP	321581
2	60	LORU	BrachRad	L	LIF-CKP	287008
2	60	ROLU	BrachRad	L	LIF-CKP	299429
2	80	DO	BrachRad	L	LIF-CKP	331052
2	80	LORU	BrachRad	L	LIF-CKP	355800
2	80	ROLU	BrachRad	L	LIF-CKP	320115
3	60	DO	BrachRad	L	LIF-CKP	160586
3	60	LORU	BrachRad	L	LIF-CKP	133326
3	60	ROLU	BrachRad	L	LIF-CKP	34075
3	80	DO	BrachRad	L	LIF-CKP	199791
3	80	LORU	BrachRad	L	LIF-CKP	291089
3	80	ROLU	BrachRad	L	LIF-CKP	108987
4	60	DO	BrachRad	L	LIF-CKP	88596
4	60	LORU	BrachRad	L	LIF-CKP	136820
4	60	ROLU	BrachRad	L	LIF-CKP	111187
4	80	DO	BrachRad	L	LIF-CKP	130045
4	80	LORU	BrachRad	L	LIF-CKP	124620
4	80	ROLU	BrachRad	L	LIF-CKP	211285
5	60	DO	BrachRad	L	LIF-CKP	153498
5	60	LORU	BrachRad	L	LIF-CKP	102799
5	60	ROLU	BrachRad	L	LIF-CKP	10720
5	80	DO	BrachRad	L	LIF-CKP	105763
5	80	LORU	BrachRad	L	LIF-CKP	170548
5	80	ROLU	BrachRad	L	LIF-CKP	95452
6	60	DO	BrachRad	L	LIF-CKP	216240
6	60	LORU	BrachRad	L	LIF-CKP	154633
6	60	ROLU	BrachRad	L	LIF-CKP	90199
6	80	DO	BrachRad	L	LIF-CKP	75118
6	80	LORU	BrachRad	L	LIF-CKP	199669
6	80	ROLU	BrachRad	L	LIF-CKP	108723
7	60	DO	BrachRad	L	LIF-CKP	290345
7	60	LORU	BrachRad	L	LIF-CKP	303858
7	60	ROLU	BrachRad	L	LIF-CKP	316080
7	80	DO	BrachRad	L	LIF-CKP	337780
7	80	LORU	BrachRad	L	LIF-CKP	334652
7	80	ROLU	BrachRad	L	LIF-CKP	359712
8	60	DO	BrachRad	L	LIF-CKP	285252
8	60	LORU	BrachRad	L	LIF-CKP	121910
8	60	ROLU	BrachRad	L	LIF-CKP	196419
8	80	DO	BrachRad	L	LIF-CKP	255863
8	80	LORU	BrachRad	L	LIF-CKP	248778
8	80	ROLU	BrachRad	L	LIF-CKP	270543
9	60	DO	BrachRad	L	LIF-CKP	308621
9	60	LORU	BrachRad	L	LIF-CKP	261303
9	60	ROLU	BrachRad	L	LIF-CKP	297702
9	80	DO	BrachRad	L	LIF-CKP	272806
9	80	LORU	BrachRad	L	LIF-CKP	314663
9	80	ROLU	BrachRad	L	LIF-CKP	325941
10	60	DO	BrachRad	L	LIF-CKP	318951
10	60	LORU	BrachRad	L	LIF-CKP	117064
10	60	ROLU	BrachRad	L	LIF-CKP	84504
10	80	DO	BrachRad	L	LIF-CKP	117044
10	80	LORU	BrachRad	L	LIF-CKP	152318
10	80	ROLU	BrachRad	L	LIF-CKP	85631
1	60	DO	BrachRad	L	CKP-LOC	229250
1	60	LORU	BrachRad	L	CKP-LOC	69278
1	60	ROLU	BrachRad	L	CKP-LOC	51809
1	80	DO	BrachRad	L	CKP-LOC	80976

1	80	LORU	BrachRad	L	CKP-LOC	67435
1	80	ROLU	BrachRad	L	CKP-LOC	57776
2	60	DO	BrachRad	L	CKP-LOC	226875
2	60	LORU	BrachRad	L	CKP-LOC	160045
2	60	ROLU	BrachRad	L	CKP-LOC	304182
2	80	DO	BrachRad	L	CKP-LOC	278127
2	80	LORU	BrachRad	L	CKP-LOC	326517
2	80	ROLU	BrachRad	L	CKP-LOC	342295
3	60	DO	BrachRad	L	CKP-LOC	141224
3	60	LORU	BrachRad	L	CKP-LOC	81119
3	60	ROLU	BrachRad	L	CKP-LOC	40263
3	80	DO	BrachRad	L	CKP-LOC	146031
3	80	LORU	BrachRad	L	CKP-LOC	182142
3	80	ROLU	BrachRad	L	CKP-LOC	73122
4	60	DO	BrachRad	L	CKP-LOC	83378
4	60	LORU	BrachRad	L	CKP-LOC	73977
4	60	ROLU	BrachRad	L	CKP-LOC	97867
4	80	DO	BrachRad	L	CKP-LOC	80388
4	80	LORU	BrachRad	L	CKP-LOC	51845
4	80	ROLU	BrachRad	L	CKP-LOC	173030
5	60	DO	BrachRad	L	CKP-LOC	144640
5	60	LORU	BrachRad	L	CKP-LOC	106309
5	60	ROLU	BrachRad	L	CKP-LOC	33374
5	80	DO	BrachRad	L	CKP-LOC	66438
5	80	LORU	BrachRad	L	CKP-LOC	89844
5	80	ROLU	BrachRad	L	CKP-LOC	65762
6	60	DO	BrachRad	L	CKP-LOC	212272
6	60	LORU	BrachRad	L	CKP-LOC	206179
6	60	ROLU	BrachRad	L	CKP-LOC	63546
6	80	DO	BrachRad	L	CKP-LOC	38827
6	80	LORU	BrachRad	L	CKP-LOC	195586
6	80	ROLU	BrachRad	L	CKP-LOC	94908
7	60	DO	BrachRad	L	CKP-LOC	289956
7	60	LORU	BrachRad	L	CKP-LOC	282199
7	60	ROLU	BrachRad	L	CKP-LOC	273618
7	80	DO	BrachRad	L	CKP-LOC	268723
7	80	LORU	BrachRad	L	CKP-LOC	322159
7	80	ROLU	BrachRad	L	CKP-LOC	317585
8	60	DO	BrachRad	L	CKP-LOC	231387
8	60	LORU	BrachRad	L	CKP-LOC	77498
8	60	ROLU	BrachRad	L	CKP-LOC	84278
8	80	DO	BrachRad	L	CKP-LOC	267887
8	80	LORU	BrachRad	L	CKP-LOC	283593
8	80	ROLU	BrachRad	L	CKP-LOC	277160
9	60	DO	BrachRad	L	CKP-LOC	248618
9	60	LORU	BrachRad	L	CKP-LOC	144310
9	60	ROLU	BrachRad	L	CKP-LOC	180834
9	80	DO	BrachRad	L	CKP-LOC	193766
9	80	LORU	BrachRad	L	CKP-LOC	228511
9	80	ROLU	BrachRad	L	CKP-LOC	244556
10	60	DO	BrachRad	L	CKP-LOC	320240
10	60	LORU	BrachRad	L	CKP-LOC	127632
10	60	ROLU	BrachRad	L	CKP-LOC	133925
10	80	DO	BrachRad	L	CKP-LOC	198664
10	80	LORU	BrachRad	L	CKP-LOC	178669
10	80	ROLU	BrachRad	L	CKP-LOC	158516
1	60	DO	BrachRad	L	LOC-EKP	249825
1	60	LORU	BrachRad	L	LOC-EKP	113000
1	60	ROLU	BrachRad	L	LOC-EKP	62956
1	80	DO	BrachRad	L	LOC-EKP	40990
1	80	LORU	BrachRad	L	LOC-EKP	129361
1	80	ROLU	BrachRad	L	LOC-EKP	159249
2	60	DO	BrachRad	L	LOC-EKP	256622
2	60	LORU	BrachRad	L	LOC-EKP	240217
2	60	ROLU	BrachRad	L	LOC-EKP	274753
2	80	DO	BrachRad	L	LOC-EKP	163669
2	80	LORU	BrachRad	L	LOC-EKP	278094
2	80	ROLU	BrachRad	L	LOC-EKP	338852
3	60	DO	BrachRad	L	LOC-EKP	131586
3	60	LORU	BrachRad	L	LOC-EKP	80316
3	60	ROLU	BrachRad	L	LOC-EKP	46413

3	80	DO	BrachRad	L	LOC-EKP	51664
3	80	LORU	BrachRad	L	LOC-EKP	117107
3	80	ROLU	BrachRad	L	LOC-EKP	56372
4	60	DO	BrachRad	L	LOC-EKP	69767
4	60	LORU	BrachRad	L	LOC-EKP	145321
4	60	ROLU	BrachRad	L	LOC-EKP	80840
4	80	DO	BrachRad	L	LOC-EKP	91489
4	80	LORU	BrachRad	L	LOC-EKP	116896
4	80	ROLU	BrachRad	L	LOC-EKP	135606
5	60	DO	BrachRad	L	LOC-EKP	115777
5	60	LORU	BrachRad	L	LOC-EKP	100007
5	60	ROLU	BrachRad	L	LOC-EKP	43907
5	80	DO	BrachRad	L	LOC-EKP	66488
5	80	LORU	BrachRad	L	LOC-EKP	94629
5	80	ROLU	BrachRad	L	LOC-EKP	35599
6	60	DO	BrachRad	L	LOC-EKP	133405
6	60	LORU	BrachRad	L	LOC-EKP	203025
6	60	ROLU	BrachRad	L	LOC-EKP	41441
6	80	DO	BrachRad	L	LOC-EKP	17661
6	80	LORU	BrachRad	L	LOC-EKP	179421
6	80	ROLU	BrachRad	L	LOC-EKP	47844
7	60	DO	BrachRad	L	LOC-EKP	265260
7	60	LORU	BrachRad	L	LOC-EKP	254606
7	60	ROLU	BrachRad	L	LOC-EKP	260550
7	80	DO	BrachRad	L	LOC-EKP	250574
7	80	LORU	BrachRad	L	LOC-EKP	316476
7	80	ROLU	BrachRad	L	LOC-EKP	310408
8	60	DO	BrachRad	L	LOC-EKP	151467
8	60	LORU	BrachRad	L	LOC-EKP	92978
8	60	ROLU	BrachRad	L	LOC-EKP	32843
8	80	DO	BrachRad	L	LOC-EKP	121576
8	80	LORU	BrachRad	L	LOC-EKP	109391
8	80	ROLU	BrachRad	L	LOC-EKP	69175
9	60	DO	BrachRad	L	LOC-EKP	229446
9	60	LORU	BrachRad	L	LOC-EKP	82966
9	60	ROLU	BrachRad	L	LOC-EKP	105312
9	80	DO	BrachRad	L	LOC-EKP	140258
9	80	LORU	BrachRad	L	LOC-EKP	224044
9	80	ROLU	BrachRad	L	LOC-EKP	227827
10	60	DO	BrachRad	L	LOC-EKP	276019
10	60	LORU	BrachRad	L	LOC-EKP	126536
10	60	ROLU	BrachRad	L	LOC-EKP	79634
10	80	DO	BrachRad	L	LOC-EKP	105193
10	80	LORU	BrachRad	L	LOC-EKP	187244
10	80	ROLU	BrachRad	L	LOC-EKP	76972
1	60	DO	BrachRad	L	EKP-LC	154534
1	60	LORU	BrachRad	L	EKP-LC	64443
1	60	ROLU	BrachRad	L	EKP-LC	110978
1	80	DO	BrachRad	L	EKP-LC	113593
1	80	LORU	BrachRad	L	EKP-LC	144872
1	80	ROLU	BrachRad	L	EKP-LC	210991
2	60	DO	BrachRad	L	EKP-LC	294492
2	60	LORU	BrachRad	L	EKP-LC	310155
2	60	ROLU	BrachRad	L	EKP-LC	300363
2	80	DO	BrachRad	L	EKP-LC	253882
2	80	LORU	BrachRad	L	EKP-LC	301141
2	80	ROLU	BrachRad	L	EKP-LC	329460
3	60	DO	BrachRad	L	EKP-LC	113654
3	60	LORU	BrachRad	L	EKP-LC	98735
3	60	ROLU	BrachRad	L	EKP-LC	55081
3	80	DO	BrachRad	L	EKP-LC	164896
3	80	LORU	BrachRad	L	EKP-LC	241045
3	80	ROLU	BrachRad	L	EKP-LC	89561
4	60	DO	BrachRad	L	EKP-LC	62832
4	60	LORU	BrachRad	L	EKP-LC	248082
4	60	ROLU	BrachRad	L	EKP-LC	130540
4	80	DO	BrachRad	L	EKP-LC	193869
4	80	LORU	BrachRad	L	EKP-LC	261291
4	80	ROLU	BrachRad	L	EKP-LC	177281
5	60	DO	BrachRad	L	EKP-LC	131292
5	60	LORU	BrachRad	L	EKP-LC	58707

5	60	ROLU	BrachRad	L	EKP-LC	16228
5	80	DO	BrachRad	L	EKP-LC	65686
5	80	LORU	BrachRad	L	EKP-LC	176137
5	80	ROLU	BrachRad	L	EKP-LC	53738
6	60	DO	BrachRad	L	EKP-LC	129879
6	60	LORU	BrachRad	L	EKP-LC	163105
6	60	ROLU	BrachRad	L	EKP-LC	27009
6	80	DO	BrachRad	L	EKP-LC	19401
6	80	LORU	BrachRad	L	EKP-LC	152228
6	80	ROLU	BrachRad	L	EKP-LC	38800
7	60	DO	BrachRad	L	EKP-LC	248934
7	60	LORU	BrachRad	L	EKP-LC	306134
7	60	ROLU	BrachRad	L	EKP-LC	256606
7	80	DO	BrachRad	L	EKP-LC	200475
7	80	LORU	BrachRad	L	EKP-LC	310163
7	80	ROLU	BrachRad	L	EKP-LC	343161
8	60	DO	BrachRad	L	EKP-LC	110235
8	60	LORU	BrachRad	L	EKP-LC	124023
8	60	ROLU	BrachRad	L	EKP-LC	79173
8	80	DO	BrachRad	L	EKP-LC	226771
8	80	LORU	BrachRad	L	EKP-LC	257071
8	80	ROLU	BrachRad	L	EKP-LC	163924
9	60	DO	BrachRad	L	EKP-LC	288265
9	60	LORU	BrachRad	L	EKP-LC	152970
9	60	ROLU	BrachRad	L	EKP-LC	183366
9	80	DO	BrachRad	L	EKP-LC	272559
9	80	LORU	BrachRad	L	EKP-LC	299194
9	80	ROLU	BrachRad	L	EKP-LC	320443
10	60	DO	BrachRad	L	EKP-LC	316660
10	60	LORU	BrachRad	L	EKP-LC	135430
10	60	ROLU	BrachRad	L	EKP-LC	88711
10	80	DO	BrachRad	L	EKP-LC	85287
10	80	LORU	BrachRad	L	EKP-LC	167867
10	80	ROLU	BrachRad	L	EKP-LC	48393
1	60	DO	BrachRad	R	LIF-CKP	175298
1	60	LORU	BrachRad	R	LIF-CKP	136418
1	60	ROLU	BrachRad	R	LIF-CKP	76023
1	80	DO	BrachRad	R	LIF-CKP	260223
1	80	LORU	BrachRad	R	LIF-CKP	254630
1	80	ROLU	BrachRad	R	LIF-CKP	284593
2	60	DO	BrachRad	R	LIF-CKP	210388
2	60	LORU	BrachRad	R	LIF-CKP	171468
2	60	ROLU	BrachRad	R	LIF-CKP	194179
2	80	DO	BrachRad	R	LIF-CKP	260959
2	80	LORU	BrachRad	R	LIF-CKP	243798
2	80	ROLU	BrachRad	R	LIF-CKP	236656
3	60	DO	BrachRad	R	LIF-CKP	272228
3	60	LORU	BrachRad	R	LIF-CKP	62022
3	60	ROLU	BrachRad	R	LIF-CKP	151209
3	80	DO	BrachRad	R	LIF-CKP	90310
3	80	LORU	BrachRad	R	LIF-CKP	231240
3	80	ROLU	BrachRad	R	LIF-CKP	269866
4	60	DO	BrachRad	R	LIF-CKP	55984
4	60	LORU	BrachRad	R	LIF-CKP	58824
4	60	ROLU	BrachRad	R	LIF-CKP	62709
4	80	DO	BrachRad	R	LIF-CKP	101279
4	80	LORU	BrachRad	R	LIF-CKP	86172
4	80	ROLU	BrachRad	R	LIF-CKP	82946
5	60	DO	BrachRad	R	LIF-CKP	258710
5	60	LORU	BrachRad	R	LIF-CKP	137196
5	60	ROLU	BrachRad	R	LIF-CKP	245215
5	80	DO	BrachRad	R	LIF-CKP	149515
5	80	LORU	BrachRad	R	LIF-CKP	184742
5	80	ROLU	BrachRad	R	LIF-CKP	255907
6	60	DO	BrachRad	R	LIF-CKP	215171
6	60	LORU	BrachRad	R	LIF-CKP	96240
6	60	ROLU	BrachRad	R	LIF-CKP	168585
6	80	DO	BrachRad	R	LIF-CKP	156705
6	80	LORU	BrachRad	R	LIF-CKP	235274
6	80	ROLU	BrachRad	R	LIF-CKP	276332
7	60	DO	BrachRad	R	LIF-CKP	163013

7	60	LORU	BrachRad	R	LIF-CKP	91726
7	60	ROLU	BrachRad	R	LIF-CKP	154675
7	80	DO	BrachRad	R	LIF-CKP	204075
7	80	LORU	BrachRad	R	LIF-CKP	226317
7	80	ROLU	BrachRad	R	LIF-CKP	286763
8	60	DO	BrachRad	R	LIF-CKP	147066
8	60	LORU	BrachRad	R	LIF-CKP	37261
8	60	ROLU	BrachRad	R	LIF-CKP	39520
8	80	DO	BrachRad	R	LIF-CKP	40045
8	80	LORU	BrachRad	R	LIF-CKP	66434
8	80	ROLU	BrachRad	R	LIF-CKP	66436
9	60	DO	BrachRad	R	LIF-CKP	195994
9	60	LORU	BrachRad	R	LIF-CKP	90946
9	60	ROLU	BrachRad	R	LIF-CKP	141114
9	80	DO	BrachRad	R	LIF-CKP	156292
9	80	LORU	BrachRad	R	LIF-CKP	174375
9	80	ROLU	BrachRad	R	LIF-CKP	211646
10	60	DO	BrachRad	R	LIF-CKP	266086
10	60	LORU	BrachRad	R	LIF-CKP	27356
10	60	ROLU	BrachRad	R	LIF-CKP	177917
10	80	DO	BrachRad	R	LIF-CKP	143519
10	80	LORU	BrachRad	R	LIF-CKP	40772
10	80	ROLU	BrachRad	R	LIF-CKP	145318
1	60	DO	BrachRad	R	CKP-LOC	156112
1	60	LORU	BrachRad	R	CKP-LOC	95592
1	60	ROLU	BrachRad	R	CKP-LOC	79426
1	80	DO	BrachRad	R	CKP-LOC	231265
1	80	LORU	BrachRad	R	CKP-LOC	176230
1	80	ROLU	BrachRad	R	CKP-LOC	193052
2	60	DO	BrachRad	R	CKP-LOC	129190
2	60	LORU	BrachRad	R	CKP-LOC	110858
2	60	ROLU	BrachRad	R	CKP-LOC	137145
2	80	DO	BrachRad	R	CKP-LOC	201596
2	80	LORU	BrachRad	R	CKP-LOC	202266
2	80	ROLU	BrachRad	R	CKP-LOC	226911
3	60	DO	BrachRad	R	CKP-LOC	259312
3	60	LORU	BrachRad	R	CKP-LOC	103303
3	60	ROLU	BrachRad	R	CKP-LOC	131488
3	80	DO	BrachRad	R	CKP-LOC	55546
3	80	LORU	BrachRad	R	CKP-LOC	231817
3	80	ROLU	BrachRad	R	CKP-LOC	241225
4	60	DO	BrachRad	R	CKP-LOC	40036
4	60	LORU	BrachRad	R	CKP-LOC	27435
4	60	ROLU	BrachRad	R	CKP-LOC	37015
4	80	DO	BrachRad	R	CKP-LOC	37530
4	80	LORU	BrachRad	R	CKP-LOC	44907
4	80	ROLU	BrachRad	R	CKP-LOC	31709
5	60	DO	BrachRad	R	CKP-LOC	207864
5	60	LORU	BrachRad	R	CKP-LOC	65871
5	60	ROLU	BrachRad	R	CKP-LOC	200612
5	80	DO	BrachRad	R	CKP-LOC	31172
5	80	LORU	BrachRad	R	CKP-LOC	48692
5	80	ROLU	BrachRad	R	CKP-LOC	173944
6	60	DO	BrachRad	R	CKP-LOC	222403
6	60	LORU	BrachRad	R	CKP-LOC	97842
6	60	ROLU	BrachRad	R	CKP-LOC	143059
6	80	DO	BrachRad	R	CKP-LOC	157952
6	80	LORU	BrachRad	R	CKP-LOC	202567
6	80	ROLU	BrachRad	R	CKP-LOC	231446
7	60	DO	BrachRad	R	CKP-LOC	185024
7	60	LORU	BrachRad	R	CKP-LOC	68501
7	60	ROLU	BrachRad	R	CKP-LOC	185930
7	80	DO	BrachRad	R	CKP-LOC	169101
7	80	LORU	BrachRad	R	CKP-LOC	162898
7	80	ROLU	BrachRad	R	CKP-LOC	253410
8	60	DO	BrachRad	R	CKP-LOC	164314
8	60	LORU	BrachRad	R	CKP-LOC	33400
8	60	ROLU	BrachRad	R	CKP-LOC	34178
8	80	DO	BrachRad	R	CKP-LOC	113809
8	80	LORU	BrachRad	R	CKP-LOC	136668
8	80	ROLU	BrachRad	R	CKP-LOC	102657

