

ADDENDUM

BIODEX ADVANTAGE SOFTWARE VERSION 4.59 (OR HIGHER)

HAMSTRING INJURY TEST PROTOCOLS

830-000
830-550
835-000
840-000
850-000
852-000



BIODEX
Biomedex Medical Systems, Inc.

20 Ramsey Road, Shirley, New York, 11967-4704, Tel: 800-224-6339 (Int'l 631-924-9000), Fax: 631-924-9241, Email: info@biomedex.com, www.biomedex.com

This manual contains operating procedures for the following Biodex products:

830-000	System 3 QUICK-SET
830-550	Attachment, Hamstring (set)
835-000	System 3 PRO
840-000	System 4 QUICK-SET
850-000	System 4 PRO
852-000	System 4 MVP

Contact Information

Biodex Medical Systems, Inc.

20 Ramsey Road, Shirley, New York, 11967-4704

Tel: 800-224-6339 (Int'l: 631-924-9000)

Fax: 631-924-8355

email: supportservices@biodex.com

www.biodex.com

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1. Introduction

Regardless of whether you have an existing process for protecting and strengthening hamstrings, the objective test protocols offered with the Biodex System 4 will provide valuable, isolated muscle-performance data. Test results, combined with established targeted outcomes, can be used for pre-emptive injury screening, managing rehabilitation and determining readiness for return-to-play.

The hamstring injury/re-injury test protocols are designed to operate with Advantage Software version 4.59 or higher, on System 4 multi-joint systems only. The v4.59 update is free for S4 customers. To obtain a free download of the software, visit the System 4 Software Update page: www.biodex.com/software/s4.

***NOTE:** The software can also be delivered via CD, but a \$50 processing and shipping fee will be applied.*

The protocols are easy to conduct. This user guide provides detailed and step-by-step instructions.

The two protocols covered in this addendum are:

- 1.) Lengthened state multiple angle comparison test
- 2.) Mixed hamstring/quadriceps (“H/Q”) ratio

2. Protocol #1: Lengthened State Multiple Angle Comparison Test

This test examines isometric bilateral flexion peak torque symmetry where the limb position puts the hamstring in a lengthened (stretched) state. "Passive stretch" is the inherent force (or torque) produced by the hamstring in the lengthened state. When deficits are within 10%, predisposition to re-injury is significantly reduced.

To perform the Lengthened State Multiple Angle Comparison Test, a special set of knee attachments with a Range Of Motion (ROM) stop are required. These attachments provide an additional 30° of range so that when positioned, the patient's knee can reach 20° above horizontal.

The specialized attachments can be ordered from Biodex sales or customer service:
Model # 830-550, KIT, HAMSTRING ATTACHMENT



Figure 2.1 Specialized hamstring attachments

NOTE: For this protocol, the use of any attachment other than the 830-550 Hamstring Attachment is considered outside proper and intended use.

The suggested protocol is a bilateral isometric test for hamstring flexion at the angles of: 40°, 20°, 0° and -20°. The hip is flexed at 130°, which puts the hamstring in a lengthened state.

Quick Reference list for Lengthened State Multiple Angle Comparison Test protocol:

- Isometric contraction in the towards direction at 40°, 20°, 0° and -20°
- Dynamometer Orientation: System 4 Pro 90° System 4 Quick Set: 45°
- Dynamometer Tilt: 0°
- Seat Orientation: System 4 Pro 90° System 4 Quick Set: 45°
- Seatback Tilt: 70°-85°
- Hip flexed at 130°
- Knee Flexion from 90° to 0°
- Axis of Rotation: Axis is through the lateral femoral condyle on the sagittal plane
- Ready Position: Flexion at 80°

Parts needed:

- Dynamometer: Lengthen State Hamstring upper attachments with knee pad (Right and Left)
- Positioning chair: Limb Support Pad, T-Bar

For an instructional video on this topic, go to the Biodex eLearning Center:

<http://www.biodex.com/physical-medicine/biodex-university/interactive-elearning>

3. Protocol #2: Mixed H/Q Ratio Test

The test uses a ratio of eccentric and concentric flexion peak torque. In athletes where this ratio was greater than 1.4, hamstring injuries were significantly reduced (Croiser, et al, 2008).

The Mixed H/Q Ratio Test protocol consists of two separate bilateral knee extension/flexion tests. One test is an isokinetic concentric/concentric test at 60° and 240° per second. The other test is done in the reactive eccentric mode at 30° and 120° per second. The completed report takes results from each test to present a mixed ratio based on the eccentric peak torque at 30° per second and concentric peak torque at 240° per second.



