

Orthopaedic Clinical Tool #1: Lifting and Holding Legs or Arms in an Orthopaedic Setting

Introduction

Often when orthopaedic care is being provided, the care giver must lift and/or hold a limb in place while some type of treatment is being provided, such as cast application. It is assumed that you are maintaining a neutral (upright) body posture (not fully flexed); adjust the height of the table. When a caregiver must lift a leg or arm, it is important to make sure that the weight of the limb being lifted does not exceed the strength capability of the caregiver. An ergonomic tool has been developed to assist caregivers in determining whether a specific lift and/or hold of a limb is acceptable and whether some type of lift or hold assist device is needed. For lifts of limbs with casts, an alternate method is presented for assessing whether the lift is acceptable or not as presented in Table #1.

This tool shows the calculation of the average weight for an adult patient's leg and arm as a function of whole body mass, ranging from slim to morbidly obese body type. Weights are presented both in pounds (lbs.) and metric (kg.) units. Maximum lift and hold loads were calculated based on 75th percentile shoulder flexion strength and endurance capability for US adult females, where the maximum weight for a one-handed lift is 11.1 lbs. and a two-handed lift, 22.2lbs.

Table 1. Ergonomic Tool: Lifting and Holding Legs or Arms in an Orthopaedic Setting*

Patient Weight lbs. (kg.)	Body Part	Body Part Weight Lbs. (kg.)		Lift 1- hand	Lift 2- hand	Hold 2-hand 1 min.	Hold 2-hand 2 min.	Hold 2-hand 3 min.
<40 lbs.	Leg	<6.3 lbs.	(3 kg.)					
(< 18 kg.)	Arm	<2.0 lbs.	(1 kg.)					
40-90 lbs.	Leg	<14.1 lbs.	(6 kg.)					
(18-41 kg.)	Arm	<4.6 lbs.	(2 kg.)					
90-140 lbs.	Leg	<22.0 lbs.	(10 kg.)					
(41-64 kg.)	Arm	<7.1 lbs.	(3 kg.)					
140-190 lbs.	Leg	<29.8 lbs.	(14 kg.)					
(64-86 kg.)	Arm	<9.7 lbs.	(4 kg.)					
190-240 lbs.	Leg	<37.7 lbs.	(17 kg.)					
(86-109 kg.)	Arm	<12.2 lbs.	(6 kg.)					
240-290 lbs.	Leg	<45.5 lbs.	(21 kg.)					
(109-132 kg.)	Arm	<14.8 lbs.	(7 kg.)					
290-340 lbs.	Leg	<53.4 lbs.	(24 kg.)					
(132-155 kg.)	Arm	<17.3 lbs.	(8 kg.)					
340-390 lbs.	Leg	<61.2 lbs.	(28 kg.)					
(155-177 kg.)	Arm	<19.9 lbs.	(9 kg.)					
390-440 lbs.	Leg	<69.1 lbs.	(31 kg.)					
(177-200 kg.)	Arm	<22.2 lbs.	(10 kg.)					
> 440 lbs.	Leg	>69.1 lbs.	(31 kg.)					
(>200 kg.)	Arm	>22.2 lbs.	(10 kg.)					

* No shading: Lift and hold is appropriate but use clinical judgment and do not hold longer than noted.
 Heavy shading: Do not lift alone; use assistive device or more than one caregiver.

The shaded areas of the table indicate whether it would be acceptable for one caregiver to lift the listed body parts with one or two hands or hold the respective body parts for 1, 2, or 3 minutes with two hands. Respecting these limits will minimize risk of muscle fatigue and the potential for musculoskeletal disorders. If the limb weight exceeds the values listed in the table it is recommended to use assistive technology, such as a ceiling lift or floor based lift with a limb support sling. Orthopaedic caregivers must use clinical judgment to assess the need for additional staff member assistance or assistive devices to lift and/or hold one of these body parts for a particular period of time.

Note: It is important to remember that the chart shows the acceptable weights for limbs without a cast in place. If the caregiver is lifting a limb with a cast, the additional weight of the cast should be added to the weight of the limb to determine whether the lift is acceptable. An alternate method is provided below for limbs with casts. These are guidelines for the average weight of the leg and arm, and are based upon the patient's weight. The maximum weight for a 1-handed lift is 11.1 lbs. and a 2-handed lift, 22.2 lbs.

Patient weight is divided into weight categories (see Table 1), ranging from very light to morbidly obese. Normalized weight for each leg and each arm are calculated as a percentage of body weight where each complete arm weighs 5.1% of total body mass and each leg weighs 15.7% of total body mass (Chaffin, Anderson, & Martin, 1999). All weights are presented in both pounds and kilograms, rounded to the nearest whole unit.

To accommodate 75% of the US adult female working population, maximum load for a 1-handed lift is calculated to be 11.1 lbs. (5.0 kg.). This is determined by calculating the strength capabilities for 25th percentile US adult female maximum shoulder flexion movement (the mean equals 40 Newton meters, standard deviation equals 13 Nm) (Chaffin, Anderson, & Martin, 1999) and 75th percentile US adult female shoulder to grip length (the mean equals 610 mm, the standard deviation equals 30 mm) (Pheasant, 1992). Maximum loads for one person for a 2-handed lift (i.e., 22.2 lbs. /10.1 kg.) are calculated as twice that of a 1-handed lift. Muscle strength capabilities diminish as a function of time, therefore, maximum loads for 2-handed holding of body parts are presented for 1, 2, and 3 minute durations. After 1 minute, muscle endurance has decreased by 48%, decreased by 65% after 2 minutes, and, after 3 minutes of continuous holding, strength capability is only 29% of initial lifting strength (Rohmert, 1973, a, b). If the limits in ergonomic Table 1 are exceeded, additional staff members or assistive limb holders should be used.

References

- Chaffin, D. B., Anderson, G.B.J., & Martin, B.J. (1999). *Occupational biomechanics* (3rd ed.). New York, NY: J. Wiley & Sons
- Pheasant, S. (1992). *Bodyspace*. Taylor & Francis, Ltd: London.
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