9	60	DO	BrachRad	R	CKP-LOC	177520
9	60	LORU	BrachRad	R	CKP-LOC	71670
9	60	ROLU	BrachRad	R	CKP-LOC	118526
9	80	DO	BrachRad	R	CKP-LOC	127501
9	80	LORU	BrachRad	R	CKP-LOC	138623
9	80	ROLU	BrachRad	R	CKP-LOC	177436
10	60	DO	BrachRad	R	CKP-LOC	233428
10	60	LORU	BrachRad	R	CKP-LOC	42227
10	60	ROLU	BrachRad	R	CKP-LOC	117881
10	80	DO	BrachRad	R	CKP-LOC	149538
10	80	LORU	BrachRad	R	CKP-LOC	41567
10	80	ROLU	BrachRad	R	CKP-LOC	142568
1	60	DO	BrachRad	R	LOC-EKP	100151
1	60	LORU	BrachRad	R	LOC-EKP	51004
1	60	ROLU	BrachRad	R	LOC-EKP	57816
1	80	DO	BrachRad	R	LOC-EKP	105753
1	80	LORU	BrachRad	R	LOC-EKP	73529
1	80	ROLU	BrachRad	R	LOC-EKP	125643
2	60	DO	BrachRad	R	LOC-EKP	100671
2	60	LORU	BrachRad	R	LOC-EKP	134277
2	60	ROLU	BrachRad	R	LOC-EKP	128217
2	80	DO	BrachRad	R	LOC-EKP	123344
2	80	LORU	BrachRad	R	LOC-EKP	128279
2	80	ROLU	BrachRad	R	LOC-EKP	163493
3	60	DO	BrachRad	R	LOC-EKP	229751
3	60	LORU	BrachRad	R	LOC-EKP	79148
3	60	ROLU	BrachRad	R	LOC-EKP	192163
3	80	DO	BrachRad	R	LOC-EKP	46710
3	80	LORU	BrachRad	R	LOC-EKP	141388
3	80	ROLU	BrachRad	R	LOC-EKP	256428
4	60	DO	BrachRad	R	LOC-EKP	40386
4	60	LORU	BrachRad	R	LOC-EKP	42262
4	60	ROLU	BrachRad	R	LOC-EKP	34515
4	80	DO	BrachRad	R	LOC-EKP	41940
4	80	LORU	BrachRad	R	LOC-EKP	47832
4	80	ROLU	BrachRad	R	LOC-EKP	49728
5	60	DO	BrachRad	R	LOC-EKP	175115
5	60	LORU	BrachRad	R	LOC-EKP	72853
5	60	ROLU	BrachRad	R	LOC-EKP	183807
5	80	DO	BrachRad	R	LOC-EKP	74768
5	80	LORU	BrachRad	R	LOC-EKP	91676
5	80	ROLU	BrachRad	R	LOC-EKP	195505
6	60	DO	BrachRad	R	LOC-EKP	143969
6	60	LORU	BrachRad	R	LOC-EKP	49448
6	60	ROLU	BrachRad	R	LOC-EKP	125938
6	80	DO	BrachRad	R	LOC-EKP	90907
6	80	LORU	BrachRad	R	LOC-EKP	129415
6	80	ROLU	BrachRad	R	LOC-EKP	201565
7	60	DO	BrachRad	R	LOC-EKP	219815
7	60	LORU	BrachRad	R	LOC-EKP	44671
7	60	ROLU	BrachRad	R	LOC-EKP	177128
7	80	DO	BrachRad	R	LOC-EKP	115380
7	80	LORU	BrachRad	R	LOC-EKP	108790
7	80	ROLU	BrachRad	R	LOC-EKP	225726
8	60	DO	BrachRad	R	LOC-EKP	103715
8	60	LORU	BrachRad	R	LOC-EKP	41472
8	60	ROLU	BrachRad	R	LOC-EKP	36350
8	80	DO	BrachRad	R	LOC-EKP	45119
8	80	LORU	BrachRad	R	LOC-EKP	58031
8	80	ROLU	BrachRad	R	LOC-EKP	57181
9	60	DO	BrachRad	R	LOC-EKP	144396
9	60	LORU	BrachRad	R	LOC-EKP	61436
9	60	ROLU	BrachRad	R	LOC-EKP	113092
9	80	DO	BrachRad	R	LOC-EKP	80234
9	80	LORU	BrachRad	R	LOC-EKP	90654
9	80	ROLU	BrachRad	R	LOC-EKP	151221
10	60	DO	BrachRad	R	LOC-EKP	185994
10	60	LORU	BrachRad	R	LOC-EKP	37788
10	60	ROLU	BrachRad	R	LOC-EKP	81896
10	80	DO	BrachRad	R	LOC-EKP	78184
10	80	LORU	BrachRad	R	LOC-EKP	36945

10	80	ROLU	BrachRad	R	LOC-EKP	85722
1	60	DO	BrachRad	R	EKP-LC	73593
1	60	LORU	BrachRad	R	EKP-LC	73124
1	60	ROLU	BrachRad	R	EKP-LC	59176
1	80	DO	BrachRad	R	EKP-LC	123774
1	80	LORU	BrachRad	R	EKP-LC	176742
1	80	ROLU	BrachRad	R	EKP-LC	146246
2	60	DO	BrachRad	R	EKP-LC	112078
2	60	LORU	BrachRad	R	EKP-LC	123163
2	60	ROLU	BrachRad	R	EKP-LC	136512
2	80	DO	BrachRad	R	EKP-LC	173285
2	80	LORU	BrachRad	R	EKP-LC	162053
2	80	ROLU	BrachRad	R	EKP-LC	171623
3	60	DO	BrachRad	R	EKP-LC	212838
3	60	LORU	BrachRad	R	EKP-LC	82151
3	60	ROLU	BrachRad	R	EKP-LC	156940
3	80	DO	BrachRad	R	EKP-LC	46465
3	80	LORU	BrachRad	R	EKP-LC	129029
3	80	ROLU	BrachRad	R	EKP-LC	209449
4	60	DO	BrachRad	R	EKP-LC	41050
4	60	LORU	BrachRad	R	EKP-LC	110573
4	60	ROLU	BrachRad	R	EKP-LC	57900
4	80	DO	BrachRad	R	EKP-LC	105617
4	80	LORU	BrachRad	R	EKP-LC	143824
4	80	ROLU	BrachRad	R	EKP-LC	79019
5	60	DO	BrachRad	R	EKP-LC	225967
5	60	LORU	BrachRad	R	EKP-LC	116262
5	60	ROLU	BrachRad	R	EKP-LC	233723
5	80	DO	BrachRad	R	EKP-LC	215735
5	80	LORU	BrachRad	R	EKP-LC	187730
5	80	ROLU	BrachRad	R	EKP-LC	277439
6	60	DO	BrachRad	R	EKP-LC	132451
6	60	LORU	BrachRad	R	EKP-LC	52749
6	60	ROLU	BrachRad	R	EKP-LC	112598
6	80	DO	BrachRad	R	EKP-LC	114784
6	80	LORU	BrachRad	R	EKP-LC	165284
6	80	ROLU	BrachRad	R	EKP-LC	184804
7	60	DO	BrachRad	R	EKP-LC	182939
7	60	LORU	BrachRad	R	EKP-LC	64278
7	60	ROLU	BrachRad	R	EKP-LC	141930
7	80	DO	BrachRad	R	EKP-LC	113469
7	80	LORU	BrachRad	R	EKP-LC	171954
7	80	ROLU	BrachRad	R	EKP-LC	244621
8	60	DO	BrachRad	R	EKP-LC	105392
8	60	LORU	BrachRad	R	EKP-LC	90936
8	60	ROLU	BrachRad	R	EKP-LC	77593
8	80	DO	BrachRad	R	EKP-LC	126569
8	80	LORU	BrachRad	R	EKP-LC	166866
8	80	ROLU	BrachRad	R	EKP-LC	155538
9	60	DO	BrachRad	R	EKP-LC	146621
9	60	LORU	BrachRad	R	EKP-LC	81922
9	60	ROLU	BrachRad	R	EKP-LC	124961
9	80	DO	BrachRad	R	EKP-LC	123846
9	80	LORU	BrachRad	R	EKP-LC	148348
9	80	ROLU	BrachRad	R	EKP-LC	175364
10	60	DO	BrachRad	R	EKP-LC	233283
10	60	LORU	BrachRad	R	EKP-LC	24063
10	60	ROLU	BrachRad	R	EKP-LC	148279
10	80	DO	BrachRad	R	EKP-LC	94919
10	80	LORU	BrachRad	R	EKP-LC	31653
10	80	ROLU	BrachRad	R	EKP-LC	109534
1	60	DO	BicepsBrach	L	LIF-CKP	13137
1	60	LORU	BicepsBrach	L	LIF-CKP	13897
1	60	ROLU	BicepsBrach	L	LIF-CKP	43767
1	80	DO	BicepsBrach	L	LIF-CKP	35369
1	80	LORU	BicepsBrach	L	LIF-CKP	27923
1	80	ROLU	BicepsBrach	L	LIF-CKP	52162
2	60	DO	BicepsBrach	L	LIF-CKP	60644
2	60	LORU	BicepsBrach	L	LIF-CKP	60237
2	60	ROLU	BicepsBrach	L	LIF-CKP	133294
2	80	DO	BicepsBrach	L	LIF-CKP	74669

2	80	LORU	BicepsBrach	L	LIF-CKP	112253
2	80	ROLU	BicepsBrach	L	LIF-CKP	208420
3	60	DO	BicepsBrach	L	LIF-CKP	4355
3	60	LORU	BicepsBrach	L	LIF-CKP	7104
3	60	ROLU	BicepsBrach	L	LIF-CKP	4803
3	80	DO	BicepsBrach	L	LIF-CKP	14991
3	80	LORU	BicepsBrach	L	LIF-CKP	17908
3	80	ROLU	BicepsBrach	L	LIF-CKP	8697
4	60	DO	BicepsBrach	L	LIF-CKP	4109
4	60	LORU	BicepsBrach	L	LIF-CKP	6224
4	60	ROLU	BicepsBrach	L	LIF-CKP	10297
4	80	DO	BicepsBrach	L	LIF-CKP	7933
4	80	LORU	BicepsBrach	L	LIF-CKP	5577
4	80	ROLU	BicepsBrach	L	LIF-CKP	17067
5	60	DO	BicepsBrach	L	LIF-CKP	10266
5	60	LORU	BicepsBrach	L	LIF-CKP	13448
5	60	ROLU	BicepsBrach	L	LIF-CKP	5501
5	80	DO	BicepsBrach	L	LIF-CKP	23810
5	80	LORU	BicepsBrach	L	LIF-CKP	25844
5	80	ROLU	BicepsBrach	L	LIF-CKP	19930
6	60	DO	BicepsBrach	L	LIF-CKP	9042
6	60	LORU	BicepsBrach	L	LIF-CKP	7661
6	60	ROLU	BicepsBrach	L	LIF-CKP	15946
6	80	DO	BicepsBrach	L	LIF-CKP	7735
6	80	LORU	BicepsBrach	L	LIF-CKP	23700
6	80	ROLU	BicepsBrach	L	LIF-CKP	33750
7	60	DO	BicepsBrach	L	LIF-CKP	22407
7	60	LORU	BicepsBrach	L	LIF-CKP	23747
7	60	ROLU	BicepsBrach	L	LIF-CKP	53970
7	80	DO	BicepsBrach	L	LIF-CKP	43645
7	80	LORU	BicepsBrach	L	LIF-CKP	48713
7	80	ROLU	BicepsBrach	L	LIF-CKP	168253
8	60	DO	BicepsBrach	L	LIF-CKP	32219
8	60	LORU	BicepsBrach	L	LIF-CKP	13136
8	60	ROLU	BicepsBrach	L	LIF-CKP	14783
8	80	DO	BicepsBrach	L	LIF-CKP	26622
8	80	LORU	BicepsBrach	L	LIF-CKP	27141
8	80	ROLU	BicepsBrach	L	LIF-CKP	19670
9	60	DO	BicepsBrach	L	LIF-CKP	146621
9	60	LORU	BicepsBrach	L	LIF-CKP	81922
9	60	ROLU	BicepsBrach	L	LIF-CKP	124961
9	80	DO	BicepsBrach	L	LIF-CKP	123846
9	80	LORU	BicepsBrach	L	LIF-CKP	148348
9	80	ROLU	BicepsBrach	L	LIF-CKP	175364
10	60	DO	BicepsBrach	L	LIF-CKP	26705
10	60	LORU	BicepsBrach	L	LIF-CKP	11387
10	60	ROLU	BicepsBrach	L	LIF-CKP	12754
10	80	DO	BicepsBrach	L	LIF-CKP	14919
10	80	LORU	BicepsBrach	L	LIF-CKP	16157
10	80	ROLU	BicepsBrach	L	LIF-CKP	13658
1	60	DO	BicepsBrach	L	CKP-LOC	12915
1	60	LORU	BicepsBrach	L	CKP-LOC	7814
1	60	ROLU	BicepsBrach	L	CKP-LOC	48852
1	80	DO	BicepsBrach	L	CKP-LOC	13605
1	80	LORU	BicepsBrach	L	CKP-LOC	9155
1	80	ROLU	BicepsBrach	L	CKP-LOC	32649
2	60	DO	BicepsBrach	L	CKP-LOC	28037
2	60	LORU	BicepsBrach	L	CKP-LOC	14159
2	60	ROLU	BicepsBrach	L	CKP-LOC	108931
2	80	DO	BicepsBrach	L	CKP-LOC	36968
2	80	LORU	BicepsBrach	L	CKP-LOC	37637
2	80	ROLU	BicepsBrach	L	CKP-LOC	186046
3	60	DO	BicepsBrach	L	CKP-LOC	4157
3	60	LORU	BicepsBrach	L	CKP-LOC	5185
3	60	ROLU	BicepsBrach	L	CKP-LOC	8146
3	80	DO	BicepsBrach	L	CKP-LOC	10043
3	80	LORU	BicepsBrach	L	CKP-LOC	12902
3	80	ROLU	BicepsBrach	L	CKP-LOC	13296
4	60	DO	BicepsBrach	L	CKP-LOC	3982
4	60	LORU	BicepsBrach	L	CKP-LOC	4216
4	60	ROLU	BicepsBrach	L	CKP-LOC	17256

4	80	DO	BicepsBrach	L	CKP-LOC	5030
4	80	LORU	BicepsBrach	L	CKP-LOC	4505
4	80	ROLU	BicepsBrach	L	CKP-LOC	14807
5	60	DO	BicepsBrach	L	CKP-LOC	48132
5	60	LORU	BicepsBrach	L	CKP-LOC	84439
5	60	ROLU	BicepsBrach	L	CKP-LOC	22181
5	80	DO	BicepsBrach	L	CKP-LOC	9964
5	80	LORU	BicepsBrach	L	CKP-LOC	15565
5	80	ROLU	BicepsBrach	L	CKP-LOC	18580
6	60	DO	BicepsBrach	L	CKP-LOC	16756
6	60	LORU	BicepsBrach	L	CKP-LOC	10170
6	60	ROLU	BicepsBrach	L	CKP-LOC	25528
6	80	DO	BicepsBrach	L	CKP-LOC	5182
6	80	LORU	BicepsBrach	L	CKP-LOC	8864
6	80	ROLU	BicepsBrach	L	CKP-LOC	20019
7	60	DO	BicepsBrach	L	CKP-LOC	28145
7	60	LORU	BicepsBrach	L	CKP-LOC	19661
7	60	ROLU	BicepsBrach	L	CKP-LOC	113583
7	80	DO	BicepsBrach	L	CKP-LOC	49187
7	80	LORU	BicepsBrach	L	CKP-LOC	35875
7	80	ROLU	BicepsBrach	L	CKP-LOC	132542
8	60	DO	BicepsBrach	L	CKP-LOC	16539
8	60	LORU	BicepsBrach	L	CKP-LOC	6760
8	60	ROLU	BicepsBrach	L	CKP-LOC	7082
8	80	DO	BicepsBrach	L	CKP-LOC	29319
8	80	LORU	BicepsBrach	L	CKP-LOC	29645
8	80	ROLU	BicepsBrach	L	CKP-LOC	24080
9	60	DO	BicepsBrach	L	CKP-LOC	146621
9	60	LORU	BicepsBrach	L	CKP-LOC	81922
9	60	ROLU	BicepsBrach	L	CKP-LOC	124961
9	80	DO	BicepsBrach	L	CKP-LOC	123846
9	80	LORU	BicepsBrach	L	CKP-LOC	148348
9	80	ROLU	BicepsBrach	L	CKP-LOC	175364
10	60	DO	BicepsBrach	L	CKP-LOC	36754
10	60	LORU	BicepsBrach	L	CKP-LOC	11563
10	60	ROLU	BicepsBrach	L	CKP-LOC	16845
10	80	DO	BicepsBrach	L	CKP-LOC	19803
10	80	LORU	BicepsBrach	L	CKP-LOC	17300
10	80	ROLU	BicepsBrach	L	CKP-LOC	17367
1	60	DO	BicepsBrach	L	LOC-EKP	14295
1	60	LORU	BicepsBrach	L	LOC-EKP	10519
1	60	ROLU	BicepsBrach	L	LOC-EKP	71369
1	80	DO	BicepsBrach	L	LOC-EKP	10222
1	80	LORU	BicepsBrach	L	LOC-EKP	13583
1	80	ROLU	BicepsBrach	L	LOC-EKP	33434
2	60	DO	BicepsBrach	L	LOC-EKP	46782
2	60	LORU	BicepsBrach	L	LOC-EKP	37525
2	60	ROLU	BicepsBrach	L	LOC-EKP	118840
2	80	DO	BicepsBrach	L	LOC-EKP	27042
2	80	LORU	BicepsBrach	L	LOC-EKP	46697
2	80	ROLU	BicepsBrach	L	LOC-EKP	200562
3	60	DO	BicepsBrach	L	LOC-EKP	4308
3	60	LORU	BicepsBrach	L	LOC-EKP	4908
3	60	ROLU	BicepsBrach	L	LOC-EKP	6062
3	80	DO	BicepsBrach	L	LOC-EKP	6185
3	80	LORU	BicepsBrach	L	LOC-EKP	7414
3	80	ROLU	BicepsBrach	L	LOC-EKP	6310
4	60	DO	BicepsBrach	L	LOC-EKP	4109
4	60	LORU	BicepsBrach	L	LOC-EKP	15618
4	60	ROLU	BicepsBrach	L	LOC-EKP	11997
4	80	DO	BicepsBrach	L	LOC-EKP	5125
4	80	LORU	BicepsBrach	L	LOC-EKP	5862
4	80	ROLU	BicepsBrach	L	LOC-EKP	10952
5	60	DO	BicepsBrach	L	LOC-EKP	33083
5	60	LORU	BicepsBrach	L	LOC-EKP	65482
5	60	ROLU	BicepsBrach	L	LOC-EKP	31702
5	80	DO	BicepsBrach	L	LOC-EKP	10616
5	80	LORU	BicepsBrach	L	LOC-EKP	27890
5	80	ROLU	BicepsBrach	L	LOC-EKP	28377
6	60	DO	BicepsBrach	L	LOC-EKP	5198
6	60	LORU	BicepsBrach	L	LOC-EKP	7142

6	60	ROLU	BicepsBrach	L	LOC-EKP	24158
6	80	DO	BicepsBrach	L	LOC-EKP	4084
6	80	LORU	BicepsBrach	L	LOC-EKP	6995
6	80	ROLU	BicepsBrach	L	LOC-EKP	16462
7	60	DO	BicepsBrach	L	LOC-EKP	23456
7	60	LORU	BicepsBrach	L	LOC-EKP	23021
7	60	ROLU	BicepsBrach	L	LOC-EKP	133613
7	80	DO	BicepsBrach	L	LOC-EKP	17374
7	80	LORU	BicepsBrach	L	LOC-EKP	34794
7	80	ROLU	BicepsBrach	L	LOC-EKP	90528
8	60	DO	BicepsBrach	L	LOC-EKP	7548
8	60	LORU	BicepsBrach	L	LOC-EKP	4719
8	60	ROLU	BicepsBrach	L	LOC-EKP	5348
8	80	DO	BicepsBrach	L	LOC-EKP	10762
8	80	LORU	BicepsBrach	L	LOC-EKP	9862
8	80	ROLU	BicepsBrach	L	LOC-EKP	8566
9	60	DO	BicepsBrach	L	LOC-EKP	12380
9	60	LORU	BicepsBrach	L	LOC-EKP	9256
9	60	ROLU	BicepsBrach	L	LOC-EKP	20760
9	80	DO	BicepsBrach	L	LOC-EKP	14215
9	80	LORU	BicepsBrach	L	LOC-EKP	25984
9	80	ROLU	BicepsBrach	L	LOC-EKP	43969
10	60	DO	BicepsBrach	L	LOC-EKP	25844
10	60	LORU	BicepsBrach	L	LOC-EKP	11434
10	60	ROLU	BicepsBrach	L	LOC-EKP	31761
10	80	DO	BicepsBrach	L	LOC-EKP	10655
10	80	LORU	BicepsBrach	L	LOC-EKP	11362
10	80	ROLU	BicepsBrach	L	LOC-EKP	9943
1	60	DO	BicepsBrach	L	EKP-LC	16265
1	60	LORU	BicepsBrach	L	EKP-LC	12391
1	60	ROLU	BicepsBrach	L	EKP-LC	17004
1	80	DO	BicepsBrach	L	EKP-LC	18194
1	80	LORU	BicepsBrach	L	EKP-LC	22437
1	80	ROLU	BicepsBrach	L	EKP-LC	34594
2	60	DO	BicepsBrach	L	EKP-LC	44090
2	60	LORU	BicepsBrach	L	EKP-LC	78238
2	60	ROLU	BicepsBrach	L	EKP-LC	181645
2	80	DO	BicepsBrach	L	EKP-LC	79407
2	80	LORU	BicepsBrach	L	EKP-LC	64196
2	80	ROLU	BicepsBrach	L	EKP-LC	178264
3	60	DO	BicepsBrach	L	EKP-LC	4642
3	60	LORU	BicepsBrach	L	EKP-LC	6164
3	60	ROLU	BicepsBrach	L	EKP-LC	4538
3	80	DO	BicepsBrach	L	EKP-LC	10983
3	80	LORU	BicepsBrach	L	EKP-LC	13409
3	80	ROLU	BicepsBrach	L	EKP-LC	6682
4	60	DO	BicepsBrach	L	EKP-LC	4161
4	60	LORU	BicepsBrach	L	EKP-LC	43072
4	60	ROLU	BicepsBrach	L	EKP-LC	11536
4	80	DO	BicepsBrach	L	EKP-LC	12264
4	80	LORU	BicepsBrach	L	EKP-LC	15513
4	80	ROLU	BicepsBrach	L	EKP-LC	13157
5	60	DO	BicepsBrach	L	EKP-LC	7484
5	60	LORU	BicepsBrach	L	EKP-LC	7942
5	60	ROLU	BicepsBrach	L	EKP-LC	10154
5	80	DO	BicepsBrach	L	EKP-LC	17112
5	80	LORU	BicepsBrach	L	EKP-LC	31821
5	80	ROLU	BicepsBrach	L	EKP-LC	14285
6	60	DO	BicepsBrach	L	EKP-LC	4390
6	60	LORU	BicepsBrach	L	EKP-LC	4597
6	60	ROLU	BicepsBrach	L	EKP-LC	6358
6	80	DO	BicepsBrach	L	EKP-LC	4134
6	80	LORU	BicepsBrach	L	EKP-LC	5452
6	80	ROLU	BicepsBrach	L	EKP-LC	10448
7	60	DO	BicepsBrach	L	EKP-LC	15962
7	60	LORU	BicepsBrach	L	EKP-LC	35553
7	60	ROLU	BicepsBrach	L	EKP-LC	46081
7	80	DO	BicepsBrach	L	EKP-LC	15761
7	80	LORU	BicepsBrach	L	EKP-LC	54061
7	80	ROLU	BicepsBrach	L	EKP-LC	202392
8	60	DO	BicepsBrach	L	EKP-LC	8608