Figure 3.1 Subject positioned for Mixed H/Q Test

NOTE: This protocol utilizes a standard Biodex System 4 Knee Attachment.

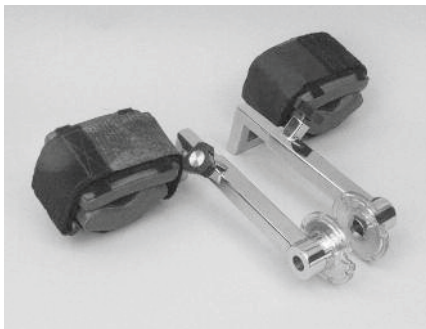


Figure 3.2 Standard knee attachments

The goal is for a mixed HEcc/QConc ratio to be greater than 1.4

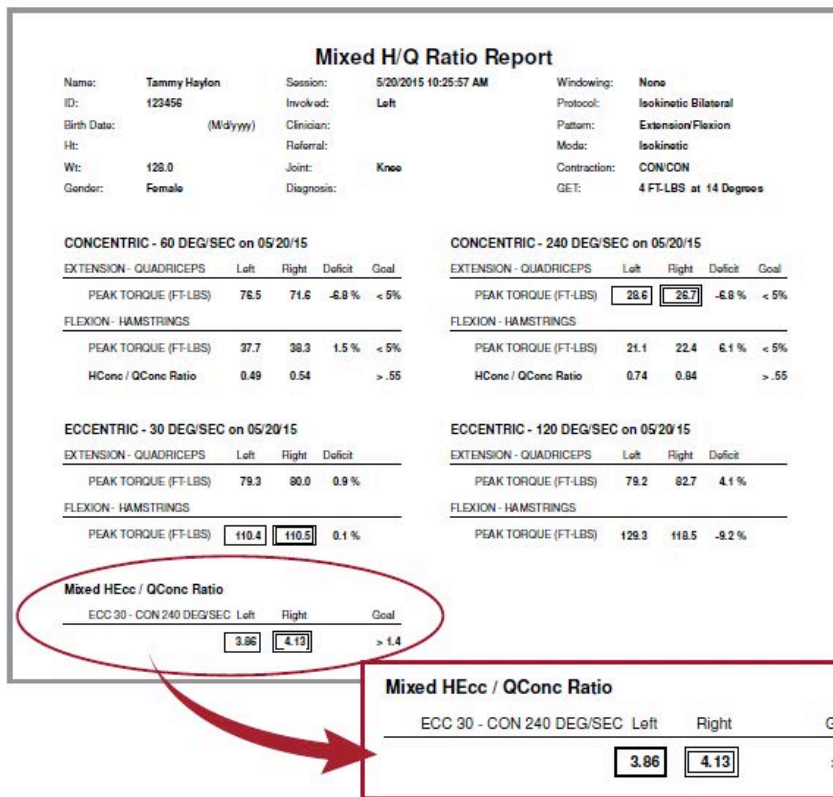


Figure 3.3 Mixed H/Q Ratio report

The Mixed H/Q Ratio Test protocol and supporting research is the work of Jean-Louis Croiser, et al:

Croiser JL, Ganteaume S, Binet J, Genty M, Ferret JM. STRENGTH IMBALANCES AND PREVENTION OF HAMSTRING INJURY IN PROFESSIONAL SOCCER PLAYERS. The American Journal of Sports Medicine. April 30, 2008.

www.biodes.com/research/15213

Quick Reference list for Mixed H/Q Ratio Test protocol:

- Dynamometer Orientation: System 4 Pro: 90° System 4 Quick Set: 45°
- Dynamometer Tilt: 0°
- Seat Orientation: System 4 Pro: 90° System 4 Quick Set: 45°
- Seatback Tilt: 70°-85°
- Knee Flexion from 135° (Toward) to 0° (Away)
- Axis of Rotation: Axis is through the lateral femoral condyle on the sagittal plane
- Ready Position: Full Flexion

Parts needed:

- Dynamometer: Standard Knee Attachment (Right or Left)
- Positioning chair: No additional parts required

For an instructional video on this topic, go to the Biodes eLearning Center:

<http://www.biodes.com/physical-medicine/biodes-university/interactive-elearning>

4. Biodex Advantage Software Settings

Lengthened State Multiple Angle Comparison Test protocol settings:

Protocol Mode: Isometric	Joint: Knee
Pattern: Extension/Flexion	Contraction Direction: Toward
Bilateral	Number of Positions: 4
End by Reps: 2 at each position	Angle*: 40° 20° 0° -20°
Contraction Time: 5 seconds	Relaxation Time: 5 seconds
Anatomical Reference: 0	Rest Time: (between sets) 30 seconds

* **NOTE:** Drop-down angle selections will not contain these angles. The specific angle values must be typed in manually.

