Real Time Ultrasound (RTUS)

James Beazell MS, PT, OCS, FAAOMPT, ATC
University of Virginia-Healthsouth

RTUS

- Visualization
  - High magnification/high resolution
- Operator dependent

RTUS

- Essential knowledge of anatomy
- Proper positioning

RTUS

- US better than MRI
  - Better spatial resolution
  - Better image of tissue architecture

RTUS

- International consensus
  - MRI/CT Scan 50% of exams
  - US 50% of exams

RTUS

- Muscle pathology
  - 2-48 hours post injury best time to observe muscle abnormalities

Visualizing Tissues

- Stokes M, Rankin G, Newham DJ. Ultrasound imaging of lumbar multifidus muscle: normal reference ranges for measurements and practical guidance on the technique. *Man.Ther.* 2005;10:116-26.

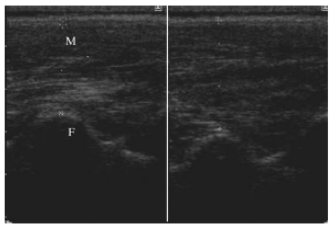
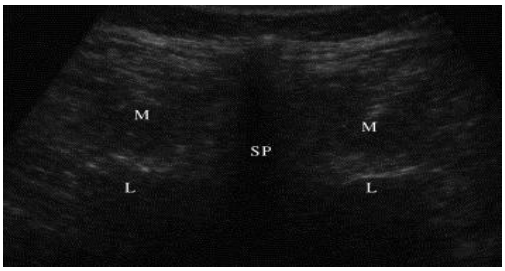
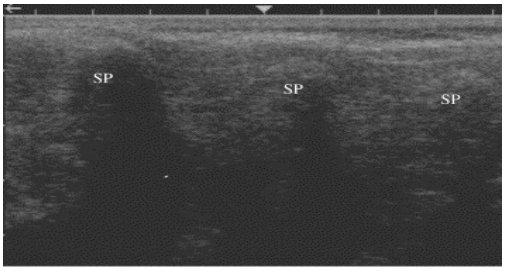
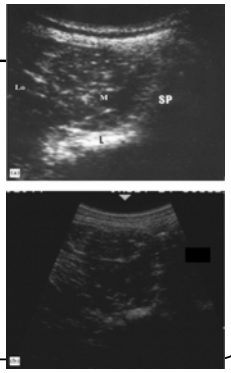


Fig. 6. Biofeedback of lumbar multifidus—longitudinal view using split screen facility. The facet joints (F) can be used as landmarks for the lower borders of the muscles. During contraction (right panel), the muscle becomes thicker and the angle of the fibres becomes steeper, providing feedback. Right multifidus of female aged 46 years. (5 MHz linear probe.)



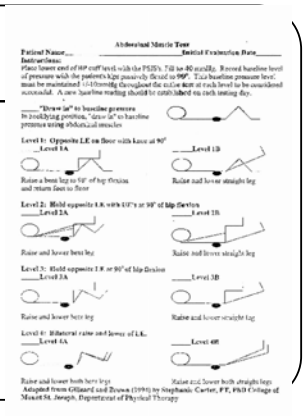
Visualization of Tissues





Abdominal Muscle Strength Test

Gilleard WL, Brown JM. An electromyographic validation of an abdominal muscle test. *Arch.Phys.Med Rehabil.* 1994;75:1002-7.
Kisner C, Carter S. Spinal Stabilization: What have we learned from research? An Update of Knowledge and Skills. APTA National Conference. Plenary session at APTA National Conference . 2002.



Abdominal Muscle Test

Patient Name:_____ _____Initial Evaluation Date_____

Instructions:
Place lower end of BP cuff level with the PSIS's. Fill to 40 mmHg. Record baseline level of pressure with the patient's legs passively flexed to 90°. This baseline pressure level must be maintained +/-10mmHg throughout the entire test at each level to be considered successful. A new baseline starting should be established for each testing day.