8	60	LORU	BicepsBrach	L	EKP-LC	10794
8	60	ROLU	BicepsBrach	L	EKP-LC	8169
8	80	DO	BicepsBrach	L	EKP-LC	22311
8	80	LORU	BicepsBrach	L	EKP-LC	21660
8	80	ROLU	BicepsBrach	L	EKP-LC	14771
9	60	DO	BicepsBrach	L	EKP-LC	21131
9	60	LORU	BicepsBrach	L	EKP-LC	15605
9	60	ROLU	BicepsBrach	L	EKP-LC	25980
9	80	DO	BicepsBrach	L	EKP-LC	45261
9	80	LORU	BicepsBrach	L	EKP-LC	49027
9	80	ROLU	BicepsBrach	L	EKP-LC	108880
10	60	DO	BicepsBrach	L	EKP-LC	22920
10	60	LORU	BicepsBrach	L	EKP-LC	9148
10	60	ROLU	BicepsBrach	L	EKP-LC	15823
10	80	DO	BicepsBrach	L	EKP-LC	10662
10	80	LORU	BicepsBrach	L	EKP-LC	10131
10	80	ROLU	BicepsBrach	L	EKP-LC	8526
1	60	DO	BicepsBrach	R	LIF-CKP	34668
1	60	LORU	BicepsBrach	R	LIF-CKP	59593
1	60	ROLU	BicepsBrach	R	LIF-CKP	22140
1	80	DO	BicepsBrach	R	LIF-CKP	70219
1	80	LORU	BicepsBrach	R	LIF-CKP	90591
1	80	ROLU	BicepsBrach	R	LIF-CKP	70228
2	60	DO	BicepsBrach	R	LIF-CKP	25093
2	60	LORU	BicepsBrach	R	LIF-CKP	126117
2	60	ROLU	BicepsBrach	R	LIF-CKP	56753
2	80	DO	BicepsBrach	R	LIF-CKP	51079
2	80	LORU	BicepsBrach	R	LIF-CKP	135507
2	80	ROLU	BicepsBrach	R	LIF-CKP	56935
3	60	DO	BicepsBrach	R	LIF-CKP	4609
3	60	LORU	BicepsBrach	R	LIF-CKP	5357
3	60	ROLU	BicepsBrach	R	LIF-CKP	5010
3	80	DO	BicepsBrach	R	LIF-CKP	8304
3	80	LORU	BicepsBrach	R	LIF-CKP	12737
3	80	ROLU	BicepsBrach	R	LIF-CKP	10109
4	60	DO	BicepsBrach	R	LIF-CKP	5005
4	60	LORU	BicepsBrach	R	LIF-CKP	21664
4	60	ROLU	BicepsBrach	R	LIF-CKP	4082
4	80	DO	BicepsBrach	R	LIF-CKP	5841
4	80	LORU	BicepsBrach	R	LIF-CKP	8471
4	80	ROLU	BicepsBrach	R	LIF-CKP	6383
5	60	DO	BicepsBrach	R	LIF-CKP	14915
5	60	LORU	BicepsBrach	R	LIF-CKP	23526
5	60	ROLU	BicepsBrach	R	LIF-CKP	11122
5	80	DO	BicepsBrach	R	LIF-CKP	25057
5	80	LORU	BicepsBrach	R	LIF-CKP	22462
5	80	ROLU	BicepsBrach	R	LIF-CKP	23770
6	60	DO	BicepsBrach	R	LIF-CKP	13395
6	60	LORU	BicepsBrach	R	LIF-CKP	26701
6	60	ROLU	BicepsBrach	R	LIF-CKP	8293
6	80	DO	BicepsBrach	R	LIF-CKP	16824
6	80	LORU	BicepsBrach	R	LIF-CKP	54622
6	80	ROLU	BicepsBrach	R	LIF-CKP	28465
7	60	DO	BicepsBrach	R	LIF-CKP	17099
7	60	LORU	BicepsBrach	R	LIF-CKP	56466
7	60	ROLU	BicepsBrach	R	LIF-CKP	17345
7	80	DO	BicepsBrach	R	LIF-CKP	28166
7	80	LORU	BicepsBrach	R	LIF-CKP	158889
7	80	ROLU	BicepsBrach	R	LIF-CKP	79843
8	60	DO	BicepsBrach	R	LIF-CKP	10344
8	60	LORU	BicepsBrach	R	LIF-CKP	9908
8	60	ROLU	BicepsBrach	R	LIF-CKP	6051
8	80	DO	BicepsBrach	R	LIF-CKP	7149
8	80	LORU	BicepsBrach	R	LIF-CKP	7910
8	80	ROLU	BicepsBrach	R	LIF-CKP	7938
9	60	DO	BicepsBrach	R	LIF-CKP	35917
9	60	LORU	BicepsBrach	R	LIF-CKP	35052
9	60	ROLU	BicepsBrach	R	LIF-CKP	92195
9	80	DO	BicepsBrach	R	LIF-CKP	100763
9	80	LORU	BicepsBrach	R	LIF-CKP	162686
9	80	ROLU	BicepsBrach	R	LIF-CKP	155616

10	60	DO	BicepsBrach	R	LIF-CKP	56568
10	60	LORU	BicepsBrach	R	LIF-CKP	19592
10	60	ROLU	BicepsBrach	R	LIF-CKP	25239
10	80	DO	BicepsBrach	R	LIF-CKP	42896
10	80	LORU	BicepsBrach	R	LIF-CKP	25177
10	80	ROLU	BicepsBrach	R	LIF-CKP	43487
1	60	DO	BicepsBrach	R	CKP-LOC	29022
1	60	LORU	BicepsBrach	R	CKP-LOC	60400
1	60	ROLU	BicepsBrach	R	CKP-LOC	25479
1	80	DO	BicepsBrach	R	CKP-LOC	66230
1	80	LORU	BicepsBrach	R	CKP-LOC	67470
1	80	ROLU	BicepsBrach	R	CKP-LOC	47996
2	60	DO	BicepsBrach	R	CKP-LOC	15121
2	60	LORU	BicepsBrach	R	CKP-LOC	54686
2	60	ROLU	BicepsBrach	R	CKP-LOC	16289
2	80	DO	BicepsBrach	R	CKP-LOC	27064
2	80	LORU	BicepsBrach	R	CKP-LOC	59265
2	80	ROLU	BicepsBrach	R	CKP-LOC	29587
3	60	DO	BicepsBrach	R	CKP-LOC	4342
3	60	LORU	BicepsBrach	R	CKP-LOC	9048
3	60	ROLU	BicepsBrach	R	CKP-LOC	3710
3	80	DO	BicepsBrach	R	CKP-LOC	5788
3	80	LORU	BicepsBrach	R	CKP-LOC	13745
3	80	ROLU	BicepsBrach	R	CKP-LOC	7489
4	60	DO	BicepsBrach	R	CKP-LOC	13812
4	60	LORU	BicepsBrach	R	CKP-LOC	19207
4	60	ROLU	BicepsBrach	R	CKP-LOC	5278
4	80	DO	BicepsBrach	R	CKP-LOC	5214
4	80	LORU	BicepsBrach	R	CKP-LOC	20595
4	80	ROLU	BicepsBrach	R	CKP-LOC	6049
5	60	DO	BicepsBrach	R	CKP-LOC	73922
5	60	LORU	BicepsBrach	R	CKP-LOC	45323
5	60	ROLU	BicepsBrach	R	CKP-LOC	80627
5	80	DO	BicepsBrach	R	CKP-LOC	7817
5	80	LORU	BicepsBrach	R	CKP-LOC	24771
5	80	ROLU	BicepsBrach	R	CKP-LOC	16675
6	60	DO	BicepsBrach	R	CKP-LOC	23087
6	60	LORU	BicepsBrach	R	CKP-LOC	30394
6	60	ROLU	BicepsBrach	R	CKP-LOC	36690
6	80	DO	BicepsBrach	R	CKP-LOC	24536
6	80	LORU	BicepsBrach	R	CKP-LOC	53882
6	80	ROLU	BicepsBrach	R	CKP-LOC	26108
7	60	DO	BicepsBrach	R	CKP-LOC	17704
7	60	LORU	BicepsBrach	R	CKP-LOC	61749
7	60	ROLU	BicepsBrach	R	CKP-LOC	19508
7	80	DO	BicepsBrach	R	CKP-LOC	21962
7	80	LORU	BicepsBrach	R	CKP-LOC	77762
7	80	ROLU	BicepsBrach	R	CKP-LOC	44290
8	60	DO	BicepsBrach	R	CKP-LOC	15113
8	60	LORU	BicepsBrach	R	CKP-LOC	6716
8	60	ROLU	BicepsBrach	R	CKP-LOC	4663
8	80	DO	BicepsBrach	R	CKP-LOC	6815
8	80	LORU	BicepsBrach	R	CKP-LOC	8048
8	80	ROLU	BicepsBrach	R	CKP-LOC	6914
9	60	DO	BicepsBrach	R	CKP-LOC	13777
9	60	LORU	BicepsBrach	R	CKP-LOC	21415
9	60	ROLU	BicepsBrach	R	CKP-LOC	12247
9	80	DO	BicepsBrach	R	CKP-LOC	18227
9	80	LORU	BicepsBrach	R	CKP-LOC	20150
9	80	ROLU	BicepsBrach	R	CKP-LOC	19009
10	60	DO	BicepsBrach	R	CKP-LOC	44677
10	60	LORU	BicepsBrach	R	CKP-LOC	9826
10	60	ROLU	BicepsBrach	R	CKP-LOC	22353
10	80	DO	BicepsBrach	R	CKP-LOC	25586
10	80	LORU	BicepsBrach	R	CKP-LOC	18091
10	80	ROLU	BicepsBrach	R	CKP-LOC	30855
1	60	DO	BicepsBrach	R	LOC-EKP	24683
1	60	LORU	BicepsBrach	R	LOC-EKP	43498
1	60	ROLU	BicepsBrach	R	LOC-EKP	20192
1	80	DO	BicepsBrach	R	LOC-EKP	27691
1	80	LORU	BicepsBrach	R	LOC-EKP	43729

1	80	ROLU	BicepsBrach	R	LOC-EKP	22318
2	60	DO	BicepsBrach	R	LOC-EKP	26087
2	60	LORU	BicepsBrach	R	LOC-EKP	105550
2	60	ROLU	BicepsBrach	R	LOC-EKP	25013
2	80	DO	BicepsBrach	R	LOC-EKP	27192
2	80	LORU	BicepsBrach	R	LOC-EKP	91759
2	80	ROLU	BicepsBrach	R	LOC-EKP	28471
3	60	DO	BicepsBrach	R	LOC-EKP	4249
3	60	LORU	BicepsBrach	R	LOC-EKP	14192
3	60	ROLU	BicepsBrach	R	LOC-EKP	4220
3	80	DO	BicepsBrach	R	LOC-EKP	5194
3	80	LORU	BicepsBrach	R	LOC-EKP	13837
3	80	ROLU	BicepsBrach	R	LOC-EKP	4654
4	60	DO	BicepsBrach	R	LOC-EKP	4882
4	60	LORU	BicepsBrach	R	LOC-EKP	24403
4	60	ROLU	BicepsBrach	R	LOC-EKP	3900
4	80	DO	BicepsBrach	R	LOC-EKP	6645
4	80	LORU	BicepsBrach	R	LOC-EKP	11567
4	80	ROLU	BicepsBrach	R	LOC-EKP	4847
5	60	DO	BicepsBrach	R	LOC-EKP	81168
5	60	LORU	BicepsBrach	R	LOC-EKP	81801
5	60	ROLU	BicepsBrach	R	LOC-EKP	68394
5	80	DO	BicepsBrach	R	LOC-EKP	9059
5	80	LORU	BicepsBrach	R	LOC-EKP	51949
5	80	ROLU	BicepsBrach	R	LOC-EKP	14421
6	60	DO	BicepsBrach	R	LOC-EKP	8618
6	60	LORU	BicepsBrach	R	LOC-EKP	29864
6	60	ROLU	BicepsBrach	R	LOC-EKP	9798
6	80	DO	BicepsBrach	R	LOC-EKP	11923
6	80	LORU	BicepsBrach	R	LOC-EKP	53918
6	80	ROLU	BicepsBrach	R	LOC-EKP	19765
7	60	DO	BicepsBrach	R	LOC-EKP	18413
7	60	LORU	BicepsBrach	R	LOC-EKP	48652
7	60	ROLU	BicepsBrach	R	LOC-EKP	22115
7	80	DO	BicepsBrach	R	LOC-EKP	15544
7	80	LORU	BicepsBrach	R	LOC-EKP	68666
7	80	ROLU	BicepsBrach	R	LOC-EKP	41484
8	60	DO	BicepsBrach	R	LOC-EKP	4944
8	60	LORU	BicepsBrach	R	LOC-EKP	5709
8	60	ROLU	BicepsBrach	R	LOC-EKP	4225
8	80	DO	BicepsBrach	R	LOC-EKP	5639
8	80	LORU	BicepsBrach	R	LOC-EKP	6275
8	80	ROLU	BicepsBrach	R	LOC-EKP	5752
9	60	DO	BicepsBrach	R	LOC-EKP	51812
9	60	LORU	BicepsBrach	R	LOC-EKP	33454
9	60	ROLU	BicepsBrach	R	LOC-EKP	23551
9	80	DO	BicepsBrach	R	LOC-EKP	21595
9	80	LORU	BicepsBrach	R	LOC-EKP	30806
9	80	ROLU	BicepsBrach	R	LOC-EKP	37836
10	60	DO	BicepsBrach	R	LOC-EKP	26840
10	60	LORU	BicepsBrach	R	LOC-EKP	11862
10	60	ROLU	BicepsBrach	R	LOC-EKP	20358
10	80	DO	BicepsBrach	R	LOC-EKP	12107
10	80	LORU	BicepsBrach	R	LOC-EKP	13429
10	80	ROLU	BicepsBrach	R	LOC-EKP	12221
1	60	DO	BicepsBrach	R	EKP-LC	14633
1	60	LORU	BicepsBrach	R	EKP-LC	23710
1	60	ROLU	BicepsBrach	R	EKP-LC	18874
1	80	DO	BicepsBrach	R	EKP-LC	32231
1	80	LORU	BicepsBrach	R	EKP-LC	58080
1	80	ROLU	BicepsBrach	R	EKP-LC	29995
2	60	DO	BicepsBrach	R	EKP-LC	30678
2	60	LORU	BicepsBrach	R	EKP-LC	162976
2	60	ROLU	BicepsBrach	R	EKP-LC	58821
2	80	DO	BicepsBrach	R	EKP-LC	133930
2	80	LORU	BicepsBrach	R	EKP-LC	193507
2	80	ROLU	BicepsBrach	R	EKP-LC	56069
3	60	DO	BicepsBrach	R	EKP-LC	3989
3	60	LORU	BicepsBrach	R	EKP-LC	4328
3	60	ROLU	BicepsBrach	R	EKP-LC	3968
3	80	DO	BicepsBrach	R	EKP-LC	6872

3	80	LORU	BicepsBrach	R	EKP-LC	7420
3	80	ROLU	BicepsBrach	R	EKP-LC	5875
4	60	DO	BicepsBrach	R	EKP-LC	4258
4	60	LORU	BicepsBrach	R	EKP-LC	60263
4	60	ROLU	BicepsBrach	R	EKP-LC	8085
4	80	DO	BicepsBrach	R	EKP-LC	19386
4	80	LORU	BicepsBrach	R	EKP-LC	89498
4	80	ROLU	BicepsBrach	R	EKP-LC	7633
5	60	DO	BicepsBrach	R	EKP-LC	10491
5	60	LORU	BicepsBrach	R	EKP-LC	28529
5	60	ROLU	BicepsBrach	R	EKP-LC	13377
5	80	DO	BicepsBrach	R	EKP-LC	26933
5	80	LORU	BicepsBrach	R	EKP-LC	30881
5	80	ROLU	BicepsBrach	R	EKP-LC	25108
6	60	DO	BicepsBrach	R	EKP-LC	7077
6	60	LORU	BicepsBrach	R	EKP-LC	14435
6	60	ROLU	BicepsBrach	R	EKP-LC	8253
6	80	DO	BicepsBrach	R	EKP-LC	10660
6	80	LORU	BicepsBrach	R	EKP-LC	42832
6	80	ROLU	BicepsBrach	R	EKP-LC	14971
7	60	DO	BicepsBrach	R	EKP-LC	12088
7	60	LORU	BicepsBrach	R	EKP-LC	47746
7	60	ROLU	BicepsBrach	R	EKP-LC	14088
7	80	DO	BicepsBrach	R	EKP-LC	12446
7	80	LORU	BicepsBrach	R	EKP-LC	145653
7	80	ROLU	BicepsBrach	R	EKP-LC	119537
8	60	DO	BicepsBrach	R	EKP-LC	13259
8	60	LORU	BicepsBrach	R	EKP-LC	6432
8	60	ROLU	BicepsBrach	R	EKP-LC	7905
8	80	DO	BicepsBrach	R	EKP-LC	7369
8	80	LORU	BicepsBrach	R	EKP-LC	6954
8	80	ROLU	BicepsBrach	R	EKP-LC	11575
9	60	DO	BicepsBrach	R	EKP-LC	26476
9	60	LORU	BicepsBrach	R	EKP-LC	20386
9	60	ROLU	BicepsBrach	R	EKP-LC	18583
9	80	DO	BicepsBrach	R	EKP-LC	64880
9	80	LORU	BicepsBrach	R	EKP-LC	58099
9	80	ROLU	BicepsBrach	R	EKP-LC	81447
10	60	DO	BicepsBrach	R	EKP-LC	27386
10	60	LORU	BicepsBrach	R	EKP-LC	12270
10	60	ROLU	BicepsBrach	R	EKP-LC	27946
10	80	DO	BicepsBrach	R	EKP-LC	21256
10	80	LORU	BicepsBrach	R	EKP-LC	23022
10	80	ROLU	BicepsBrach	R	EKP-LC	24227
1	60	DO	Trapezius	L	LIF-CKP	17334
1	60	LORU	Trapezius	L	LIF-CKP	16056
1	60	ROLU	Trapezius	L	LIF-CKP	13506
1	80	DO	Trapezius	L	LIF-CKP	18835
1	80	LORU	Trapezius	L	LIF-CKP	15326
1	80	ROLU	Trapezius	L	LIF-CKP	19617
2	60	DO	Trapezius	L	LIF-CKP	48171
2	60	LORU	Trapezius	L	LIF-CKP	68119
2	60	ROLU	Trapezius	L	LIF-CKP	32664
2	80	DO	Trapezius	L	LIF-CKP	31232
2	80	LORU	Trapezius	L	LIF-CKP	50273
2	80	ROLU	Trapezius	L	LIF-CKP	28057
3	60	DO	Trapezius	L	LIF-CKP	85480
3	60	LORU	Trapezius	L	LIF-CKP	85175
3	60	ROLU	Trapezius	L	LIF-CKP	58440
3	80	DO	Trapezius	L	LIF-CKP	112765
3	80	LORU	Trapezius	L	LIF-CKP	55177
3	80	ROLU	Trapezius	L	LIF-CKP	147648
4	60	DO	Trapezius	L	LIF-CKP	93524
4	60	LORU	Trapezius	L	LIF-CKP	86316
4	60	ROLU	Trapezius	L	LIF-CKP	39845
4	80	DO	Trapezius	L	LIF-CKP	78628
4	80	LORU	Trapezius	L	LIF-CKP	66418
4	80	ROLU	Trapezius	L	LIF-CKP	71609
5	60	DO	Trapezius	L	LIF-CKP	172793
5	60	LORU	Trapezius	L	LIF-CKP	111764
5	60	ROLU	Trapezius	L	LIF-CKP	118213