After configuring this protocol once, you can add it to your Favorites.

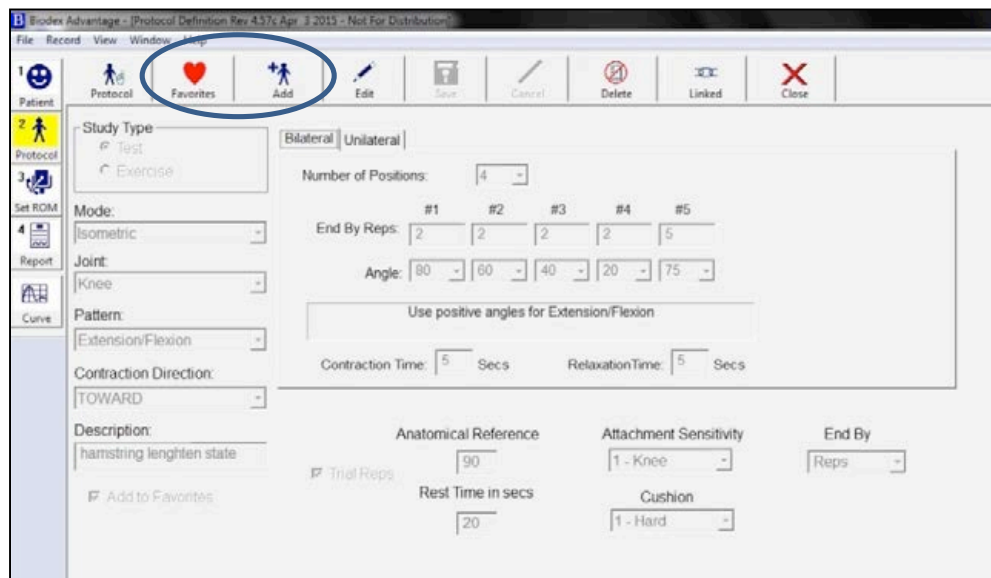


Figure 4.1 Lengthened State Multiple Angle Comparison Test protocol set-up.

The Multiple Angle Comparison report is available immediately after completing test.

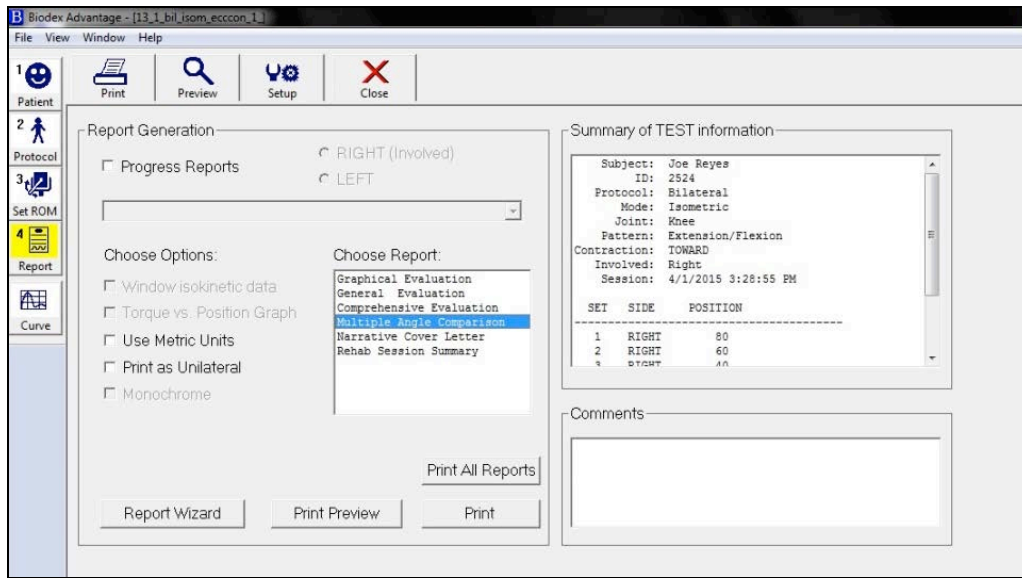


Figure 4.2 Report Generation screen.

From the Patient Management screen, you can repeat a test, obtain a report, or edit or delete the protocol.

