1-RM SQUAT ASSESSMENT PROTOCOL

Objective: To evaluate lower-extremity strength using an unsupported, functional movement: the squat

Equipment:

- Barbell and squat rack
- Weights, ranging from 2.5-pound plates to 45-pound plates (1-kg to 20-kg plates)
- Collars
- Spotter (in addition to the personal trainer is preferred)

Pre-assessment procedure:

- After explaining the purpose of the assessment, explain and demonstrate the proper technique for the squat.
  - The client should stand behind a racked bar that is positioned below the shoulders, but above the nipple line.
  - He or she should grasp the bar with a closed, pronated (overhead) grip (hand placement depends on bar position) and step under the bar with the feet parallel to unrack the bar.
  - Position the barbell in the high-bar position (i.e., the bar is placed above the posterior deltoids, resting on the upper trapezius at the base of the neck with the hands slightly wider than shoulder-width apart), or the low-bar position, where the bar is placed across the posterior deltoids along the spine of the scapulae using a wider hand position.
  - The client engages the core and abdominal muscles to brace the trunk, then uses the lower extremity to unrack the bar and move into the starting position.
  - The client stands with the feet shoulder-width apart, back neutral, feet flat, chest up and out, and the head neutral or positioned facing slightly upward.
  - The lowering phase is initiated with flexion at the hips first, pushing the buttocks backward prior to bending the knees. This hip-hinge movement reduces the stress across the knee joint.
  - Range of motion during the squat is from standing with legs straight to a squatting position with the knees bent slightly more than 90 degrees, or until the thighs are parallel to the floor.
  - The client inhales during the lowering phase and exhales during the lifting phase. Breath-holding (i.e., Valsalva maneuver) should be avoided.
  - Throughout the movement, the heels must remain in contact with the floor, and the upward phase is performed by pushing through the heels.
  - It is important for the client to communicate with the spotter if he or she cannot complete the repetition.
  - Instruct the client to avoid locking the knees and not to exceed a parallel-with-the-floor position with the thighs.
- Encourage the client to perform a few practice trials to ensure proper technique.
- The goal of this assessment is to determine the client's one-repetition maximum (1-RM). It is important not to fatigue the client by having him or her perform too many "unnecessary" repetitions. Finding a suitable starting weight is important.

Assessment protocol and administration:

- Explain the assessment protocol for a 1-RM squat.
  - The client should warm up with one set of light resistance that allows five to 10 repetitions, and then rest for one minute.
  - Based on the client's warm-up effort, determine a suitable workload for the second set that allows for three to five repetitions by increasing the weight by 30 to 40 pounds (13.7 to 18.2 kg) or 10 to 20%, after which the client will rest for two minutes. Use the following guideline for determining workload increases throughout this assessment:
    - Increase the weight by 10 to 20%.
  - Next, have the client perform one heavy set of two to three repetitions and rest for two to four minutes.
- Based on the client's third set, determine the next workload to find the client's 1-RM effort.
- Allow the client to attempt this set. If the client is successful, he or she should rest for two to four minutes and repeat the 1-RM effort with a heavier load.
- If the attempt was unsuccessful, decrease the load accordingly [by 15 to 20 pounds (6.8 to 9.1 kg) or 5 to 10%] and have the client try again after resting for two to four minutes.
- Continue to adjust the resistance level until a true 1-RM is achieved. *Ideally, the client should achieve his or her 1-RM in three to five testing sets.*

- The final successful load is recorded as the absolute strength.
- Record the weight, progression, sets, repetitions, and any comments on the client's progress on the assessment form.
- Calculate relative strength and record that value as well.
  - For example, if Jose's actual 1-RM was measured at 230 lb (104.5 kg) and he weighs 175 lb (79.5 kg), then his strength-to-weight ratio, or relative strength, would be 1.31 (230/175 or 104.5/79.5).

Interpretation:

- Record the client's performance and use the results as a baseline against which to measure future progress.

If you decide not to use 1-RM testing at this time the following tables can be used to predict a 1-RM based off the actual number of repetitions completed with a given weight.

1-RM—Repetition Table

Repetitions	% 1-RM
1	100
2	95
3	93
4	90
5	87
6	85
7	83
8	80
9	77
10	75
11	70
12	67
15	65

Note: 1-RM = One-repetition maximum

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One-repetition Maximum (1-RM) Prediction Coefficients

Number of repetitions completed	Squat or leg press coefficient	Bench or chest press coefficient
1	1.000	1.000
2	1.0475	1.035
3	1.13	1.08
4	1.1575	1.115
5	1.2	1.15
6	1.242	1.18
7	1.284	1.22
8	1.326	1.255
9	1.368	1.29
10	1.41	1.325

Source: Brzycki, M. (1993). Strength testing: Predicting a one-rep max from reps-to-fatigue. *Journal of Physical Education, Recreation, and Dance,* 64, 1, 88–90.