5	80	DO	Trapezius	L	LIF-CKP	119104
5	80	LORU	Trapezius	L	LIF-CKP	114301
5	80	ROLU	Trapezius	L	LIF-CKP	109272
6	60	DO	Trapezius	L	LIF-CKP	107750
6	60	LORU	Trapezius	L	LIF-CKP	82852
6	60	ROLU	Trapezius	L	LIF-CKP	54226
6	80	DO	Trapezius	L	LIF-CKP	35651
6	80	LORU	Trapezius	L	LIF-CKP	80034
6	80	ROLU	Trapezius	L	LIF-CKP	52583
7	60	DO	Trapezius	L	LIF-CKP	119619
7	60	LORU	Trapezius	L	LIF-CKP	105108
7	60	ROLU	Trapezius	L	LIF-CKP	63904
7	80	DO	Trapezius	L	LIF-CKP	131473
7	80	LORU	Trapezius	L	LIF-CKP	110498
7	80	ROLU	Trapezius	L	LIF-CKP	108037
8	60	DO	Trapezius	L	LIF-CKP	72940
8	60	LORU	Trapezius	L	LIF-CKP	53975
8	60	ROLU	Trapezius	L	LIF-CKP	86054
8	80	DO	Trapezius	L	LIF-CKP	68391
8	80	LORU	Trapezius	L	LIF-CKP	70426
8	80	ROLU	Trapezius	L	LIF-CKP	78333
9	60	DO	Trapezius	L	LIF-CKP	224324
9	60	LORU	Trapezius	L	LIF-CKP	201913
9	60	ROLU	Trapezius	L	LIF-CKP	208551
9	80	DO	Trapezius	L	LIF-CKP	250552
9	80	LORU	Trapezius	L	LIF-CKP	261887
9	80	ROLU	Trapezius	L	LIF-CKP	248583
10	60	DO	Trapezius	L	LIF-CKP	219371
10	60	LORU	Trapezius	L	LIF-CKP	116388
10	60	ROLU	Trapezius	L	LIF-CKP	156366
10	80	DO	Trapezius	L	LIF-CKP	113807
10	80	LORU	Trapezius	L	LIF-CKP	118306
10	80	ROLU	Trapezius	L	LIF-CKP	102384
1	60	DO	Trapezius	L	CKP-LOC	216517
1	60	LORU	Trapezius	L	CKP-LOC	160923
1	60	ROLU	Trapezius	L	CKP-LOC	175188
1	80	DO	Trapezius	L	CKP-LOC	91240
1	80	LORU	Trapezius	L	CKP-LOC	202889
1	80	ROLU	Trapezius	L	CKP-LOC	197581
2	60	DO	Trapezius	L	CKP-LOC	143431
2	60	LORU	Trapezius	L	CKP-LOC	127798
2	60	ROLU	Trapezius	L	CKP-LOC	160789
2	80	DO	Trapezius	L	CKP-LOC	253750
2	80	LORU	Trapezius	L	CKP-LOC	210047
2	80	ROLU	Trapezius	L	CKP-LOC	149477
3	60	DO	Trapezius	L	CKP-LOC	228378
3	60	LORU	Trapezius	L	CKP-LOC	257316
3	60	ROLU	Trapezius	L	CKP-LOC	189318
3	80	DO	Trapezius	L	CKP-LOC	267359
3	80	LORU	Trapezius	L	CKP-LOC	325475
3	80	ROLU	Trapezius	L	CKP-LOC	275142
4	60	DO	Trapezius	L	CKP-LOC	111702
4	60	LORU	Trapezius	L	CKP-LOC	111057
4	60	ROLU	Trapezius	L	CKP-LOC	101733
4	80	DO	Trapezius	L	CKP-LOC	216954
4	80	LORU	Trapezius	L	CKP-LOC	198287
4	80	ROLU	Trapezius	L	CKP-LOC	207756
5	60	DO	Trapezius	L	CKP-LOC	269019
5	60	LORU	Trapezius	L	CKP-LOC	275220
5	60	ROLU	Trapezius	L	CKP-LOC	257611
5	80	DO	Trapezius	L	CKP-LOC	286245
5	80	LORU	Trapezius	L	CKP-LOC	290098
5	80	ROLU	Trapezius	L	CKP-LOC	286869
6	60	DO	Trapezius	L	CKP-LOC	298480
6	60	LORU	Trapezius	L	CKP-LOC	280905
6	60	ROLU	Trapezius	L	CKP-LOC	281015
6	80	DO	Trapezius	L	CKP-LOC	260038
6	80	LORU	Trapezius	L	CKP-LOC	235065
6	80	ROLU	Trapezius	L	CKP-LOC	227552
7	60	DO	Trapezius	L	CKP-LOC	234428
7	60	LORU	Trapezius	L	CKP-LOC	239069

7	60	ROLU	Trapezius	L	CKP-LOC	215025
7	80	DO	Trapezius	L	CKP-LOC	256276
7	80	LORU	Trapezius	L	CKP-LOC	275038
7	80	ROLU	Trapezius	L	CKP-LOC	261692
8	60	DO	Trapezius	L	CKP-LOC	190265
8	60	LORU	Trapezius	L	CKP-LOC	69487
8	60	ROLU	Trapezius	L	CKP-LOC	191104
8	80	DO	Trapezius	L	CKP-LOC	299558
8	80	LORU	Trapezius	L	CKP-LOC	302000
8	80	ROLU	Trapezius	L	CKP-LOC	316473
9	60	DO	Trapezius	L	CKP-LOC	173766
9	60	LORU	Trapezius	L	CKP-LOC	171468
9	60	ROLU	Trapezius	L	CKP-LOC	130249
9	80	DO	Trapezius	L	CKP-LOC	202311
9	80	LORU	Trapezius	L	CKP-LOC	191291
9	80	ROLU	Trapezius	L	CKP-LOC	167908
10	60	DO	Trapezius	L	CKP-LOC	326697
10	60	LORU	Trapezius	L	CKP-LOC	295442
10	60	ROLU	Trapezius	L	CKP-LOC	305182
10	80	DO	Trapezius	L	CKP-LOC	323547
10	80	LORU	Trapezius	L	CKP-LOC	318085
10	80	ROLU	Trapezius	L	CKP-LOC	314702
1	60	DO	Trapezius	L	LOC-EKP	152783
1	60	LORU	Trapezius	L	LOC-EKP	76882
1	60	ROLU	Trapezius	L	LOC-EKP	88401
1	80	DO	Trapezius	L	LOC-EKP	225843
1	80	LORU	Trapezius	L	LOC-EKP	140629
1	80	ROLU	Trapezius	L	LOC-EKP	120257
2	60	DO	Trapezius	L	LOC-EKP	208928
2	60	LORU	Trapezius	L	LOC-EKP	203111
2	60	ROLU	Trapezius	L	LOC-EKP	140455
2	80	DO	Trapezius	L	LOC-EKP	233993
2	80	LORU	Trapezius	L	LOC-EKP	208487
2	80	ROLU	Trapezius	L	LOC-EKP	190803
3	60	DO	Trapezius	L	LOC-EKP	135215
3	60	LORU	Trapezius	L	LOC-EKP	177749
3	60	ROLU	Trapezius	L	LOC-EKP	115259
3	80	DO	Trapezius	L	LOC-EKP	235690
3	80	LORU	Trapezius	L	LOC-EKP	238267
3	80	ROLU	Trapezius	L	LOC-EKP	179439
4	60	DO	Trapezius	L	LOC-EKP	122638
4	60	LORU	Trapezius	L	LOC-EKP	122856
4	60	ROLU	Trapezius	L	LOC-EKP	67168
4	80	DO	Trapezius	L	LOC-EKP	153073
4	80	LORU	Trapezius	L	LOC-EKP	151050
4	80	ROLU	Trapezius	L	LOC-EKP	109817
5	60	DO	Trapezius	L	LOC-EKP	196794
5	60	LORU	Trapezius	L	LOC-EKP	198949
5	60	ROLU	Trapezius	L	LOC-EKP	190511
5	80	DO	Trapezius	L	LOC-EKP	215080
5	80	LORU	Trapezius	L	LOC-EKP	227298
5	80	ROLU	Trapezius	L	LOC-EKP	222576
6	60	DO	Trapezius	L	LOC-EKP	216348
6	60	LORU	Trapezius	L	LOC-EKP	279753
6	60	ROLU	Trapezius	L	LOC-EKP	161034
6	80	DO	Trapezius	L	LOC-EKP	148004
6	80	LORU	Trapezius	L	LOC-EKP	174803
6	80	ROLU	Trapezius	L	LOC-EKP	131514
7	60	DO	Trapezius	L	LOC-EKP	174700
7	60	LORU	Trapezius	L	LOC-EKP	146487
7	60	ROLU	Trapezius	L	LOC-EKP	121386
7	80	DO	Trapezius	L	LOC-EKP	206556
7	80	LORU	Trapezius	L	LOC-EKP	190088
7	80	ROLU	Trapezius	L	LOC-EKP	193222
8	60	DO	Trapezius	L	LOC-EKP	92974
8	60	LORU	Trapezius	L	LOC-EKP	102349
8	60	ROLU	Trapezius	L	LOC-EKP	90694
8	80	DO	Trapezius	L	LOC-EKP	165928
8	80	LORU	Trapezius	L	LOC-EKP	182196
8	80	ROLU	Trapezius	L	LOC-EKP	177863
9	60	DO	Trapezius	L	LOC-EKP	95980

9	60	LORU	Trapezius	L	LOC-EKP	103196
9	60	ROLU	Trapezius	L	LOC-EKP	75028
9	80	DO	Trapezius	L	LOC-EKP	99419
9	80	LORU	Trapezius	L	LOC-EKP	85822
9	80	ROLU	Trapezius	L	LOC-EKP	70371
10	60	DO	Trapezius	L	LOC-EKP	263516
10	60	LORU	Trapezius	L	LOC-EKP	235077
10	60	ROLU	Trapezius	L	LOC-EKP	197336
10	80	DO	Trapezius	L	LOC-EKP	236634
10	80	LORU	Trapezius	L	LOC-EKP	208803
10	80	ROLU	Trapezius	L	LOC-EKP	185682
1	60	DO	Trapezius	L	EKP-LC	22289
1	60	LORU	Trapezius	L	EKP-LC	9707
1	60	ROLU	Trapezius	L	EKP-LC	11540
1	80	DO	Trapezius	L	EKP-LC	132187
1	80	LORU	Trapezius	L	EKP-LC	16763
1	80	ROLU	Trapezius	L	EKP-LC	23051
2	60	DO	Trapezius	L	EKP-LC	134776
2	60	LORU	Trapezius	L	EKP-LC	151894
2	60	ROLU	Trapezius	L	EKP-LC	187370
2	80	DO	Trapezius	L	EKP-LC	134929
2	80	LORU	Trapezius	L	EKP-LC	89049
2	80	ROLU	Trapezius	L	EKP-LC	101234
3	60	DO	Trapezius	L	EKP-LC	118333
3	60	LORU	Trapezius	L	EKP-LC	70210
3	60	ROLU	Trapezius	L	EKP-LC	65425
3	80	DO	Trapezius	L	EKP-LC	125535
3	80	LORU	Trapezius	L	EKP-LC	105178
3	80	ROLU	Trapezius	L	EKP-LC	91679
4	60	DO	Trapezius	L	EKP-LC	96253
4	60	LORU	Trapezius	L	EKP-LC	180957
4	60	ROLU	Trapezius	L	EKP-LC	87146
4	80	DO	Trapezius	L	EKP-LC	178065
4	80	LORU	Trapezius	L	EKP-LC	178314
4	80	ROLU	Trapezius	L	EKP-LC	115792
5	60	DO	Trapezius	L	EKP-LC	89565
5	60	LORU	Trapezius	L	EKP-LC	125854
5	60	ROLU	Trapezius	L	EKP-LC	132699
5	80	DO	Trapezius	L	EKP-LC	71090
5	80	LORU	Trapezius	L	EKP-LC	128340
5	80	ROLU	Trapezius	L	EKP-LC	102707
6	60	DO	Trapezius	L	EKP-LC	145236
6	60	LORU	Trapezius	L	EKP-LC	206993
6	60	ROLU	Trapezius	L	EKP-LC	30215
6	80	DO	Trapezius	L	EKP-LC	22861
6	80	LORU	Trapezius	L	EKP-LC	36791
6	80	ROLU	Trapezius	L	EKP-LC	17479
7	60	DO	Trapezius	L	EKP-LC	47222
7	60	LORU	Trapezius	L	EKP-LC	38593
7	60	ROLU	Trapezius	L	EKP-LC	41540
7	80	DO	Trapezius	L	EKP-LC	87737
7	80	LORU	Trapezius	L	EKP-LC	55982
7	80	ROLU	Trapezius	L	EKP-LC	58063
8	60	DO	Trapezius	L	EKP-LC	81277
8	60	LORU	Trapezius	L	EKP-LC	92624
8	60	ROLU	Trapezius	L	EKP-LC	66372
8	80	DO	Trapezius	L	EKP-LC	100014
8	80	LORU	Trapezius	L	EKP-LC	124776
8	80	ROLU	Trapezius	L	EKP-LC	87401
9	60	DO	Trapezius	L	EKP-LC	95980
9	60	LORU	Trapezius	L	EKP-LC	103196
9	60	ROLU	Trapezius	L	EKP-LC	75028
9	80	DO	Trapezius	L	EKP-LC	99419
9	80	LORU	Trapezius	L	EKP-LC	85822
9	80	ROLU	Trapezius	L	EKP-LC	70371
10	60	DO	Trapezius	L	EKP-LC	128875
10	60	LORU	Trapezius	L	EKP-LC	51931
10	60	ROLU	Trapezius	L	EKP-LC	52947
10	80	DO	Trapezius	L	EKP-LC	42354
10	80	LORU	Trapezius	L	EKP-LC	37201
10	80	ROLU	Trapezius	L	EKP-LC	35932

1	60	DO	Trapezius	R	LIF-CKP	35412
1	60	LORU	Trapezius	R	LIF-CKP	23859
1	60	ROLU	Trapezius	R	LIF-CKP	27045
1	80	DO	Trapezius	R	LIF-CKP	31380
1	80	LORU	Trapezius	R	LIF-CKP	30173
1	80	ROLU	Trapezius	R	LIF-CKP	30025
2	60	DO	Trapezius	R	LIF-CKP	28293
2	60	LORU	Trapezius	R	LIF-CKP	32316
2	60	ROLU	Trapezius	R	LIF-CKP	42106
2	80	DO	Trapezius	R	LIF-CKP	15744
2	80	LORU	Trapezius	R	LIF-CKP	29496
2	80	ROLU	Trapezius	R	LIF-CKP	13882
3	60	DO	Trapezius	R	LIF-CKP	10544
3	60	LORU	Trapezius	R	LIF-CKP	12594
3	60	ROLU	Trapezius	R	LIF-CKP	10147
3	80	DO	Trapezius	R	LIF-CKP	31537
3	80	LORU	Trapezius	R	LIF-CKP	21316
3	80	ROLU	Trapezius	R	LIF-CKP	54636
4	60	DO	Trapezius	R	LIF-CKP	153160
4	60	LORU	Trapezius	R	LIF-CKP	78449
4	60	ROLU	Trapezius	R	LIF-CKP	131237
4	80	DO	Trapezius	R	LIF-CKP	118441
4	80	LORU	Trapezius	R	LIF-CKP	49203
4	80	ROLU	Trapezius	R	LIF-CKP	119936
5	60	DO	Trapezius	R	LIF-CKP	170456
5	60	LORU	Trapezius	R	LIF-CKP	85473
5	60	ROLU	Trapezius	R	LIF-CKP	153694
5	80	DO	Trapezius	R	LIF-CKP	107945
5	80	LORU	Trapezius	R	LIF-CKP	95568
5	80	ROLU	Trapezius	R	LIF-CKP	101677
6	60	DO	Trapezius	R	LIF-CKP	32005
6	60	LORU	Trapezius	R	LIF-CKP	16339
6	60	ROLU	Trapezius	R	LIF-CKP	23956
6	80	DO	Trapezius	R	LIF-CKP	34243
6	80	LORU	Trapezius	R	LIF-CKP	75665
6	80	ROLU	Trapezius	R	LIF-CKP	39248
7	60	DO	Trapezius	R	LIF-CKP	96032
7	60	LORU	Trapezius	R	LIF-CKP	56015
7	60	ROLU	Trapezius	R	LIF-CKP	54695
7	80	DO	Trapezius	R	LIF-CKP	105588
7	80	LORU	Trapezius	R	LIF-CKP	84797
7	80	ROLU	Trapezius	R	LIF-CKP	105839
8	60	DO	Trapezius	R	LIF-CKP	135302
8	60	LORU	Trapezius	R	LIF-CKP	136651
8	60	ROLU	Trapezius	R	LIF-CKP	150714
8	80	DO	Trapezius	R	LIF-CKP	160934
8	80	LORU	Trapezius	R	LIF-CKP	177341
8	80	ROLU	Trapezius	R	LIF-CKP	162300
9	60	DO	Trapezius	R	LIF-CKP	102204
9	60	LORU	Trapezius	R	LIF-CKP	55950
9	60	ROLU	Trapezius	R	LIF-CKP	88878
9	80	DO	Trapezius	R	LIF-CKP	77937
9	80	LORU	Trapezius	R	LIF-CKP	71977
9	80	ROLU	Trapezius	R	LIF-CKP	83143
10	60	DO	Trapezius	R	LIF-CKP	258629
10	60	LORU	Trapezius	R	LIF-CKP	61855
10	60	ROLU	Trapezius	R	LIF-CKP	206310
10	80	DO	Trapezius	R	LIF-CKP	95623
10	80	LORU	Trapezius	R	LIF-CKP	84231
10	80	ROLU	Trapezius	R	LIF-CKP	120739
1	60	DO	Trapezius	R	CKP-LOC	286414
1	60	LORU	Trapezius	R	CKP-LOC	227845
1	60	ROLU	Trapezius	R	CKP-LOC	267415
1	80	DO	Trapezius	R	CKP-LOC	122529
1	80	LORU	Trapezius	R	CKP-LOC	253094
1	80	ROLU	Trapezius	R	CKP-LOC	268044
2	60	DO	Trapezius	R	CKP-LOC	75256
2	60	LORU	Trapezius	R	CKP-LOC	61444
2	60	ROLU	Trapezius	R	CKP-LOC	131605
2	80	DO	Trapezius	R	CKP-LOC	130308
2	80	LORU	Trapezius	R	CKP-LOC	118485

2	80	ROLU	Trapezius	R	CKP-LOC	76796
3	60	DO	Trapezius	R	CKP-LOC	54373
3	60	LORU	Trapezius	R	CKP-LOC	82646
3	60	ROLU	Trapezius	R	CKP-LOC	46803
3	80	DO	Trapezius	R	CKP-LOC	152175
3	80	LORU	Trapezius	R	CKP-LOC	157068
3	80	ROLU	Trapezius	R	CKP-LOC	161131
4	60	DO	Trapezius	R	CKP-LOC	141211
4	60	LORU	Trapezius	R	CKP-LOC	110544
4	60	ROLU	Trapezius	R	CKP-LOC	164100
4	80	DO	Trapezius	R	CKP-LOC	254542
4	80	LORU	Trapezius	R	CKP-LOC	211130
4	80	ROLU	Trapezius	R	CKP-LOC	251825
5	60	DO	Trapezius	R	CKP-LOC	225753
5	60	LORU	Trapezius	R	CKP-LOC	169800
5	60	ROLU	Trapezius	R	CKP-LOC	240401
5	80	DO	Trapezius	R	CKP-LOC	299983
5	80	LORU	Trapezius	R	CKP-LOC	274478
5	80	ROLU	Trapezius	R	CKP-LOC	298690
6	60	DO	Trapezius	R	CKP-LOC	182919
6	60	LORU	Trapezius	R	CKP-LOC	144264
6	60	ROLU	Trapezius	R	CKP-LOC	135687
6	80	DO	Trapezius	R	CKP-LOC	255803
6	80	LORU	Trapezius	R	CKP-LOC	242281
6	80	ROLU	Trapezius	R	CKP-LOC	256036
7	60	DO	Trapezius	R	CKP-LOC	163385
7	60	LORU	Trapezius	R	CKP-LOC	136500
7	60	ROLU	Trapezius	R	CKP-LOC	156699
7	80	DO	Trapezius	R	CKP-LOC	205018
7	80	LORU	Trapezius	R	CKP-LOC	213058
7	80	ROLU	Trapezius	R	CKP-LOC	212071
8	60	DO	Trapezius	R	CKP-LOC	212105
8	60	LORU	Trapezius	R	CKP-LOC	149907
8	60	ROLU	Trapezius	R	CKP-LOC	219078
8	80	DO	Trapezius	R	CKP-LOC	317290
8	80	LORU	Trapezius	R	CKP-LOC	315651
8	80	ROLU	Trapezius	R	CKP-LOC	333063
9	60	DO	Trapezius	R	CKP-LOC	184490
9	60	LORU	Trapezius	R	CKP-LOC	149313
9	60	ROLU	Trapezius	R	CKP-LOC	184781
9	80	DO	Trapezius	R	CKP-LOC	229432
9	80	LORU	Trapezius	R	CKP-LOC	232383
9	80	ROLU	Trapezius	R	CKP-LOC	242259
10	60	DO	Trapezius	R	CKP-LOC	318997
10	60	LORU	Trapezius	R	CKP-LOC	260862
10	60	ROLU	Trapezius	R	CKP-LOC	301242
10	80	DO	Trapezius	R	CKP-LOC	327243
10	80	LORU	Trapezius	R	CKP-LOC	306206
10	80	ROLU	Trapezius	R	CKP-LOC	322675
1	60	DO	Trapezius	R	LOC-EKP	218187
1	60	LORU	Trapezius	R	LOC-EKP	134243
1	60	ROLU	Trapezius	R	LOC-EKP	201746
1	80	DO	Trapezius	R	LOC-EKP	278357
1	80	LORU	Trapezius	R	LOC-EKP	211799
1	80	ROLU	Trapezius	R	LOC-EKP	220662
2	60	DO	Trapezius	R	LOC-EKP	105586
2	60	LORU	Trapezius	R	LOC-EKP	94533
2	60	ROLU	Trapezius	R	LOC-EKP	130326
2	80	DO	Trapezius	R	LOC-EKP	122203
2	80	LORU	Trapezius	R	LOC-EKP	90833
2	80	ROLU	Trapezius	R	LOC-EKP	82988
3	60	DO	Trapezius	R	LOC-EKP	30607
3	60	LORU	Trapezius	R	LOC-EKP	37589
3	60	ROLU	Trapezius	R	LOC-EKP	49352
3	80	DO	Trapezius	R	LOC-EKP	71529
3	80	LORU	Trapezius	R	LOC-EKP	65723
3	80	ROLU	Trapezius	R	LOC-EKP	76615
4	60	DO	Trapezius	R	LOC-EKP	179323
4	60	LORU	Trapezius	R	LOC-EKP	95304
4	60	ROLU	Trapezius	R	LOC-EKP	131652
4	80	DO	Trapezius	R	LOC-EKP	177948