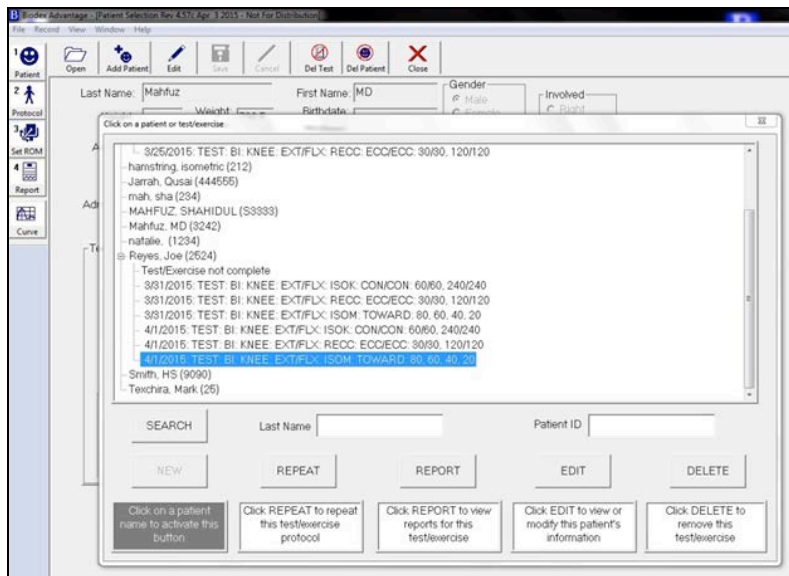


Figure 4.3 Patient Management screen.

Mixed H/Q Ratio Test (Isokinetic Concentric) protocol settings:

Study Type: Test

Protocol Mode: Isokinetic

Joint: Knee

Pattern: Extension/Flexion

Contraction: CON/CON

Bilateral

Number of Speeds: 2

End by Reps: First Set: 3; Second Set: 5

Speed Away: First Set: 60°/sec; Second Set: 240°/sec

Speed Toward: First Set: 60°/sec; Second Set: 240°/sec

Anatomical Reference: 90

Rest Time: (between sets) 60 seconds

After configuring this protocol once, you can add it to your Favorites.

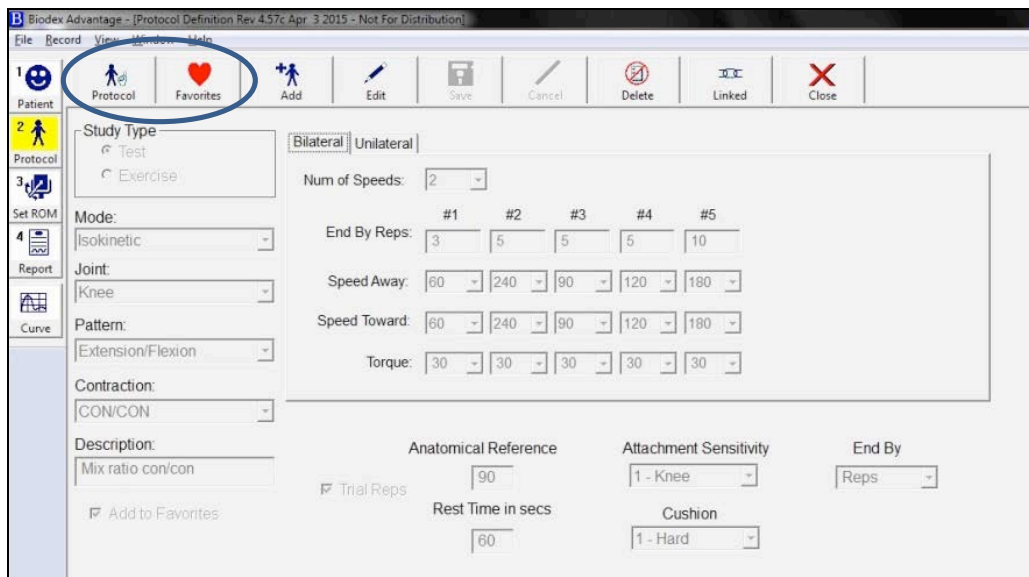


Figure 4.4 Mixed H/Q Ratio Test (Isokinetic Concentric) protocol set-up.

The Mixed H/Q Ratio report is available immediately after completing test, or via the Patient Management screen. In both cases, it is important to select concentric test first, and then the eccentric test.