____"Draw in" to baseline pressure
In hooklying position, "draw in" to baseline pressure using abdominal muscles

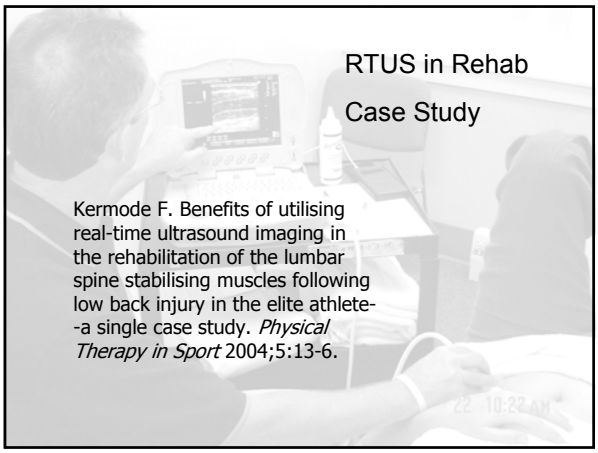
Level 1: Opposite LE on floor with knee at 90°
____Level 1A
Raise a bent leg to 90° of hip flexion and return foot to floor
____Level 1B
Raise and lower straight leg

Level 2: Hold opposite LE with 10°'s or 90° of hip flexion
____Level 2A
Raise and lower bent leg
____Level 2B
Raise and lower straight leg

Level 3: Hold opposite LE at 90° of hip flexion
____Level 3A
Raise and lower bent leg
____Level 3B
Raise and lower straight leg

Level 4: Bilateral raise and lower of LE.
____Level 4A
Raise and lower both bent legs
____Level 4B
Raise and lower both straight legs

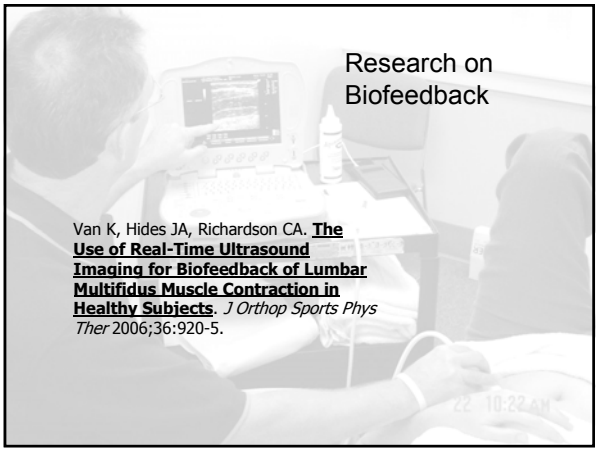
Adapted from Gilleard and Brown (1994) by Stephanie Carter, PT, PhD College of Mount St. Joseph, Department of Physical Therapy



RTUS in Rehab

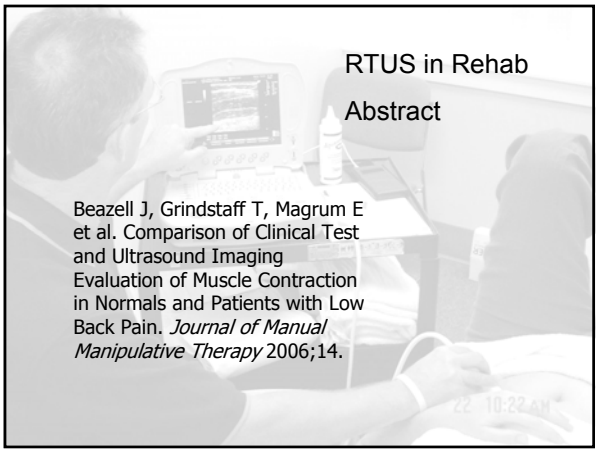
Case Study

Kermode F. Benefits of utilising real-time ultrasound imaging in the rehabilitation of the lumbar spine stabilising muscles following low back injury in the elite athlete--a single case study. *Physical Therapy in Sport* 2004;5:13-6.



Research on Biofeedback

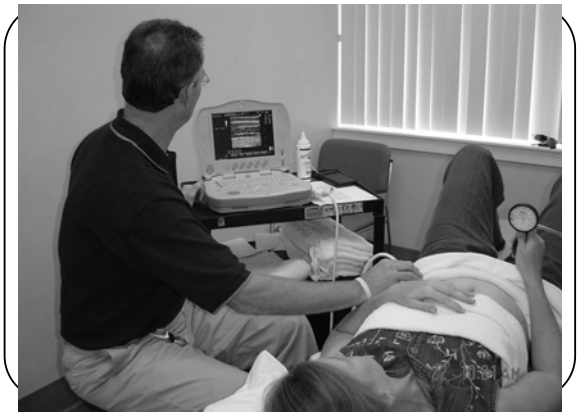
Van K, Hides JA, Richardson CA. **The Use of Real-Time Ultrasound Imaging for Biofeedback of Lumbar Multifidus Muscle Contraction in Healthy Subjects**. *J Orthop Sports Phys Ther* 2006;36:920-5.