4	80	LORU	Trapezius	R	LOC-EKP	131852
4	80	ROLU	Trapezius	R	LOC-EKP	174690
5	60	DO	Trapezius	R	LOC-EKP	142901
5	60	LORU	Trapezius	R	LOC-EKP	95223
5	60	ROLU	Trapezius	R	LOC-EKP	170133
5	80	DO	Trapezius	R	LOC-EKP	227726
5	80	LORU	Trapezius	R	LOC-EKP	190129
5	80	ROLU	Trapezius	R	LOC-EKP	220469
6	60	DO	Trapezius	R	LOC-EKP	96601
6	60	LORU	Trapezius	R	LOC-EKP	94300
6	60	ROLU	Trapezius	R	LOC-EKP	59585
6	80	DO	Trapezius	R	LOC-EKP	136531
6	80	LORU	Trapezius	R	LOC-EKP	157934
6	80	ROLU	Trapezius	R	LOC-EKP	153017
7	60	DO	Trapezius	R	LOC-EKP	109965
7	60	LORU	Trapezius	R	LOC-EKP	83366
7	60	ROLU	Trapezius	R	LOC-EKP	101155
7	80	DO	Trapezius	R	LOC-EKP	153228
7	80	LORU	Trapezius	R	LOC-EKP	126977
7	80	ROLU	Trapezius	R	LOC-EKP	162970
8	60	DO	Trapezius	R	LOC-EKP	118621
8	60	LORU	Trapezius	R	LOC-EKP	115054
8	60	ROLU	Trapezius	R	LOC-EKP	129714
8	80	DO	Trapezius	R	LOC-EKP	202443
8	80	LORU	Trapezius	R	LOC-EKP	202728
8	80	ROLU	Trapezius	R	LOC-EKP	203194
9	60	DO	Trapezius	R	LOC-EKP	140356
9	60	LORU	Trapezius	R	LOC-EKP	105536
9	60	ROLU	Trapezius	R	LOC-EKP	133658
9	80	DO	Trapezius	R	LOC-EKP	181648
9	80	LORU	Trapezius	R	LOC-EKP	152174
9	80	ROLU	Trapezius	R	LOC-EKP	171801
10	60	DO	Trapezius	R	LOC-EKP	261409
10	60	LORU	Trapezius	R	LOC-EKP	200211
10	60	ROLU	Trapezius	R	LOC-EKP	229260
10	80	DO	Trapezius	R	LOC-EKP	264867
10	80	LORU	Trapezius	R	LOC-EKP	191593
10	80	ROLU	Trapezius	R	LOC-EKP	251600
1	60	DO	Trapezius	R	EKP-LC	45163
1	60	LORU	Trapezius	R	EKP-LC	17361
1	60	ROLU	Trapezius	R	EKP-LC	27891
1	80	DO	Trapezius	R	EKP-LC	191473
1	80	LORU	Trapezius	R	EKP-LC	23358
1	80	ROLU	Trapezius	R	EKP-LC	28154
2	60	DO	Trapezius	R	EKP-LC	51537
2	60	LORU	Trapezius	R	EKP-LC	79017
2	60	ROLU	Trapezius	R	EKP-LC	100280
2	80	DO	Trapezius	R	EKP-LC	66665
2	80	LORU	Trapezius	R	EKP-LC	51356
2	80	ROLU	Trapezius	R	EKP-LC	7437
3	60	DO	Trapezius	R	EKP-LC	14281
3	60	LORU	Trapezius	R	EKP-LC	9530
3	60	ROLU	Trapezius	R	EKP-LC	6972
3	80	DO	Trapezius	R	EKP-LC	10586
3	80	LORU	Trapezius	R	EKP-LC	10645
3	80	ROLU	Trapezius	R	EKP-LC	9051
4	60	DO	Trapezius	R	EKP-LC	133849
4	60	LORU	Trapezius	R	EKP-LC	169034
4	60	ROLU	Trapezius	R	EKP-LC	215424
4	80	DO	Trapezius	R	EKP-LC	284630
4	80	LORU	Trapezius	R	EKP-LC	193380
4	80	ROLU	Trapezius	R	EKP-LC	268342
5	60	DO	Trapezius	R	EKP-LC	108926
5	60	LORU	Trapezius	R	EKP-LC	73741
5	60	ROLU	Trapezius	R	EKP-LC	157881
5	80	DO	Trapezius	R	EKP-LC	42185
5	80	LORU	Trapezius	R	EKP-LC	32399
5	80	ROLU	Trapezius	R	EKP-LC	47856
6	60	DO	Trapezius	R	EKP-LC	45178
6	60	LORU	Trapezius	R	EKP-LC	56036
6	60	ROLU	Trapezius	R	EKP-LC	16647

6	80	DO	Trapezius	R	EKP-LC	13074
6	80	LORU	Trapezius	R	EKP-LC	15658
6	80	ROLU	Trapezius	R	EKP-LC	13526
7	60	DO	Trapezius	R	EKP-LC	41313
7	60	LORU	Trapezius	R	EKP-LC	30065
7	60	ROLU	Trapezius	R	EKP-LC	50107
7	80	DO	Trapezius	R	EKP-LC	85762
7	80	LORU	Trapezius	R	EKP-LC	43346
7	80	ROLU	Trapezius	R	EKP-LC	73084
8	60	DO	Trapezius	R	EKP-LC	150570
8	60	LORU	Trapezius	R	EKP-LC	133966
8	60	ROLU	Trapezius	R	EKP-LC	137553
8	80	DO	Trapezius	R	EKP-LC	132673
8	80	LORU	Trapezius	R	EKP-LC	132748
8	80	ROLU	Trapezius	R	EKP-LC	172914
9	60	DO	Trapezius	R	EKP-LC	81541
9	60	LORU	Trapezius	R	EKP-LC	67605
9	60	ROLU	Trapezius	R	EKP-LC	89357
9	80	DO	Trapezius	R	EKP-LC	97332
9	80	LORU	Trapezius	R	EKP-LC	60710
9	80	ROLU	Trapezius	R	EKP-LC	73663
10	60	DO	Trapezius	R	EKP-LC	143051
10	60	LORU	Trapezius	R	EKP-LC	39698
10	60	ROLU	Trapezius	R	EKP-LC	91457
10	80	DO	Trapezius	R	EKP-LC	48941
10	80	LORU	Trapezius	R	EKP-LC	43504
10	80	ROLU	Trapezius	R	EKP-LC	42605
1	60	DO	Latissimus	L	LIF-CKP	293769
1	60	LORU	Latissimus	L	LIF-CKP	279573
1	60	ROLU	Latissimus	L	LIF-CKP	293405
1	80	DO	Latissimus	L	LIF-CKP	328576
1	80	LORU	Latissimus	L	LIF-CKP	336853
1	80	ROLU	Latissimus	L	LIF-CKP	332782
2	60	DO	Latissimus	L	LIF-CKP	330280
2	60	LORU	Latissimus	L	LIF-CKP	318330
2	60	ROLU	Latissimus	L	LIF-CKP	331318
2	80	DO	Latissimus	L	LIF-CKP	349833
2	80	LORU	Latissimus	L	LIF-CKP	353208
2	80	ROLU	Latissimus	L	LIF-CKP	304447
3	60	DO	Latissimus	L	LIF-CKP	268829
3	60	LORU	Latissimus	L	LIF-CKP	282771
3	60	ROLU	Latissimus	L	LIF-CKP	316486
3	80	DO	Latissimus	L	LIF-CKP	267188
3	80	LORU	Latissimus	L	LIF-CKP	285438
3	80	ROLU	Latissimus	L	LIF-CKP	290839
4	60	DO	Latissimus	L	LIF-CKP	86343
4	60	LORU	Latissimus	L	LIF-CKP	68070
4	60	ROLU	Latissimus	L	LIF-CKP	80478
4	80	DO	Latissimus	L	LIF-CKP	110026
4	80	LORU	Latissimus	L	LIF-CKP	91706
4	80	ROLU	Latissimus	L	LIF-CKP	119166
5	60	DO	Latissimus	L	LIF-CKP	273530
5	60	LORU	Latissimus	L	LIF-CKP	277738
5	60	ROLU	Latissimus	L	LIF-CKP	244498
5	80	DO	Latissimus	L	LIF-CKP	206295
5	80	LORU	Latissimus	L	LIF-CKP	311061
5	80	ROLU	Latissimus	L	LIF-CKP	104262
6	60	DO	Latissimus	L	LIF-CKP	130799
6	60	LORU	Latissimus	L	LIF-CKP	98035
6	60	ROLU	Latissimus	L	LIF-CKP	138800
6	80	DO	Latissimus	L	LIF-CKP	152857
6	80	LORU	Latissimus	L	LIF-CKP	153169
6	80	ROLU	Latissimus	L	LIF-CKP	173071
7	60	DO	Latissimus	L	LIF-CKP	301029
7	60	LORU	Latissimus	L	LIF-CKP	293847
7	60	ROLU	Latissimus	L	LIF-CKP	296031
7	80	DO	Latissimus	L	LIF-CKP	296652
7	80	LORU	Latissimus	L	LIF-CKP	305935
7	80	ROLU	Latissimus	L	LIF-CKP	300883
8	60	DO	Latissimus	L	LIF-CKP	293270
8	60	LORU	Latissimus	L	LIF-CKP	269622

8	60	ROLU	Latissimus	L	LIF-CKP	303927
8	80	DO	Latissimus	L	LIF-CKP	309640
8	80	LORU	Latissimus	L	LIF-CKP	295086
8	80	ROLU	Latissimus	L	LIF-CKP	312358
9	60	DO	Latissimus	L	LIF-CKP	221255
9	60	LORU	Latissimus	L	LIF-CKP	225588
9	60	ROLU	Latissimus	L	LIF-CKP	226994
9	80	DO	Latissimus	L	LIF-CKP	195143
9	80	LORU	Latissimus	L	LIF-CKP	206474
9	80	ROLU	Latissimus	L	LIF-CKP	157884
10	60	DO	Latissimus	L	LIF-CKP	289610
10	60	LORU	Latissimus	L	LIF-CKP	264915
10	60	ROLU	Latissimus	L	LIF-CKP	241444
10	80	DO	Latissimus	L	LIF-CKP	266109
10	80	LORU	Latissimus	L	LIF-CKP	281147
10	80	ROLU	Latissimus	L	LIF-CKP	269350
1	60	DO	Latissimus	L	CKP-LOC	204815
1	60	LORU	Latissimus	L	CKP-LOC	192834
1	60	ROLU	Latissimus	L	CKP-LOC	207619
1	80	DO	Latissimus	L	CKP-LOC	311493
1	80	LORU	Latissimus	L	CKP-LOC	258567
1	80	ROLU	Latissimus	L	CKP-LOC	255364
2	60	DO	Latissimus	L	CKP-LOC	232257
2	60	LORU	Latissimus	L	CKP-LOC	239449
2	60	ROLU	Latissimus	L	CKP-LOC	223540
2	80	DO	Latissimus	L	CKP-LOC	280204
2	80	LORU	Latissimus	L	CKP-LOC	275641
2	80	ROLU	Latissimus	L	CKP-LOC	267247
3	60	DO	Latissimus	L	CKP-LOC	201113
3	60	LORU	Latissimus	L	CKP-LOC	235977
3	60	ROLU	Latissimus	L	CKP-LOC	260366
3	80	DO	Latissimus	L	CKP-LOC	281859
3	80	LORU	Latissimus	L	CKP-LOC	295985
3	80	ROLU	Latissimus	L	CKP-LOC	271396
4	60	DO	Latissimus	L	CKP-LOC	112351
4	60	LORU	Latissimus	L	CKP-LOC	104586
4	60	ROLU	Latissimus	L	CKP-LOC	130704
4	80	DO	Latissimus	L	CKP-LOC	178587
4	80	LORU	Latissimus	L	CKP-LOC	185861
4	80	ROLU	Latissimus	L	CKP-LOC	188644
5	60	DO	Latissimus	L	CKP-LOC	198742
5	60	LORU	Latissimus	L	CKP-LOC	212679
5	60	ROLU	Latissimus	L	CKP-LOC	149149
5	80	DO	Latissimus	L	CKP-LOC	143939
5	80	LORU	Latissimus	L	CKP-LOC	211610
5	80	ROLU	Latissimus	L	CKP-LOC	95203
6	60	DO	Latissimus	L	CKP-LOC	187505
6	60	LORU	Latissimus	L	CKP-LOC	176758
6	60	ROLU	Latissimus	L	CKP-LOC	157864
6	80	DO	Latissimus	L	CKP-LOC	209650
6	80	LORU	Latissimus	L	CKP-LOC	219145
6	80	ROLU	Latissimus	L	CKP-LOC	201758
7	60	DO	Latissimus	L	CKP-LOC	262918
7	60	LORU	Latissimus	L	CKP-LOC	230536
7	60	ROLU	Latissimus	L	CKP-LOC	247286
7	80	DO	Latissimus	L	CKP-LOC	272795
7	80	LORU	Latissimus	L	CKP-LOC	279712
7	80	ROLU	Latissimus	L	CKP-LOC	285831
8	60	DO	Latissimus	L	CKP-LOC	265195
8	60	LORU	Latissimus	L	CKP-LOC	218500
8	60	ROLU	Latissimus	L	CKP-LOC	204325
8	80	DO	Latissimus	L	CKP-LOC	277347
8	80	LORU	Latissimus	L	CKP-LOC	276834
8	80	ROLU	Latissimus	L	CKP-LOC	270914
9	60	DO	Latissimus	L	CKP-LOC	114879
9	60	LORU	Latissimus	L	CKP-LOC	117940
9	60	ROLU	Latissimus	L	CKP-LOC	122163
9	80	DO	Latissimus	L	CKP-LOC	158846
9	80	LORU	Latissimus	L	CKP-LOC	156150
9	80	ROLU	Latissimus	L	CKP-LOC	150434
10	60	DO	Latissimus	L	CKP-LOC	158571

10	60	LORU	Latissimus	L	CKP-LOC	214251
10	60	ROLU	Latissimus	L	CKP-LOC	174913
10	80	DO	Latissimus	L	CKP-LOC	228193
10	80	LORU	Latissimus	L	CKP-LOC	203800
10	80	ROLU	Latissimus	L	CKP-LOC	239576
1	60	DO	Latissimus	L	LOC-EKP	215735
1	60	LORU	Latissimus	L	LOC-EKP	189106
1	60	ROLU	Latissimus	L	LOC-EKP	217593
1	80	DO	Latissimus	L	LOC-EKP	214827
1	80	LORU	Latissimus	L	LOC-EKP	216052
1	80	ROLU	Latissimus	L	LOC-EKP	225744
2	60	DO	Latissimus	L	LOC-EKP	130658
2	60	LORU	Latissimus	L	LOC-EKP	142598
2	60	ROLU	Latissimus	L	LOC-EKP	152068
2	80	DO	Latissimus	L	LOC-EKP	181613
2	80	LORU	Latissimus	L	LOC-EKP	166972
2	80	ROLU	Latissimus	L	LOC-EKP	167064
3	60	DO	Latissimus	L	LOC-EKP	200083
3	60	LORU	Latissimus	L	LOC-EKP	194925
3	60	ROLU	Latissimus	L	LOC-EKP	169991
3	80	DO	Latissimus	L	LOC-EKP	247140
3	80	LORU	Latissimus	L	LOC-EKP	222193
3	80	ROLU	Latissimus	L	LOC-EKP	209120
4	60	DO	Latissimus	L	LOC-EKP	81226
4	60	LORU	Latissimus	L	LOC-EKP	75206
4	60	ROLU	Latissimus	L	LOC-EKP	106650
4	80	DO	Latissimus	L	LOC-EKP	127069
4	80	LORU	Latissimus	L	LOC-EKP	118438
4	80	ROLU	Latissimus	L	LOC-EKP	142756
5	60	DO	Latissimus	L	LOC-EKP	129966
5	60	LORU	Latissimus	L	LOC-EKP	116803
5	60	ROLU	Latissimus	L	LOC-EKP	93461
5	80	DO	Latissimus	L	LOC-EKP	44304
5	80	LORU	Latissimus	L	LOC-EKP	152521
5	80	ROLU	Latissimus	L	LOC-EKP	72475
6	60	DO	Latissimus	L	LOC-EKP	131441
6	60	LORU	Latissimus	L	LOC-EKP	100456
6	60	ROLU	Latissimus	L	LOC-EKP	109019
6	80	DO	Latissimus	L	LOC-EKP	171897
6	80	LORU	Latissimus	L	LOC-EKP	202636
6	80	ROLU	Latissimus	L	LOC-EKP	157619
7	60	DO	Latissimus	L	LOC-EKP	257562
7	60	LORU	Latissimus	L	LOC-EKP	254047
7	60	ROLU	Latissimus	L	LOC-EKP	263119
7	80	DO	Latissimus	L	LOC-EKP	292660
7	80	LORU	Latissimus	L	LOC-EKP	297495
7	80	ROLU	Latissimus	L	LOC-EKP	278007
8	60	DO	Latissimus	L	LOC-EKP	201399
8	60	LORU	Latissimus	L	LOC-EKP	149075
8	60	ROLU	Latissimus	L	LOC-EKP	164991
8	80	DO	Latissimus	L	LOC-EKP	223290
8	80	LORU	Latissimus	L	LOC-EKP	224786
8	80	ROLU	Latissimus	L	LOC-EKP	202493
9	60	DO	Latissimus	L	LOC-EKP	95349
9	60	LORU	Latissimus	L	LOC-EKP	100300
9	60	ROLU	Latissimus	L	LOC-EKP	118548
9	80	DO	Latissimus	L	LOC-EKP	124362
9	80	LORU	Latissimus	L	LOC-EKP	154941
9	80	ROLU	Latissimus	L	LOC-EKP	142414
10	60	DO	Latissimus	L	LOC-EKP	120757
10	60	LORU	Latissimus	L	LOC-EKP	119295
10	60	ROLU	Latissimus	L	LOC-EKP	111913
10	80	DO	Latissimus	L	LOC-EKP	158184
10	80	LORU	Latissimus	L	LOC-EKP	164776
10	80	ROLU	Latissimus	L	LOC-EKP	191031
1	60	DO	Latissimus	L	EKP-LC	275590
1	60	LORU	Latissimus	L	EKP-LC	284269
1	60	ROLU	Latissimus	L	EKP-LC	265583
1	80	DO	Latissimus	L	EKP-LC	218923
1	80	LORU	Latissimus	L	EKP-LC	296788
1	80	ROLU	Latissimus	L	EKP-LC	292671