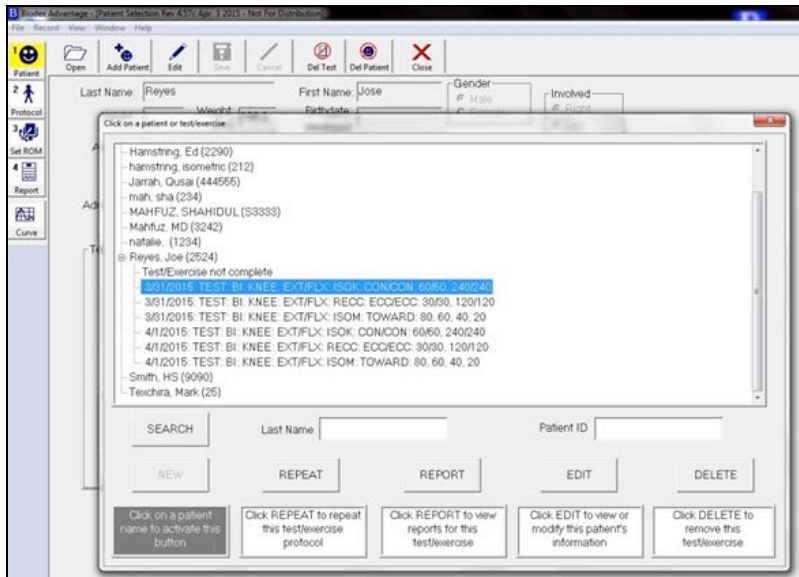


Figure 4.6 Patient Management screen.

Choose the report of desired date and protocol. Then select the eccentric test.

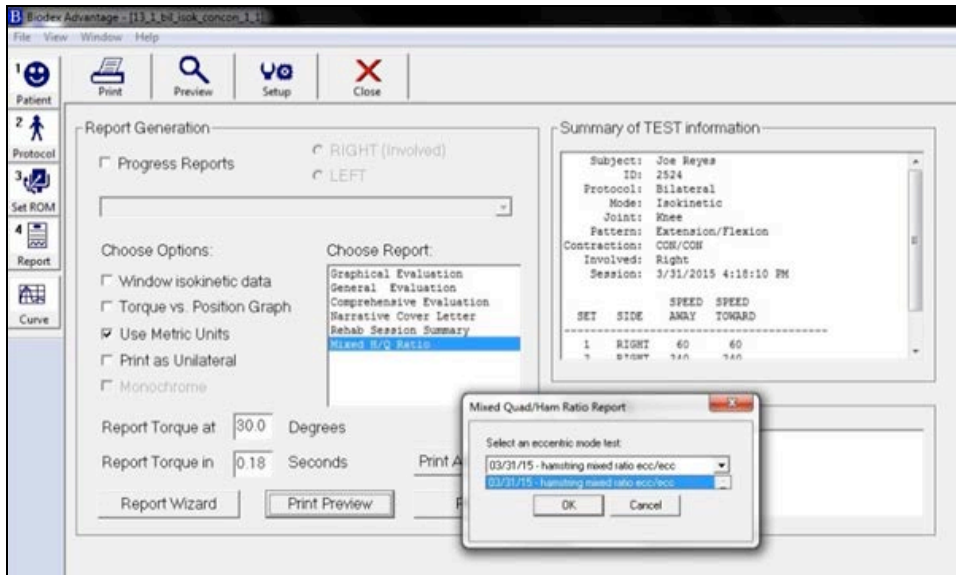
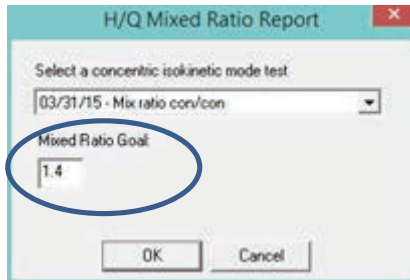


Figure 4.7 Report Generation screen.

The software will allow for mixed ratio of other speeds as well. However, since the research was based on a Concentric protocol of 60/60 and 240/240, and also a Reactive Eccentric protocol of 30/30 and 120/120, the Mixed Ratio Goal of exceeding 1.4 is for that specific protocol. The opportunity to change the Mixed Ratio Goal if different protocols are used is available.



If you are interested in adding Lengthened State Eccentric training to your current hamstring injury rehabilitation program, we suggest this paper. *Hamstring Injury Rehabilitation and Prevention of Reinjury using lengthen state eccentric training: A new Concept*. Brandon Schmitt, DPT ATC, Tim Tyler PT ATC and Malachy McHugh PhD. IJSPT Vol 7, No.3 June 2012, 333.

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