RTUS in Rehab

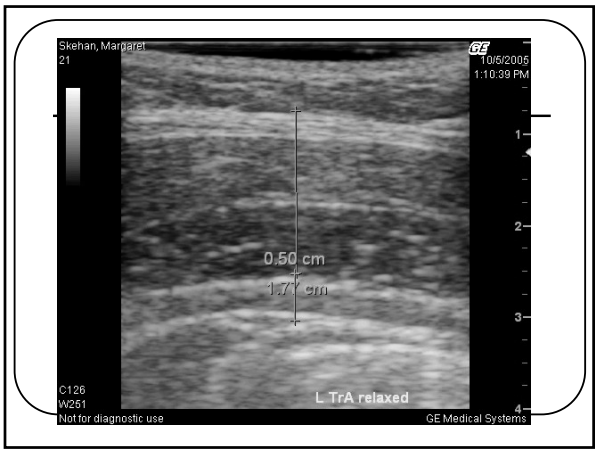
Abstract

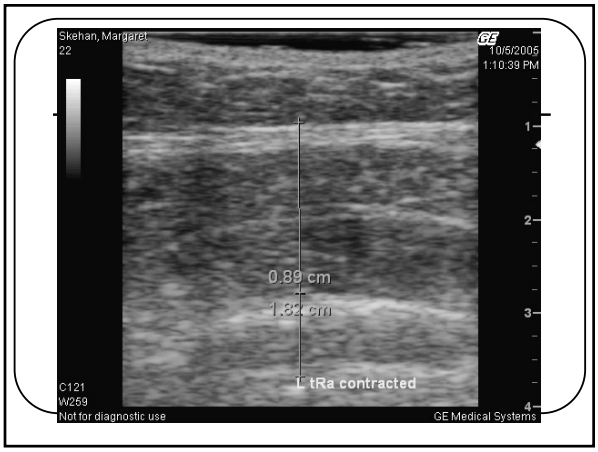
Beazell J, Grindstaff T, Magrum E et al. Comparison of Clinical Test and Ultrasound Imaging Evaluation of Muscle Contraction in Normals and Patients with Low Back Pain. *Journal of Manual Manipulative Therapy* 2006;14.

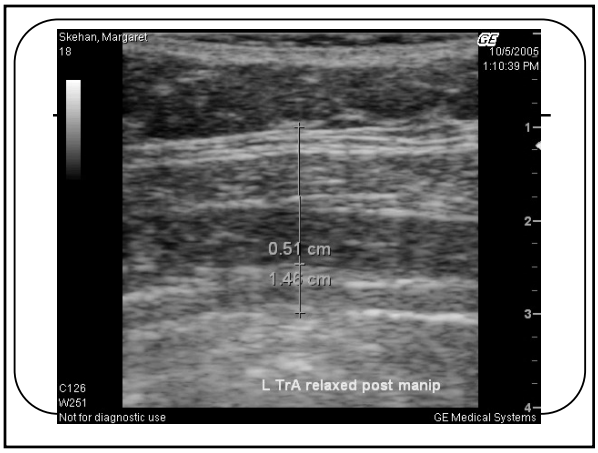



09/20/05 8:14:04 PM adm 231
MI 0.8 TIs 0.5
8L-RS
Adult
B
Frq 8.0 MHz
Gn 54
E/A 0/3
Map F/0
D 5.0 cm
DR 81
FR 77 Hz
AO 100 %
L TrA relaxed
1 L 2.92 cm
2 2.09 cm
GE Medical Systems