2	60	DO	Latissimus	L	EKP-LC	223781
2	60	LORU	Latissimus	L	EKP-LC	262273
2	60	ROLU	Latissimus	L	EKP-LC	255671
2	80	DO	Latissimus	L	EKP-LC	283314
2	80	LORU	Latissimus	L	EKP-LC	317464
2	80	ROLU	Latissimus	L	EKP-LC	283655
3	60	DO	Latissimus	L	EKP-LC	240473
3	60	LORU	Latissimus	L	EKP-LC	270220
3	60	ROLU	Latissimus	L	EKP-LC	274112
3	80	DO	Latissimus	L	EKP-LC	299948
3	80	LORU	Latissimus	L	EKP-LC	276681
3	80	ROLU	Latissimus	L	EKP-LC	274840
4	60	DO	Latissimus	L	EKP-LC	73162
4	60	LORU	Latissimus	L	EKP-LC	65741
4	60	ROLU	Latissimus	L	EKP-LC	77693
4	80	DO	Latissimus	L	EKP-LC	121395
4	80	LORU	Latissimus	L	EKP-LC	102006
4	80	ROLU	Latissimus	L	EKP-LC	91422
5	60	DO	Latissimus	L	EKP-LC	242911
5	60	LORU	Latissimus	L	EKP-LC	186677
5	60	ROLU	Latissimus	L	EKP-LC	195740
5	80	DO	Latissimus	L	EKP-LC	107785
5	80	LORU	Latissimus	L	EKP-LC	278765
5	80	ROLU	Latissimus	L	EKP-LC	68203
6	60	DO	Latissimus	L	EKP-LC	103592
6	60	LORU	Latissimus	L	EKP-LC	103224
6	60	ROLU	Latissimus	L	EKP-LC	79947
6	80	DO	Latissimus	L	EKP-LC	106418
6	80	LORU	Latissimus	L	EKP-LC	124207
6	80	ROLU	Latissimus	L	EKP-LC	131888
7	60	DO	Latissimus	L	EKP-LC	272470
7	60	LORU	Latissimus	L	EKP-LC	284541
7	60	ROLU	Latissimus	L	EKP-LC	286380
7	80	DO	Latissimus	L	EKP-LC	290881
7	80	LORU	Latissimus	L	EKP-LC	304528
7	80	ROLU	Latissimus	L	EKP-LC	289326
8	60	DO	Latissimus	L	EKP-LC	258838
8	60	LORU	Latissimus	L	EKP-LC	242027
8	60	ROLU	Latissimus	L	EKP-LC	265863
8	80	DO	Latissimus	L	EKP-LC	317460
8	80	LORU	Latissimus	L	EKP-LC	305827
8	80	ROLU	Latissimus	L	EKP-LC	297520
9	60	DO	Latissimus	L	EKP-LC	194898
9	60	LORU	Latissimus	L	EKP-LC	178482
9	60	ROLU	Latissimus	L	EKP-LC	188240
9	80	DO	Latissimus	L	EKP-LC	199639
9	80	LORU	Latissimus	L	EKP-LC	188050
9	80	ROLU	Latissimus	L	EKP-LC	204736
10	60	DO	Latissimus	L	EKP-LC	247460
10	60	LORU	Latissimus	L	EKP-LC	248815
10	60	ROLU	Latissimus	L	EKP-LC	251850
10	80	DO	Latissimus	L	EKP-LC	290497
10	80	LORU	Latissimus	L	EKP-LC	292269
10	80	ROLU	Latissimus	L	EKP-LC	261085
1	60	DO	Latissimus	R	LIF-CKP	368253
1	60	LORU	Latissimus	R	LIF-CKP	372472
1	60	ROLU	Latissimus	R	LIF-CKP	362461
1	80	DO	Latissimus	R	LIF-CKP	375307
1	80	LORU	Latissimus	R	LIF-CKP	375779
1	80	ROLU	Latissimus	R	LIF-CKP	375721
2	60	DO	Latissimus	R	LIF-CKP	363166
2	60	LORU	Latissimus	R	LIF-CKP	347602
2	60	ROLU	Latissimus	R	LIF-CKP	350954
2	80	DO	Latissimus	R	LIF-CKP	370523
2	80	LORU	Latissimus	R	LIF-CKP	361003
2	80	ROLU	Latissimus	R	LIF-CKP	342442
3	60	DO	Latissimus	R	LIF-CKP	282165
3	60	LORU	Latissimus	R	LIF-CKP	298758
3	60	ROLU	Latissimus	R	LIF-CKP	301475
3	80	DO	Latissimus	R	LIF-CKP	65733
3	80	LORU	Latissimus	R	LIF-CKP	62038

3	80	ROLU	Latissimus	R	LIF-CKP	3731
4	60	DO	Latissimus	R	LIF-CKP	170731
4	60	LORU	Latissimus	R	LIF-CKP	221352
4	60	ROLU	Latissimus	R	LIF-CKP	187946
4	80	DO	Latissimus	R	LIF-CKP	202383
4	80	LORU	Latissimus	R	LIF-CKP	220324
4	80	ROLU	Latissimus	R	LIF-CKP	228016
5	60	DO	Latissimus	R	LIF-CKP	221047
5	60	LORU	Latissimus	R	LIF-CKP	243487
5	60	ROLU	Latissimus	R	LIF-CKP	234133
5	80	DO	Latissimus	R	LIF-CKP	196622
5	80	LORU	Latissimus	R	LIF-CKP	275067
5	80	ROLU	Latissimus	R	LIF-CKP	277553
6	60	DO	Latissimus	R	LIF-CKP	161918
6	60	LORU	Latissimus	R	LIF-CKP	122481
6	60	ROLU	Latissimus	R	LIF-CKP	167065
6	80	DO	Latissimus	R	LIF-CKP	181102
6	80	LORU	Latissimus	R	LIF-CKP	189179
6	80	ROLU	Latissimus	R	LIF-CKP	203036
7	60	DO	Latissimus	R	LIF-CKP	279205
7	60	LORU	Latissimus	R	LIF-CKP	279778
7	60	ROLU	Latissimus	R	LIF-CKP	277231
7	80	DO	Latissimus	R	LIF-CKP	263970
7	80	LORU	Latissimus	R	LIF-CKP	274645
7	80	ROLU	Latissimus	R	LIF-CKP	264729
8	60	DO	Latissimus	R	LIF-CKP	329719
8	60	LORU	Latissimus	R	LIF-CKP	333548
8	60	ROLU	Latissimus	R	LIF-CKP	326946
8	80	DO	Latissimus	R	LIF-CKP	352465
8	80	LORU	Latissimus	R	LIF-CKP	361189
8	80	ROLU	Latissimus	R	LIF-CKP	354649
9	60	DO	Latissimus	R	LIF-CKP	254484
9	60	LORU	Latissimus	R	LIF-CKP	239357
9	60	ROLU	Latissimus	R	LIF-CKP	236701
9	80	DO	Latissimus	R	LIF-CKP	265551
9	80	LORU	Latissimus	R	LIF-CKP	264950
9	80	ROLU	Latissimus	R	LIF-CKP	231553
10	60	DO	Latissimus	R	LIF-CKP	361363
10	60	LORU	Latissimus	R	LIF-CKP	338944
10	60	ROLU	Latissimus	R	LIF-CKP	327403
10	80	DO	Latissimus	R	LIF-CKP	366041
10	80	LORU	Latissimus	R	LIF-CKP	362273
10	80	ROLU	Latissimus	R	LIF-CKP	365860
1	60	DO	Latissimus	R	CKP-LOC	341016
1	60	LORU	Latissimus	R	CKP-LOC	349699
1	60	ROLU	Latissimus	R	CKP-LOC	335430
1	80	DO	Latissimus	R	CKP-LOC	371329
1	80	LORU	Latissimus	R	CKP-LOC	355369
1	80	ROLU	Latissimus	R	CKP-LOC	344261
2	60	DO	Latissimus	R	CKP-LOC	329844
2	60	LORU	Latissimus	R	CKP-LOC	320623
2	60	ROLU	Latissimus	R	CKP-LOC	318709
2	80	DO	Latissimus	R	CKP-LOC	331954
2	80	LORU	Latissimus	R	CKP-LOC	329061
2	80	ROLU	Latissimus	R	CKP-LOC	349657
3	60	DO	Latissimus	R	CKP-LOC	270578
3	60	LORU	Latissimus	R	CKP-LOC	240390
3	60	ROLU	Latissimus	R	CKP-LOC	224640
3	80	DO	Latissimus	R	CKP-LOC	71615
3	80	LORU	Latissimus	R	CKP-LOC	54998
3	80	ROLU	Latissimus	R	CKP-LOC	48794
4	60	DO	Latissimus	R	CKP-LOC	150043
4	60	LORU	Latissimus	R	CKP-LOC	195670
4	60	ROLU	Latissimus	R	CKP-LOC	139481
4	80	DO	Latissimus	R	CKP-LOC	207307
4	80	LORU	Latissimus	R	CKP-LOC	257518
4	80	ROLU	Latissimus	R	CKP-LOC	224961
5	60	DO	Latissimus	R	CKP-LOC	139769
5	60	LORU	Latissimus	R	CKP-LOC	133618
5	60	ROLU	Latissimus	R	CKP-LOC	125936
5	80	DO	Latissimus	R	CKP-LOC	143334

5	80	LORU	Latissimus	R	CKP-LOC	202882
5	80	ROLU	Latissimus	R	CKP-LOC	205151
6	60	DO	Latissimus	R	CKP-LOC	164464
6	60	LORU	Latissimus	R	CKP-LOC	142240
6	60	ROLU	Latissimus	R	CKP-LOC	118098
6	80	DO	Latissimus	R	CKP-LOC	189013
6	80	LORU	Latissimus	R	CKP-LOC	193849
6	80	ROLU	Latissimus	R	CKP-LOC	203473
7	60	DO	Latissimus	R	CKP-LOC	240732
7	60	LORU	Latissimus	R	CKP-LOC	240740
7	60	ROLU	Latissimus	R	CKP-LOC	223223
7	80	DO	Latissimus	R	CKP-LOC	246846
7	80	LORU	Latissimus	R	CKP-LOC	255803
7	80	ROLU	Latissimus	R	CKP-LOC	255076
8	60	DO	Latissimus	R	CKP-LOC	331713
8	60	LORU	Latissimus	R	CKP-LOC	299556
8	60	ROLU	Latissimus	R	CKP-LOC	299149
8	80	DO	Latissimus	R	CKP-LOC	340908
8	80	LORU	Latissimus	R	CKP-LOC	343008
8	80	ROLU	Latissimus	R	CKP-LOC	342624
9	60	DO	Latissimus	R	CKP-LOC	147534
9	60	LORU	Latissimus	R	CKP-LOC	147359
9	60	ROLU	Latissimus	R	CKP-LOC	136406
9	80	DO	Latissimus	R	CKP-LOC	211283
9	80	LORU	Latissimus	R	CKP-LOC	220510
9	80	ROLU	Latissimus	R	CKP-LOC	219064
10	60	DO	Latissimus	R	CKP-LOC	291629
10	60	LORU	Latissimus	R	CKP-LOC	337505
10	60	ROLU	Latissimus	R	CKP-LOC	311155
10	80	DO	Latissimus	R	CKP-LOC	354870
10	80	LORU	Latissimus	R	CKP-LOC	345030
10	80	ROLU	Latissimus	R	CKP-LOC	357696
1	60	DO	Latissimus	R	LOC-EKP	347537
1	60	LORU	Latissimus	R	LOC-EKP	349786
1	60	ROLU	Latissimus	R	LOC-EKP	334560
1	80	DO	Latissimus	R	LOC-EKP	348411
1	80	LORU	Latissimus	R	LOC-EKP	354968
1	80	ROLU	Latissimus	R	LOC-EKP	350095
2	60	DO	Latissimus	R	LOC-EKP	212315
2	60	LORU	Latissimus	R	LOC-EKP	233713
2	60	ROLU	Latissimus	R	LOC-EKP	216998
2	80	DO	Latissimus	R	LOC-EKP	232267
2	80	LORU	Latissimus	R	LOC-EKP	246161
2	80	ROLU	Latissimus	R	LOC-EKP	267877
3	60	DO	Latissimus	R	LOC-EKP	220009
3	60	LORU	Latissimus	R	LOC-EKP	178757
3	60	ROLU	Latissimus	R	LOC-EKP	163545
3	80	DO	Latissimus	R	LOC-EKP	33259
3	80	LORU	Latissimus	R	LOC-EKP	27334
3	80	ROLU	Latissimus	R	LOC-EKP	55741
4	60	DO	Latissimus	R	LOC-EKP	153021
4	60	LORU	Latissimus	R	LOC-EKP	181944
4	60	ROLU	Latissimus	R	LOC-EKP	150194
4	80	DO	Latissimus	R	LOC-EKP	189680
4	80	LORU	Latissimus	R	LOC-EKP	218897
4	80	ROLU	Latissimus	R	LOC-EKP	182263
5	60	DO	Latissimus	R	LOC-EKP	124660
5	60	LORU	Latissimus	R	LOC-EKP	98452
5	60	ROLU	Latissimus	R	LOC-EKP	107011
5	80	DO	Latissimus	R	LOC-EKP	56386
5	80	LORU	Latissimus	R	LOC-EKP	156997
5	80	ROLU	Latissimus	R	LOC-EKP	170046
6	60	DO	Latissimus	R	LOC-EKP	127274
6	60	LORU	Latissimus	R	LOC-EKP	84234
6	60	ROLU	Latissimus	R	LOC-EKP	97258
6	80	DO	Latissimus	R	LOC-EKP	171997
6	80	LORU	Latissimus	R	LOC-EKP	158135
6	80	ROLU	Latissimus	R	LOC-EKP	147972
7	60	DO	Latissimus	R	LOC-EKP	212676
7	60	LORU	Latissimus	R	LOC-EKP	198622
7	60	ROLU	Latissimus	R	LOC-EKP	191001

7	80	DO	Latissimus	R	LOC-EKP	207818
7	80	LORU	Latissimus	R	LOC-EKP	221962
7	80	ROLU	Latissimus	R	LOC-EKP	224034
8	60	DO	Latissimus	R	LOC-EKP	288618
8	60	LORU	Latissimus	R	LOC-EKP	249750
8	60	ROLU	Latissimus	R	LOC-EKP	232460
8	80	DO	Latissimus	R	LOC-EKP	314395
8	80	LORU	Latissimus	R	LOC-EKP	309664
8	80	ROLU	Latissimus	R	LOC-EKP	308183
9	60	DO	Latissimus	R	LOC-EKP	125824
9	60	LORU	Latissimus	R	LOC-EKP	124407
9	60	ROLU	Latissimus	R	LOC-EKP	112356
9	80	DO	Latissimus	R	LOC-EKP	191019
9	80	LORU	Latissimus	R	LOC-EKP	199908
9	80	ROLU	Latissimus	R	LOC-EKP	196840
10	60	DO	Latissimus	R	LOC-EKP	314821
10	60	LORU	Latissimus	R	LOC-EKP	286556
10	60	ROLU	Latissimus	R	LOC-EKP	304631
10	80	DO	Latissimus	R	LOC-EKP	332950
10	80	LORU	Latissimus	R	LOC-EKP	325590
10	80	ROLU	Latissimus	R	LOC-EKP	337286
1	60	DO	Latissimus	R	EKP-LC	364122
1	60	LORU	Latissimus	R	EKP-LC	352791
1	60	ROLU	Latissimus	R	EKP-LC	353258
1	80	DO	Latissimus	R	EKP-LC	354881
1	80	LORU	Latissimus	R	EKP-LC	367189
1	80	ROLU	Latissimus	R	EKP-LC	365543
2	60	DO	Latissimus	R	EKP-LC	320392
2	60	LORU	Latissimus	R	EKP-LC	310061
2	60	ROLU	Latissimus	R	EKP-LC	268360
2	80	DO	Latissimus	R	EKP-LC	304211
2	80	LORU	Latissimus	R	EKP-LC	318000
2	80	ROLU	Latissimus	R	EKP-LC	358461
3	60	DO	Latissimus	R	EKP-LC	254085
3	60	LORU	Latissimus	R	EKP-LC	255764
3	60	ROLU	Latissimus	R	EKP-LC	232617
3	80	DO	Latissimus	R	EKP-LC	51210
3	80	LORU	Latissimus	R	EKP-LC	63762
3	80	ROLU	Latissimus	R	EKP-LC	18617
4	60	DO	Latissimus	R	EKP-LC	182431
4	60	LORU	Latissimus	R	EKP-LC	207634
4	60	ROLU	Latissimus	R	EKP-LC	154872
4	80	DO	Latissimus	R	EKP-LC	203624
4	80	LORU	Latissimus	R	EKP-LC	197873
4	80	ROLU	Latissimus	R	EKP-LC	175710
5	60	DO	Latissimus	R	EKP-LC	182107
5	60	LORU	Latissimus	R	EKP-LC	195590
5	60	ROLU	Latissimus	R	EKP-LC	197106
5	80	DO	Latissimus	R	EKP-LC	114004
5	80	LORU	Latissimus	R	EKP-LC	244507
5	80	ROLU	Latissimus	R	EKP-LC	273161
6	60	DO	Latissimus	R	EKP-LC	136408
6	60	LORU	Latissimus	R	EKP-LC	132231
6	60	ROLU	Latissimus	R	EKP-LC	107731
6	80	DO	Latissimus	R	EKP-LC	158447
6	80	LORU	Latissimus	R	EKP-LC	195642
6	80	ROLU	Latissimus	R	EKP-LC	167552
7	60	DO	Latissimus	R	EKP-LC	257893
7	60	LORU	Latissimus	R	EKP-LC	256814
7	60	ROLU	Latissimus	R	EKP-LC	236949
7	80	DO	Latissimus	R	EKP-LC	236615
7	80	LORU	Latissimus	R	EKP-LC	260802
7	80	ROLU	Latissimus	R	EKP-LC	254816
8	60	DO	Latissimus	R	EKP-LC	319303
8	60	LORU	Latissimus	R	EKP-LC	309464
8	60	ROLU	Latissimus	R	EKP-LC	301755
8	80	DO	Latissimus	R	EKP-LC	358793
8	80	LORU	Latissimus	R	EKP-LC	362158
8	80	ROLU	Latissimus	R	EKP-LC	351237
9	60	DO	Latissimus	R	EKP-LC	210328
9	60	LORU	Latissimus	R	EKP-LC	198018

9	60	ROLU	Latissimus	R	EKP-LC	163165
9	80	DO	Latissimus	R	EKP-LC	215577
9	80	LORU	Latissimus	R	EKP-LC	237487
9	80	ROLU	Latissimus	R	EKP-LC	222555
10	60	DO	Latissimus	R	EKP-LC	351860
10	60	LORU	Latissimus	R	EKP-LC	349776
10	60	ROLU	Latissimus	R	EKP-LC	353679
10	80	DO	Latissimus	R	EKP-LC	368789
10	80	LORU	Latissimus	R	EKP-LC	360603
10	80	ROLU	Latissimus	R	EKP-LC	360512

Appendix 5: Joint Angle Raw Data

Elbow Angle	Knee Angle	Wrist Angle	Hip Angle	Subject	Intensity (% of 1-RM)	Grip	Left/Right	Point of Interest
57.92	58.00	8.74	124.12	1	60	DO	R	LIF
53.30	56.95	17.35	128.18	1	60	DO	L	LIF
51.54	61.03	19.75	123.71	1	60	LORU	R	LIF
55.58	57.76	15.63	127.36	1	60	LORU	L	LIF
47.26	57.52	11.90	120.07	1	60	ROLU	R	LIF
45.76	58.99	5.10	125.18	1	60	ROLU	L	LIF
59.96	53.23	10.18	123.01	1	80	DO	R	LIF
57.28	53.07	8.68	125.95	1	80	DO	L	LIF
46.64	51.32	21.37	123.74	1	80	LORU	R	LIF
65.67	54.14	20.40	124.47	1	80	LORU	L	LIF
62.23	50.17	8.20	126.85	1	80	ROLU	R	LIF
60.64	52.18	7.25	129.95	1	80	ROLU	L	LIF
61.18	74.74	10.06	126.59	2	60	DO	R	LIF
64.90	72.74	5.30	126.29	2	60	DO	L	LIF
65.12	75.41	4.91	129.30	2	60	LORU	R	LIF
66.38	75.67	4.39	128.25	2	60	LORU	L	LIF
60.29	70.55	10.69	127.84	2	60	ROLU	R	LIF
66.80	71.79	3.21	128.66	2	60	ROLU	L	LIF
60.85	68.92	9.69	126.10	2	80	DO	R	LIF
64.50	69.50	3.50	126.76	2	80	DO	L	LIF
62.94	67.92	5.65	129.02	2	80	LORU	R	LIF
65.50	67.53	6.27	127.35	2	80	LORU	L	LIF
49.50	68.62	9.89	124.91	2	80	ROLU	R	LIF
61.88	69.42	5.82	128.49	2	80	ROLU	L	LIF
36.90	69.95	8.97	125.04	3	60	DO	R	LIF
39.47	63.44	11.01	118.50	3	60	DO	L	LIF
36.19	61.90	16.00	124.98	3	60	LORU	R	LIF
44.34	58.66	10.76	122.09	3	60	LORU	L	LIF
38.42	63.35	7.19	126.98	3	60	ROLU	R	LIF
34.43	56.82	16.17	121.70	3	60	ROLU	L	LIF
37.51	60.21	8.65	125.39	3	80	DO	R	LIF
43.35	52.90	11.89	121.51	3	80	DO	L	LIF
36.76	44.92	17.99	125.97	3	80	LORU	R	LIF
47.86	48.89	7.97	122.82	3	80	LORU	L	LIF
37.44	61.88	3.64	125.30	3	80	ROLU	R	LIF
35.64	53.39	17.79	123.72	3	80	ROLU	L	LIF
43.67	63.93	3.63	122.97	4	60	DO	R	LIF
42.17	63.64	2.22	118.61	4	60	DO	L	LIF
46.78	83.03	15.12	132.59	4	60	LORU	R	LIF
48.51	81.14	2.87	126.99	4	60	LORU	L	LIF
43.85	70.58	5.78	126.10	4	60	ROLU	R	LIF
48.45	77.44	8.63	128.56	4	60	ROLU	L	LIF
45.75	81.02	10.71	130.56	4	80	DO	R	LIF
46.32	79.93	12.19	127.65	4	80	DO	L	LIF
44.37	80.20	17.07	133.62	4	80	LORU	R	LIF
46.24	77.73	3.54	128.86	4	80	LORU	L	LIF
42.72	78.17	5.86	129.32	4	80	ROLU	R	LIF
43.23	76.26	14.93	127.20	4	80	ROLU	L	LIF
40.87	78.64	10.13	126.65	5	60	DO	R	LIF
35.57	78.86	10.57	127.22	5	60	DO	L	LIF
42.71	81.06	17.52	131.19	5	60	LORU	R	LIF
38.37	79.01	7.13	128.87	5	60	LORU	L	LIF
40.95	83.28	8.96	128.01	5	60	ROLU	R	LIF
32.26	82.04	23.17	127.98	5	60	ROLU	L	LIF
47.02	66.91	13.24	127.99	5	80	DO	R	LIF
43.23	66.48	11.61	127.30	5	80	DO	L	LIF
45.04	74.25	17.62	129.59	5	80	LORU	R	LIF
43.73	71.99	3.98	126.36	5	80	LORU	L	LIF
46.75	73.77	6.93	128.43	5	80	ROLU	R	LIF
35.19	70.09	14.32	128.34	5	80	ROLU	L	LIF
38.14	79.94	16.99	125.59	6	60	DO	R	LIF
36.83	71.48	20.10	131.59	6	60	DO	L	LIF
43.03	67.02	19.01	142.38	6	60	LORU	R	LIF
40.72	68.05	6.56	130.22	6	60	LORU	L	LIF

38.39	71.87	5.69	128.55	6	60	ROLU	R	LIF
38.05	74.35	15.79	130.06	6	60	ROLU	L	LIF
42.36	69.23	16.38	128.05	6	80	DO	R	LIF
44.38	67.52	20.48	131.08	6	80	DO	L	LIF
49.83	61.29	5.77	129.15	6	80	LORU	R	LIF
40.91	63.42	24.29	132.79	6	80	LORU	L	LIF
40.90	66.89	14.72	129.49	6	80	ROLU	R	LIF
39.21	67.47	10.78	131.95	6	80	ROLU	L	LIF
43.48	74.30	13.59	132.51	7	60	DO	R	LIF
46.96	74.05	3.04	134.36	7	60	DO	L	LIF
47.19	68.18	8.27	133.55	7	60	LORU	R	LIF
47.12	67.81	1.82	135.01	7	60	LORU	L	LIF
47.63	68.57	16.64	135.33	7	60	ROLU	R	LIF
50.52	70.90	9.42	138.68	7	60	ROLU	L	LIF
44.97	67.20	22.35	131.37	7	80	DO	R	LIF
47.64	67.07	17.42	132.92	7	80	DO	L	LIF
49.47	79.91	6.42	134.90	7	80	LORU	R	LIF
43.66	78.13	6.28	133.73	7	80	LORU	L	LIF
48.55	66.90	12.02	131.93	7	80	ROLU	R	LIF
49.76	65.13	11.34	132.39	7	80	ROLU	L	LIF
44.27	70.29	9.79	123.53	8	60	DO	R	LIF
40.68	69.61	3.25	123.07	8	60	DO	L	LIF
45.37	82.02	13.37	128.06	8	60	LORU	R	LIF
45.99	80.11	5.84	125.89	8	60	LORU	L	LIF
47.11	76.27	9.23	127.57	8	60	ROLU	R	LIF
41.05	76.07	24.38	127.62	8	60	ROLU	L	LIF
45.80	69.61	20.58	121.27	8	80	DO	R	LIF
45.78	66.47	3.56	121.11	8	80	DO	L	LIF
45.90	74.78	15.30	126.21	8	80	LORU	R	LIF
49.08	71.36	5.05	122.53	8	80	LORU	L	LIF
49.28	79.88	10.32	128.84	8	80	ROLU	R	LIF
43.16	78.88	22.77	128.03	8	80	ROLU	L	LIF
42.51	68.11	15.90	128.72	9	60	DO	R	LIF
39.32	72.16	12.55	130.36	9	60	DO	L	LIF
32.22	70.15	12.33	128.61	9	60	LORU	R	LIF
40.76	70.95	7.74	130.39	9	60	LORU	L	LIF
42.60	68.10	15.00	127.93	9	60	ROLU	R	LIF
43.34	70.00	15.98	130.70	9	60	ROLU	L	LIF
50.58	61.52	17.24	126.95	9	80	DO	R	LIF
47.64	59.25	15.80	127.69	9	80	DO	L	LIF
41.68	61.71	12.67	128.72	9	80	LORU	R	LIF
37.73	65.58	5.55	128.02	9	80	LORU	L	LIF
44.03	58.25	11.94	127.82	9	80	ROLU	R	LIF
47.00	63.26	14.34	129.10	9	80	ROLU	L	LIF
45.04	62.05	7.68	120.10	10	60	DO	R	LIF
42.13	59.54	7.11	124.75	10	60	DO	L	LIF
31.30	63.95	25.96	123.86	10	60	LORU	R	LIF
39.39	62.93	7.42	127.46	10	60	LORU	L	LIF
44.48	70.43	7.74	120.78	10	60	ROLU	R	LIF
34.84	69.32	19.41	127.48	10	60	ROLU	L	LIF
39.68	61.09	6.32	122.99	10	80	DO	R	LIF
37.22	59.59	14.14	125.62	10	80	DO	L	LIF
31.16	57.43	24.98	123.55	10	80	LORU	R	LIF
38.28	57.72	6.63	126.59	10	80	LORU	L	LIF
39.50	57.05	7.03	121.06	10	80	ROLU	R	LIF
29.00	53.88	17.11	125.76	10	80	ROLU	L	LIF
46.50	14.29	9.01	82.64	1	60	DO	R	CKP
38.77	15.90	14.98	84.68	1	60	DO	L	CKP
45.23	24.27	24.30	85.50	1	60	LORU	R	CKP
41.75	18.71	10.67	90.40	1	60	LORU	L	CKP
47.38	11.64	11.12	80.60	1	60	ROLU	R	CKP
35.14	14.75	12.90	85.63	1	60	ROLU	L	CKP
55.99	21.00	11.92	84.96	1	80	DO	R	CKP
39.73	21.40	8.80	89.32	1	80	DO	L	CKP
44.69	18.02	24.38	86.12	1	80	LORU	R	CKP
48.73	20.02	21.74	87.27	1	80	LORU	L	CKP
54.06	19.94	12.25	87.30	1	80	ROLU	R	CKP
35.64	22.10	14.56	88.48	1	80	ROLU	L	CKP
50.54	13.07	8.61	89.55	2	60	DO	R	CKP
55.35	11.85	5.49	91.35	2	60	DO	L	CKP
48.83	16.34	13.53	94.04	2	60	LORU	R	CKP

52.63	12.40	1.45	95.81	2	60	LORU	L	CKP
52.36	11.19	8.53	91.31	2	60	ROLU	R	CKP
53.46	14.57	10.00	92.18	2	60	ROLU	L	CKP
50.32	22.57	8.19	89.82	2	80	DO	R	CKP
51.92	19.97	3.88	88.70	2	80	DO	L	CKP
48.21	23.85	12.73	94.41	2	80	LORU	R	CKP
51.31	21.90	1.12	90.46	2	80	LORU	L	CKP
48.15	23.43	7.45	92.99	2	80	ROLU	R	CKP
58.33	24.52	5.01	88.73	2	80	ROLU	L	CKP
35.91	33.40	8.16	93.45	3	60	DO	R	CKP
39.30	24.03	10.50	84.95	3	60	DO	L	CKP
34.61	32.25	15.83	97.62	3	60	LORU	R	CKP
41.58	21.18	10.01	93.41	3	60	LORU	L	CKP
36.28	28.80	6.17	85.71	3	60	ROLU	R	CKP
32.15	19.86	17.14	79.38	3	60	ROLU	L	CKP
35.60	26.94	5.51	87.57	3	80	DO	R	CKP
41.10	17.30	11.21	82.92	3	80	DO	L	CKP
37.41	18.58	15.54	84.57	3	80	LORU	R	CKP
43.11	25.64	7.51	78.63	3	80	LORU	L	CKP
37.74	27.80	2.33	82.42	3	80	ROLU	R	CKP
31.40	17.08	18.38	75.94	3	80	ROLU	L	CKP
41.58	30.88	3.49	89.00	4	60	DO	R	CKP
40.30	31.69	3.60	84.67	4	60	DO	L	CKP
39.14	35.33	16.36	93.92	4	60	LORU	R	CKP
44.80	36.55	4.28	90.59	4	60	LORU	L	CKP
42.52	31.00	5.33	91.43	4	60	ROLU	R	CKP
41.70	30.83	14.27	88.25	4	60	ROLU	L	CKP
43.03	29.60	7.71	88.75	4	80	DO	R	CKP
42.29	30.88	11.73	85.52	4	80	DO	L	CKP
38.96	30.50	15.93	92.43	4	80	LORU	R	CKP
42.60	30.61	3.55	90.38	4	80	LORU	L	CKP
43.18	29.55	5.92	90.72	4	80	ROLU	R	CKP
40.88	30.17	14.93	88.09	4	80	ROLU	L	CKP
43.03	28.50	9.93	92.71	5	60	DO	R	CKP
39.40	26.76	10.21	92.02	5	60	DO	L	CKP
45.26	29.37	19.07	98.93	5	60	LORU	R	CKP
44.52	27.24	6.11	97.24	5	60	LORU	L	CKP
43.88	28.80	7.82	97.23	5	60	ROLU	R	CKP
33.50	26.99	23.57	95.45	5	60	ROLU	L	CKP
43.98	24.20	7.98	91.21	5	80	DO	R	CKP
41.93	24.07	7.32	90.18	5	80	DO	L	CKP
38.71	24.95	22.04	93.15	5	80	LORU	R	CKP
44.47	24.17	3.43	92.34	5	80	LORU	L	CKP
46.66	21.64	6.60	95.42	5	80	ROLU	R	CKP
36.98	20.98	12.64	94.34	5	80	ROLU	L	CKP
38.87	35.37	18.64	93.16	6	60	DO	R	CKP
40.34	28.40	20.21	96.52	6	60	DO	L	CKP
43.38	58.18	20.17	94.00	6	60	LORU	R	CKP
40.17	50.16	6.62	93.91	6	60	LORU	L	CKP
38.69	26.34	6.16	95.23	6	60	ROLU	R	CKP
41.16	30.60	15.51	96.30	6	60	ROLU	L	CKP
42.78	24.32	13.05	86.68	6	80	DO	R	CKP
41.95	23.14	17.31	87.58	6	80	DO	L	CKP
45.00	19.40	5.52	76.34	6	80	LORU	R	CKP
41.72	22.71	17.88	76.16	6	80	LORU	L	CKP
41.80	21.99	12.18	80.32	6	80	ROLU	R	CKP
40.71	24.39	7.14	80.04	6	80	ROLU	L	CKP
43.38	27.15	16.45	98.33	7	60	DO	R	CKP
49.97	28.14	5.89	98.62	7	60	DO	L	CKP
48.86	28.25	7.17	98.31	7	60	LORU	R	CKP
49.44	28.03	3.38	97.93	7	60	LORU	L	CKP
44.89	27.63	14.17	99.51	7	60	ROLU	R	CKP
51.59	27.61	10.55	99.53	7	60	ROLU	L	CKP
43.69	29.61	21.53	96.88	7	80	DO	R	CKP
50.16	30.36	16.08	97.66	7	80	DO	L	CKP
54.75	30.81	2.71	101.36	7	80	LORU	R	CKP
51.81	29.90	3.73	99.26	7	80	LORU	L	CKP
49.29	30.28	13.73	99.33	7	80	ROLU	R	CKP
52.68	28.12	11.47	98.22	7	80	ROLU	L	CKP
42.54	31.30	11.74	94.72	8	60	DO	R	CKP
41.14	29.56	1.34	92.59	8	60	DO	L	CKP

43.34	43.83	16.92	105.15	8	60	LORU	R	CKP
47.94	40.96	4.69	102.68	8	60	LORU	L	CKP
44.08	32.62	7.59	95.94	8	60	ROLU	R	CKP
42.81	32.23	22.90	95.36	8	60	ROLU	L	CKP
44.31	31.27	17.98	92.81	8	80	DO	R	CKP
46.61	29.50	2.06	92.66	8	80	DO	L	CKP
41.39	35.07	17.76	99.31	8	80	LORU	R	CKP
49.03	32.08	6.38	95.88	8	80	LORU	L	CKP
43.22	23.75	5.99	79.61	8	80	ROLU	R	CKP
43.54	23.11	22.04	78.93	8	80	ROLU	L	CKP
42.28	24.39	13.23	97.29	9	60	DO	R	CKP
43.65	25.55	9.15	99.06	9	60	DO	L	CKP
38.01	25.14	13.13	97.49	9	60	LORU	R	CKP
46.62	25.07	6.05	98.94	9	60	LORU	L	CKP
42.57	21.34	11.35	96.90	9	60	ROLU	R	CKP
46.50	22.99	16.33	99.82	9	60	ROLU	L	CKP
43.26	27.68	15.74	79.80	9	80	DO	R	CKP
44.21	30.61	15.41	82.17	9	80	DO	L	CKP
37.48	25.26	13.92	97.51	9	80	LORU	R	CKP
39.08	26.96	1.51	98.76	9	80	LORU	L	CKP
43.37	27.78	9.04	98.87	9	80	ROLU	R	CKP
44.84	27.00	15.32	101.10	9	80	ROLU	L	CKP
44.81	27.71	4.35	84.49	10	60	DO	R	CKP
41.61	27.75	9.14	89.08	10	60	DO	L	CKP
31.78	29.88	27.15	93.10	10	60	LORU	R	CKP
40.41	31.09	6.60	97.18	10	60	LORU	L	CKP
43.40	27.70	9.51	85.41	10	60	ROLU	R	CKP
35.05	26.42	19.69	89.92	10	60	ROLU	L	CKP
38.76	26.33	5.49	88.55	10	80	DO	R	CKP
38.41	24.49	9.84	90.30	10	80	DO	L	CKP
31.74	26.28	27.49	91.80	10	80	LORU	R	CKP
38.42	26.91	6.25	95.45	10	80	LORU	L	CKP
38.40	28.71	7.08	89.88	10	80	ROLU	R	CKP
32.54	26.43	19.35	93.44	10	80	ROLU	L	CKP
41.74	18.50	14.58	19.60	1	60	DO	R	LOC
35.06	19.59	11.67	27.59	1	60	DO	L	LOC
31.52	22.95	24.82	13.73	1	60	LORU	R	LOC
33.93	17.10	8.64	15.86	1	60	LORU	L	LOC
39.61	17.49	16.47	11.60	1	60	ROLU	R	LOC
28.71	19.51	9.27	14.66	1	60	ROLU	L	LOC
41.80	20.48	12.30	19.85	1	80	DO	R	LOC
35.27	21.55	12.50	28.09	1	80	DO	L	LOC
28.67	16.04	25.30	15.78	1	80	LORU	R	LOC
42.65	17.26	19.77	11.71	1	80	LORU	L	LOC
38.84	20.12	14.67	15.59	1	80	ROLU	R	LOC
29.58	24.46	11.62	15.41	1	80	ROLU	L	LOC
42.40	10.86	10.53	11.13	2	60	DO	R	LOC
41.83	9.72	3.83	16.60	2	60	DO	L	LOC
41.23	13.25	9.32	12.17	2	60	LORU	R	LOC
40.87	11.26	5.61	14.17	2	60	LORU	L	LOC
45.08	11.02	12.74	8.62	2	60	ROLU	R	LOC
48.60	9.39	6.27	12.74	2	60	ROLU	L	LOC
41.30	14.46	11.97	8.77	2	80	DO	R	LOC
41.77	13.40	8.19	13.69	2	80	DO	L	LOC
39.88	17.81	9.85	13.63	2	80	LORU	R	LOC
41.01	13.43	3.76	14.72	2	80	LORU	L	LOC
43.73	10.46	9.74	23.95	2	80	ROLU	R	LOC
52.33	10.36	3.20	13.63	2	80	ROLU	L	LOC
29.28	11.72	6.77	20.54	3	60	DO	R	LOC
28.85	2.69	10.05	13.41	3	60	DO	L	LOC
24.67	12.43	14.35	16.89	3	60	LORU	R	LOC
30.45	3.88	9.72	15.03	3	60	LORU	L	LOC
29.01	7.99	6.56	17.23	3	60	ROLU	R	LOC
24.14	2.34	13.93	13.99	3	60	ROLU	L	LOC
30.81	11.45	8.32	13.89	3	80	DO	R	LOC
31.11	5.29	12.05	12.45	3	80	DO	L	LOC
24.62	5.40	14.70	10.90	3	80	LORU	R	LOC
30.36	10.16	9.41	11.68	3	80	LORU	L	LOC
29.78	9.92	3.98	9.01	3	80	ROLU	R	LOC
22.11	2.50	16.70	10.92	3	80	ROLU	L	LOC
37.86	14.78	3.90	14.37	4	60	DO	R	LOC

33.37	13.82	1.49	10.93	4	60	DO	L	LOC
35.08	19.47	15.45	14.73	4	60	LORU	R	LOC
36.14	20.34	0.48	12.54	4	60	LORU	L	LOC
38.85	14.45	5.47	11.23	4	60	ROLU	R	LOC
33.20	14.47	13.38	8.65	4	60	ROLU	L	LOC
39.12	15.60	7.20	12.40	4	80	DO	R	LOC
34.48	17.12	7.32	10.38	4	80	DO	L	LOC
34.29	16.69	15.61	11.94	4	80	LORU	R	LOC
35.18	17.32	2.32	11.87	4	80	LORU	L	LOC
39.66	17.52	6.04	13.90	4	80	ROLU	R	LOC
32.68	18.49	13.98	11.64	4	80	ROLU	L	LOC
37.02	2.20	8.65	21.26	5	60	DO	R	LOC
31.75	5.48	9.35	17.52	5	60	DO	L	LOC
32.64	5.57	18.92	22.85	5	60	LORU	R	LOC
33.38	6.54	7.14	20.63	5	60	LORU	L	LOC
36.24	7.03	8.72	24.36	5	60	ROLU	R	LOC
27.02	4.63	22.00	16.38	5	60	ROLU	L	LOC
36.05	5.40	8.83	23.27	5	80	DO	R	LOC
34.80	4.00	7.86	19.54	5	80	DO	L	LOC
29.77	10.49	20.95	25.90	5	80	LORU	R	LOC
33.85	7.28	4.98	23.06	5	80	LORU	L	LOC
35.86	11.02	7.61	27.75	5	80	ROLU	R	LOC
28.20	9.60	12.38	21.52	5	80	ROLU	L	LOC
31.32	13.88	16.25	19.02	6	60	DO	R	LOC
31.47	8.65	18.58	11.18	6	60	DO	L	LOC
26.88	4.84	16.93	5.21	6	60	LORU	R	LOC
29.34	7.13	4.71	4.61	6	60	LORU	L	LOC
31.94	10.81	5.06	4.14	6	60	ROLU	R	LOC
28.17	13.96	13.38	4.65	6	60	ROLU	L	LOC
32.22	7.69	15.75	4.40	6	80	DO	R	LOC
31.70	9.99	16.89	4.85	6	80	DO	L	LOC
32.02	4.71	6.30	2.55	6	80	LORU	R	LOC
31.18	8.29	16.48	5.76	6	80	LORU	L	LOC
31.15	6.25	12.44	4.42	6	80	ROLU	R	LOC
28.35	8.43	3.60	3.76	6	80	ROLU	L	LOC
38.42	14.41	12.85	22.69	7	60	DO	R	LOC
41.36	11.58	1.56	19.30	7	60	DO	L	LOC
34.70	11.58	10.73	19.96	7	60	LORU	R	LOC
39.20	11.58	2.63	20.93	7	60	LORU	L	LOC
36.70	8.55	10.69	19.65	7	60	ROLU	R	LOC
36.51	10.10	11.29	16.13	7	60	ROLU	L	LOC
37.05	13.62	14.66	18.32	7	80	DO	R	LOC
37.33	10.18	10.14	13.72	7	80	DO	L	LOC
37.91	12.48	8.01	20.18	7	80	LORU	R	LOC
38.74	10.36	1.70	19.84	7	80	LORU	L	LOC
37.74	14.31	9.50	20.81	7	80	ROLU	R	LOC
35.83	11.82	11.41	14.64	7	80	ROLU	L	LOC
37.73	12.29	9.56	14.05	8	60	DO	R	LOC
35.14	13.69	2.17	12.44	8	60	DO	L	LOC
36.87	13.56	13.40	6.00	8	60	LORU	R	LOC
36.69	13.03	7.55	5.76	8	60	LORU	L	LOC
41.06	11.43	8.19	5.86	8	60	ROLU	R	LOC
34.80	11.41	23.62	5.93	8	60	ROLU	L	LOC
42.83	13.05	17.91	5.44	8	80	DO	R	LOC
41.27	12.88	6.60	4.83	8	80	DO	L	LOC
35.68	15.88	16.09	4.44	8	80	LORU	R	LOC
40.67	16.29	6.48	5.35	8	80	LORU	L	LOC
40.63	14.19	8.28	3.84	8	80	ROLU	R	LOC
34.06	14.64	23.33	6.61	8	80	ROLU	L	LOC
36.82	12.35	13.94	9.16	9	60	DO	R	LOC
37.80	11.69	10.36	9.06	9	60	DO	L	LOC
30.36	9.60	11.37	4.87	9	60	LORU	R	LOC
38.04	10.10	8.86	8.08	9	60	LORU	L	LOC
36.45	13.97	12.23	10.84	9	60	ROLU	R	LOC
31.49	14.14	16.63	8.55	9	60	ROLU	L	LOC
41.62	4.87	19.36	3.12	9	80	DO	R	LOC
39.75	5.81	18.71	4.13	9	80	DO	L	LOC
29.34	10.97	12.89	13.56	9	80	LORU	R	LOC
35.48	10.34	4.78	14.81	9	80	LORU	L	LOC
38.98	9.85	11.99	12.33	9	80	ROLU	R	LOC
31.10	13.44	16.84	11.07	9	80	ROLU	L	LOC