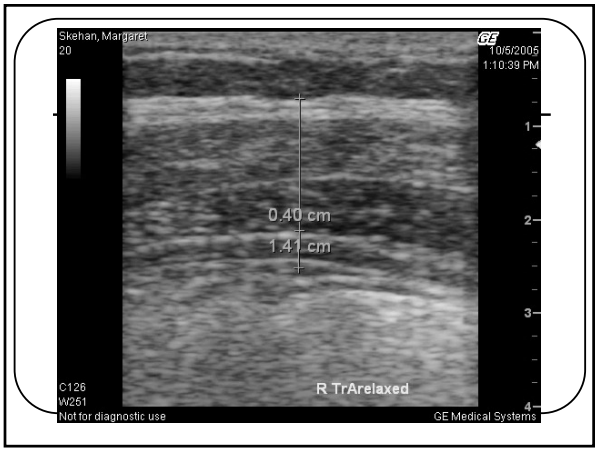

09/20/05 8:14:23 PM adm 231
MI 0.8 TIs 0.5
8L-RS
Adult
B
Frq 8.0 MHz
Gn 54
E/A 0/3
Map F/0
D 5.0 cm
DR 81
FR 77 Hz
AO 100 %
L TrA contracted
1 L 3.60 cm
2 2.37 cm
GE Medical Systems

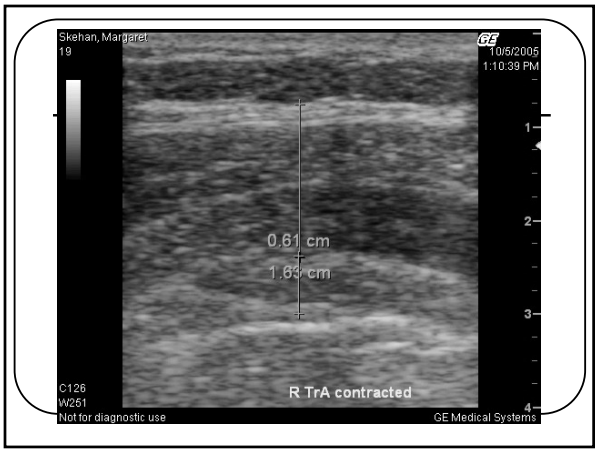

Skehan, Margaret
21
10/5/2005
1:10:39 PM
0.50 cm
1.77 cm
L TrA relaxed
C126
W251
Not for diagnostic use
GE Medical Systems

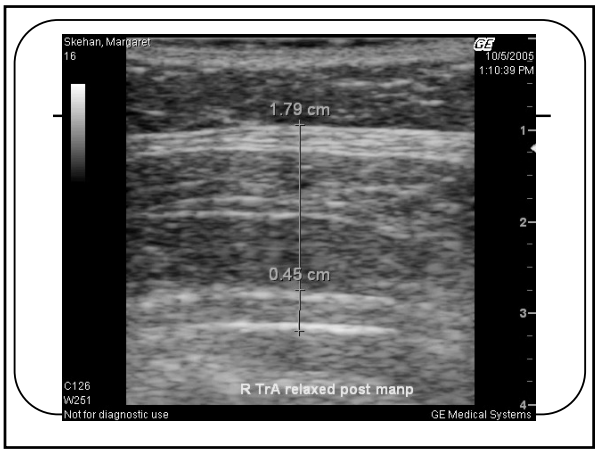

Skehan, Margaret
22
10/5/2005
1:10:39 PM
0.89 cm
1.82 cm
L tRa contracted
C121
W259
Not for diagnostic use
GE Medical Systems


Skehan, Margaret
18
10/5/2005
1:10:39 PM
0.51 cm
1.46 cm
L TrA relaxed post manip
C126
W251
Not for diagnostic use
GE Medical Systems


Skehan, Margaret
17
10/5/2005
1:10:39 PM
0.88 cm
1.72 cm
C126
W251
L TrA contracted post manip
Not for diagnostic use
GE Medical Systems


Skehan, Margaret
20
10/5/2005
1:10:39 PM
0.40 cm
1.41 cm
C126
W251
R TrArelaxed
Not for diagnostic use
GE Medical Systems


Skehan, Margaret
19
10/5/2005
1:10:39 PM
0.61 cm
1.63 cm
C126
W251
R TrA contracted
Not for diagnostic use
GE Medical Systems


Skehan, Margaret
16
10/5/2005
1:10:39 PM
1.79 cm
0.45 cm
C126
W251
Not for diagnostic use
R TrA relaxed post manp
GE Medical Systems


Skehan, Margaret
15
10/5/2005
1:10:39 PM
0.84 cm
1.97 cm
C126
W251
Not for diagnostic use
R TrA contracted post manip
GE Medical Systems