41.92	17.36	7.77	23.74	10	60	DO	R	LOC
38.68	15.65	7.52	28.00	10	60	DO	L	LOC
26.45	21.00	25.39	18.12	10	60	LORU	R	LOC
36.45	19.02	8.81	24.10	10	60	LORU	L	LOC
39.58	21.09	11.96	21.41	10	60	ROLU	R	LOC
29.31	19.22	18.55	25.75	10	60	ROLU	L	LOC
35.54	27.55	9.17	23.18	10	80	DO	R	LOC
35.84	25.62	10.18	25.24	10	80	DO	L	LOC
27.01	26.01	25.61	23.91	10	80	LORU	R	LOC
35.50	24.71	7.92	28.39	10	80	LORU	L	LOC
35.42	25.29	8.58	24.85	10	80	ROLU	R	LOC
29.32	24.56	16.77	27.14	10	80	ROLU	L	LOC
45.70	23.32	11.15	86.76	1	60	DO	R	EKP
45.55	23.81	12.19	89.62	1	60	DO	L	EKP
40.85	31.46	23.58	87.09	1	60	LORU	R	EKP
46.67	27.01	8.56	90.26	1	60	LORU	L	EKP
46.74	25.83	12.56	83.91	1	60	ROLU	R	EKP
42.44	27.04	9.95	88.92	1	60	ROLU	L	EKP
50.80	24.10	11.21	85.74	1	80	DO	R	EKP
47.45	24.33	10.43	87.58	1	80	DO	L	EKP
40.85	23.40	24.98	86.16	1	80	LORU	R	EKP
59.03	27.13	21.31	86.57	1	80	LORU	L	EKP
48.79	18.71	11.18	86.58	1	80	ROLU	R	EKP
42.30	23.48	11.64	87.01	1	80	ROLU	L	EKP
50.11	40.03	8.25	92.50	2	60	DO	R	EKP
55.34	38.92	1.34	89.39	2	60	DO	L	EKP
53.07	45.31	9.12	97.48	2	60	LORU	R	EKP
58.67	45.27	3.33	95.85	2	60	LORU	L	EKP
51.94	42.70	8.97	95.73	2	60	ROLU	R	EKP
55.52	44.27	6.99	92.57	2	60	ROLU	L	EKP
48.39	35.44	10.06	87.87	2	80	DO	R	EKP
53.07	38.24	7.41	89.44	2	80	DO	L	EKP
51.13	41.06	10.30	96.67	2	80	LORU	R	EKP
55.96	38.89	1.08	91.00	2	80	LORU	L	EKP
53.82	33.71	8.31	94.15	2	80	ROLU	R	EKP
63.32	33.94	3.83	89.40	2	80	ROLU	L	EKP
38.01	37.99	7.81	93.81	3	60	DO	R	EKP
39.74	39.87	9.58	62.96	3	60	DO	L	EKP
33.86	33.57	15.00	96.16	3	60	LORU	R	EKP
42.17	25.36	7.85	90.76	3	60	LORU	L	EKP
36.09	30.41	6.58	82.62	3	60	ROLU	R	EKP
31.77	20.71	16.29	74.94	3	60	ROLU	L	EKP
38.32	29.97	7.70	87.42	3	80	DO	R	EKP
43.87	23.11	12.01	82.20	3	80	DO	L	EKP
33.70	42.54	16.41	86.19	3	80	LORU	R	EKP
44.55	27.20	8.42	80.60	3	80	LORU	L	EKP
36.57	30.19	2.60	85.87	3	80	ROLU	R	EKP
33.59	22.72	18.44	81.65	3	80	ROLU	L	EKP
43.43	42.92	3.22	92.42	4	60	DO	R	EKP
41.74	42.92	2.83	89.27	4	60	DO	L	EKP
42.21	47.98	15.11	95.35	4	60	LORU	R	EKP
50.36	46.49	1.32	93.80	4	60	LORU	L	EKP
44.45	45.74	4.74	96.02	4	60	ROLU	R	EKP
41.25	45.97	13.03	93.27	4	60	ROLU	L	EKP
47.16	43.42	7.75	92.97	4	80	DO	R	EKP
48.02	46.00	8.85	91.86	4	80	DO	L	EKP
40.17	42.86	15.82	93.58	4	80	LORU	R	EKP
48.80	41.84	1.37	92.45	4	80	LORU	L	EKP
46.11	41.42	5.97	94.36	4	80	ROLU	R	EKP
40.05	40.89	13.70	92.16	4	80	ROLU	L	EKP
42.98	35.13	8.42	92.68	5	60	DO	R	EKP
37.96	34.44	9.00	92.61	5	60	DO	L	EKP
38.05	38.12	19.46	97.92	5	60	LORU	R	EKP
39.12	36.92	6.31	96.73	5	60	LORU	L	EKP
41.21	37.62	7.78	96.80	5	60	ROLU	R	EKP
31.64	36.35	22.28	96.16	5	60	ROLU	L	EKP
45.51	32.12	11.20	93.35	5	80	DO	R	EKP
42.89	31.03	11.60	92.40	5	80	DO	L	EKP
37.83	37.64	21.04	96.49	5	80	LORU	R	EKP
42.64	35.86	5.07	95.25	5	80	LORU	L	EKP
46.45	35.00	7.47	95.16	5	80	ROLU	R	EKP

33.30	33.19	13.05	94.63	5	80	ROLU	L	EKP
37.42	55.65	14.25	93.05	6	60	DO	R	EKP
37.75	39.90	17.04	95.04	6	60	DO	L	EKP
35.37	25.74	17.09	96.12	6	60	LORU	R	EKP
33.95	26.27	4.87	95.85	6	60	LORU	L	EKP
37.63	41.80	4.41	96.59	6	60	ROLU	R	EKP
37.59	43.55	13.34	95.70	6	60	ROLU	L	EKP
40.40	36.87	14.76	87.08	6	80	DO	R	EKP
40.11	34.87	16.82	85.94	6	80	DO	L	EKP
41.34	37.04	7.64	76.88	6	80	LORU	R	EKP
38.94	37.61	16.66	76.08	6	80	LORU	L	EKP
38.66	37.83	12.98	81.08	6	80	ROLU	R	EKP
38.39	38.75	5.23	76.78	6	80	ROLU	L	EKP
43.97	34.49	13.80	97.86	7	60	DO	R	EKP
47.08	33.24	3.86	98.76	7	60	DO	L	EKP
44.29	32.63	7.42	97.84	7	60	LORU	R	EKP
48.13	33.36	0.72	98.66	7	60	LORU	L	EKP
43.07	33.02	11.55	99.89	7	60	ROLU	R	EKP
45.90	33.99	10.54	101.26	7	60	ROLU	L	EKP
45.09	38.38	18.41	98.00	7	80	DO	R	EKP
46.23	39.73	13.64	99.38	7	80	DO	L	EKP
46.60	36.82	4.75	98.66	7	80	LORU	R	EKP
46.64	35.97	1.16	97.63	7	80	LORU	L	EKP
45.65	35.19	12.14	100.27	7	80	ROLU	R	EKP
46.17	34.07	11.29	100.25	7	80	ROLU	L	EKP
42.78	35.95	8.16	94.44	8	60	DO	R	EKP
40.75	35.00	3.82	90.81	8	60	DO	L	EKP
44.85	47.17	13.74	104.03	8	60	LORU	R	EKP
44.37	44.31	5.00	101.59	8	60	LORU	L	EKP
45.91	34.37	7.72	96.59	8	60	ROLU	R	EKP
40.29	33.66	25.56	93.18	8	60	ROLU	L	EKP
47.81	34.78	19.85	95.81	8	80	DO	R	EKP
47.53	32.39	4.26	94.31	8	80	DO	L	EKP
43.65	37.86	15.70	99.75	8	80	LORU	R	EKP
47.84	35.60	4.55	95.81	8	80	LORU	L	EKP
46.25	32.13	8.74	82.86	8	80	ROLU	R	EKP
40.44	29.88	24.58	78.92	8	80	ROLU	L	EKP
41.74	23.58	13.14	95.54	9	60	DO	R	EKP
43.46	25.46	9.57	96.45	9	60	DO	L	EKP
36.98	23.46	13.61	97.54	9	60	LORU	R	EKP
43.84	25.80	6.59	97.59	9	60	LORU	L	EKP
41.61	23.52	11.25	96.91	9	60	ROLU	R	EKP
39.37	27.90	16.65	99.47	9	60	ROLU	L	EKP
47.44	23.40	16.70	80.55	9	80	DO	R	EKP
45.43	26.39	17.89	82.90	9	80	DO	L	EKP
39.51	27.25	13.72	98.15	9	80	LORU	R	EKP
42.12	32.91	2.66	99.23	9	80	LORU	L	EKP
44.90	22.57	9.82	98.63	9	80	ROLU	R	EKP
44.67	27.08	16.15	100.65	9	80	ROLU	L	EKP
43.18	35.05	5.23	82.57	10	60	DO	R	EKP
40.39	34.39	7.37	88.96	10	60	DO	L	EKP
30.45	35.87	26.35	91.69	10	60	LORU	R	EKP
38.80	34.34	7.95	97.39	10	60	LORU	L	EKP
42.91	34.89	9.44	83.63	10	60	ROLU	R	EKP
34.40	34.46	19.34	90.27	10	60	ROLU	L	EKP
39.49	29.86	8.41	84.97	10	80	DO	R	EKP
38.38	30.73	13.57	88.36	10	80	DO	L	EKP
30.96	32.85	26.78	90.34	10	80	LORU	R	EKP
39.38	33.91	7.80	95.36	10	80	LORU	L	EKP
38.76	33.50	7.03	88.27	10	80	ROLU	R	EKP
31.79	32.71	17.83	92.56	10	80	ROLU	L	EKP
45.65	47.60	10.05	118.21	1	60	DO	R	LC
43.15	47.13	12.44	120.74	1	60	DO	L	LC
41.79	49.92	24.05	117.66	1	60	LORU	R	LC
46.32	46.35	8.51	119.63	1	60	LORU	L	LC
45.61	49.93	12.22	115.68	1	60	ROLU	R	LC
42.13	48.42	10.36	119.47	1	60	ROLU	L	LC
55.88	41.70	10.16	117.49	1	80	DO	R	LC
50.29	42.53	8.74	119.29	1	80	DO	L	LC
46.41	39.23	22.34	116.99	1	80	LORU	R	LC
61.68	43.32	22.10	116.49	1	80	LORU	L	LC

52.25	37.02	10.73	119.13	1	80	ROLU	R	LC
47.26	40.28	11.13	121.28	1	80	ROLU	L	LC
52.93	64.67	7.26	122.08	2	60	DO	R	LC
58.18	62.31	1.43	122.91	2	60	DO	L	LC
57.52	67.96	7.62	127.00	2	60	LORU	R	LC
64.14	67.88	4.35	127.55	2	60	LORU	L	LC
57.31	62.12	8.21	125.71	2	60	ROLU	R	LC
64.59	61.47	5.38	126.06	2	60	ROLU	L	LC
62.60	59.22	10.92	127.06	2	80	DO	R	LC
68.75	60.09	10.80	124.63	2	80	DO	L	LC
55.31	58.81	7.07	127.82	2	80	LORU	R	LC
61.61	57.68	2.89	124.02	2	80	LORU	L	LC
57.84	55.23	7.45	124.08	2	80	ROLU	R	LC
72.06	52.42	2.55	126.17	2	80	ROLU	L	LC
36.93	72.39	7.47	121.36	3	60	DO	R	LC
39.39	63.46	10.51	115.62	3	60	DO	L	LC
36.19	56.86	15.21	124.25	3	60	LORU	R	LC
44.85	51.23	8.23	121.02	3	60	LORU	L	LC
39.11	59.74	7.20	125.64	3	60	ROLU	R	LC
35.70	50.50	18.56	121.00	3	60	ROLU	L	LC
37.54	59.12	8.14	124.62	3	80	DO	R	LC
47.55	52.79	12.58	121.40	3	80	DO	L	LC
36.77	37.94	17.16	124.26	3	80	LORU	R	LC
49.33	40.14	6.62	122.23	3	80	LORU	L	LC
38.09	55.48	2.50	124.90	3	80	ROLU	R	LC
35.23	47.47	19.91	123.50	3	80	ROLU	L	LC
43.92	65.95	2.82	120.40	4	60	DO	R	LC
42.76	67.23	3.57	117.61	4	60	DO	L	LC
45.92	79.88	14.06	126.72	4	60	LORU	R	LC
54.05	75.02	1.15	125.24	4	60	LORU	L	LC
45.86	65.01	4.76	122.06	4	60	ROLU	R	LC
43.60	76.08	12.26	125.27	4	60	ROLU	L	LC
52.33	74.09	5.04	127.71	4	80	DO	R	LC
50.73	74.06	9.77	126.01	4	80	DO	L	LC
42.72	67.64	14.18	126.27	4	80	LORU	R	LC
54.92	64.09	0.76	123.94	4	80	LORU	L	LC
48.78	59.28	4.32	127.71	4	80	ROLU	R	LC
44.20	61.54	14.35	128.34	4	80	ROLU	L	LC
44.51	64.48	7.74	123.76	5	60	DO	R	LC
40.05	67.02	9.13	126.19	5	60	DO	L	LC
44.59	69.66	18.78	130.69	5	60	LORU	R	LC
42.61	67.49	5.21	151.15	5	60	LORU	L	LC
45.62	68.61	5.88	128.74	5	60	ROLU	R	LC
34.69	67.54	23.17	129.20	5	60	ROLU	L	LC
49.80	52.68	8.03	127.07	5	80	DO	R	LC
46.35	52.39	8.11	127.41	5	80	DO	L	LC
45.65	58.11	20.62	130.09	5	80	LORU	R	LC
49.94	54.22	3.16	127.18	5	80	LORU	L	LC
51.24	57.54	5.53	127.35	5	80	ROLU	R	LC
40.26	53.71	13.11	127.36	5	80	ROLU	L	LC
37.19	74.81	14.59	123.26	6	60	DO	R	LC
37.32	66.34	17.38	127.73	6	60	DO	L	LC
41.12	57.86	16.41	125.66	6	60	LORU	R	LC
37.42	54.00	4.99	127.55	6	60	LORU	L	LC
40.31	65.49	5.81	127.16	6	60	ROLU	R	LC
39.06	66.80	12.98	127.78	6	60	ROLU	L	LC
42.04	58.30	13.65	125.15	6	80	DO	R	LC
41.05	55.87	16.32	127.90	6	80	DO	L	LC
45.71	55.49	9.15	128.27	6	80	LORU	R	LC
38.40	57.87	16.91	128.31	6	80	LORU	L	LC
40.85	54.14	12.00	128.10	6	80	ROLU	R	LC
37.96	54.77	7.85	128.93	6	80	ROLU	L	LC
42.50	71.75	16.26	129.54	7	60	DO	R	LC
47.19	69.66	6.13	130.25	7	60	DO	L	LC
44.96	63.50	8.23	130.68	7	60	LORU	R	LC
48.05	62.22	2.65	130.36	7	60	LORU	L	LC
43.75	63.84	12.43	129.94	7	60	ROLU	R	LC
49.61	64.91	11.94	134.02	7	60	ROLU	L	LC
42.62	67.17	21.73	128.72	7	80	DO	R	LC
47.20	67.18	17.05	131.43	7	80	DO	L	LC
51.52	65.68	4.27	131.58	7	80	LORU	R	LC

47.68	62.13	6.58	128.16	7	80	LORU	L	LC
44.36	58.40	14.66	130.09	7	80	ROLU	R	LC
53.80	57.32	8.36	131.26	7	80	ROLU	L	LC
43.95	63.58	8.96	122.59	8	60	DO	R	LC
41.79	61.23	4.43	119.58	8	60	DO	L	LC
47.54	72.70	13.33	125.86	8	60	LORU	R	LC
47.40	70.52	4.58	122.54	8	60	LORU	L	LC
48.42	64.02	6.53	124.73	8	60	ROLU	R	LC
41.61	62.53	25.89	123.58	8	60	ROLU	L	LC
48.42	57.91	18.13	122.39	8	80	DO	R	LC
49.14	55.74	2.22	121.48	8	80	DO	L	LC
43.29	59.44	15.57	123.61	8	80	LORU	R	LC
50.40	57.61	5.60	120.53	8	80	LORU	L	LC
48.28	54.63	6.02	123.27	8	80	ROLU	R	LC
42.90	52.91	24.11	122.39	8	80	ROLU	L	LC
42.61	54.60	12.93	122.73	9	60	DO	R	LC
43.01	56.56	8.82	124.51	9	60	DO	L	LC
37.76	54.18	13.23	124.43	9	60	LORU	R	LC
43.87	54.88	6.05	124.04	9	60	LORU	L	LC
42.05	52.60	10.84	125.12	9	60	ROLU	R	LC
44.37	56.22	15.85	127.52	9	60	ROLU	L	LC
49.26	45.17	14.06	123.31	9	80	DO	R	LC
47.48	46.65	15.25	124.55	9	80	DO	L	LC
39.50	52.53	13.25	125.07	9	80	LORU	R	LC
38.10	55.26	3.72	124.07	9	80	LORU	L	LC
46.40	48.91	8.58	126.96	9	80	ROLU	R	LC
46.59	52.55	15.87	129.24	9	80	ROLU	L	LC
46.11	53.97	4.59	119.34	10	60	DO	R	LC
43.17	50.81	6.45	124.01	10	60	DO	L	LC
32.47	51.25	27.38	123.68	10	60	LORU	R	LC
42.04	49.33	6.04	126.43	10	60	LORU	L	LC
45.42	55.54	10.24	121.87	10	60	ROLU	R	LC
38.92	51.49	20.36	126.68	10	60	ROLU	L	LC
40.35	50.79	5.75	119.84	10	80	DO	R	LC
39.31	49.22	11.48	122.20	10	80	DO	L	LC
32.75	48.71	28.39	122.89	10	80	LORU	R	LC
40.93	49.07	6.22	125.25	10	80	LORU	L	LC
40.58	46.67	7.16	119.57	10	80	ROLU	R	LC
33.30	43.93	18.97	123.21	10	80	ROLU	L	LC

References

1. Baechle, TR and Earle, RW. Essentials of Strength Training and Conditioning. Human Kinetics, 2008.

2. Cholewicki, J, McGill, SM, and Norman, RW. Lumbar spine loads during the lifting of extremely heavy weights. *Med Sci Sports Exerc* 23: 1179-1186, 1991.

3. Cogley, RM, Archambault, TA, Fibeger, JF, Koverman, MM, Youdas, JW, and Hollman, JH. Comparison of Muscle Activation Using Various Hand Positions During the Push-Up Exercise. *J Strength Cond Res* 19(3): 628-633, 2005.

4. Colson, SS, Martin, A, and Van Hoecke, J. Effects of electrostimulation versus voluntary isometric training on elbow flexor muscle strength. *J Electromyogr Kinesiol* 19: e311-e319, 2009.

5. Ebben, WP, Feldman, CR, Dayne, A, Mitsche, D, Alexander, P, and Knetzger, KJ. Muscle Activation during Lower Body Resistance Training. *Int J Sports Med* 30: 1-8, 2009.

6. Elliott, BC, Wilson, GJ, and Kerr, GK. A biomechanical analysis of the sticking region in the bench press. *Med Sci Sports Exerc*. 21: 450-462, 1989.

7. Escamilla, RF, Francisco, AC, Kayes, AV, Speer, KP, and Moorman III, CT. An electromyographic analysis of sumo and conventional style deadlifts. *Med Sci Sports Exerc* 34: 682-688, 2002.

8. Escamilla, RF, Lowry, TM, Osbahr, DC, and Speer, KP. Biomechanical analysis of the deadlift during the 1999 Special Olympics World Games. *Med Sci Sports Exerc* 33(8): 1345-1353, 2001.

9. Escamilla, RF, Francisco, AC, Fleisig, GS, Barrentine, SW, Welch, CM, Kayes, AV, Speer, KP, and Andrews, JR. A three-dimensional biomechanical analysis of sumo and conventional style deadlifts. *Med Sci Sports Exerc* 32: 1265-1275, 2000.

10. Garfinkel, S and Cafarelli, E. Relative changes in maximal force, EMG, and muscle cross-sectional area after isometric training. *Med Sci Sports Exerc* 24(11): 1220-1227, 1992.

11. Gotshalk, L. Analysis of the deadlift. *NSCA Journal*. January: 4-5; 74-78, 1985.

12. Hales, ME, Johnson, BF, and Johnson, JT. Kinematic Analysis of the Powerlifting Style Squat and the Conventional Deadlift: Is There a Cross-Over Effect Between Lifts? *J Strength Cond Res* 23(9): 2574-2580, 2009.

13. Hides, JA, Stokes, MJ, Saide, M, Jull, GA, and Cooper, DH. Evidence of lumbar multifidus muscle wasting ipsilateral to symptoms in patients with acute/subacute low back pain. *Spine* 19: 165-172, 1994.

14. Hodges, PW, and Richardson, CA. Inefficient muscular stabilization of the lumbar spine associated with low back pain. *Spine* 21: 2640-2650, 1996.

15. Lehman, GJ. The Influence of Grip Width and Forearm Pronation/Supination on Upper-Body Myoelectric Activity During the Flat Bench Press. *J Strength Cond Res* 19(3): 587-591, 2005.

16. Lehman, GJ, Buchan, DD, Lundy, A, Myers, N, and Nalborczyk, A. Variations in muscle activation levels during traditional latissimus dorsi weight training exercises: An experimental study. *Dynamic Medicine* 3(4), 2004.

17. Lifting Q&A. *Men's Fitness*. 22(7): 141-141, 2006.

18. Lynn, SK and Costigan, PA. Changes in the medial-lateral hamstring activation ratio with foot rotation during lower limb exercise. *J Electromyogr Kinesiol* 19: e197-e205, 2009.

19. Maffiuletti, NA and Martin, A. Progressive versus rapid rate of contraction during 7 wk of isometric resistance training. *Med Sci Sports Exerc* 33(7): 1220-1227, 2001.

20. McGuigan, MRM, and Wilson, BD. Biomechanical analysis of the deadlift. *J Strength Cond Res* 10: 250-255, 1996.

21. Noe, DA, Mostardi, RA, Jackson, ME, Porterfield, JA, and Askew, MJ. Myoelectric Activity and Sequencing of Selected Trunk Muscles During Isokinetic Lifting. *Spine* 17(2): 225-229, 1992.

22. Nuzzo, JL, McCaulley, GO, Cormie, P, Cavill, MJ, and McBride, JM. Trunk Muscle Activity During Stability Ball and Free Weight Exercises. *J Strength Cond Res* 22(1): 95-101, 2008.

23. O'Sullivan, LW, and Gallwey, TJ. Upper-limb surface electro-myography at maximum supination and pronation torques: the effect of elbow and forearm angle. *J Electromyogr Kinesiol* 12: 275-285, 2002.

24. Paton, ME and Brown, JM. Functional differentiation within latissimus dorsi. *Electromyogr Clin Neurophysiol* 35(5): 301-309, 1995.

25. Signorile, JE, Zink, AJ, and Szwed, SP. A comparative electromyographical investigation of muscle utilization patterns using various hand positions during the lat pull-down. *J Strength Cond Res* 16(4): 539-546, 2002.

26. Stoutenberg, M, Pluchino, AP, Ma, F, Hoctor, JE, and Signorile, JF. The impact of foot position on electromyographical activity of the superficial quadriceps muscles during leg extension. *J Strength Cond Res*, 19(4): 931-938, 2005.

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