Masters Techniques

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Knee extension osteotomy and patellar advancement for teenage crouch gait in Cerebral Palsy-Scott Hoffinger

- Crouch Gait – persistent stance phase knee flexion
  What resists crouch? What extends the knee?
- Knee flexion is normal part of stance, loading response, typically to 20 degrees or so then knee extends

- The quads don’t extend the knee, the knee extends because of the plantar-flexion knee extension couple. Plantar flexion of the foot causes the extension force across the knee. Loss of this knee extension vector leads to persistent stance phase knee flexion THUS crouch gait.
- The force from the plantar flexion MUST be sufficient to overcome the force of knee flexion – these two are RELATED
- IF PLANTAR FLEXION force > KNEE FLEXION forces result is BACK KNEE
  IF PLANTAR FLEXION force < KNEE FLEXION forces result is CROUCH

Contributors to Crouch therefore are:

- Loss of plantarflexion force – weak gastrosoleus complex, poor mechanicos of gastrosoleus complex, foot deformity, external tibial torsion
- Excess knee flexion force – knee flexion contracture, statically short hamstrings, TOO DEEP loading response from weak quadriceps

To eliminate crouch gait one must restore plantarflexion force:

- Good gastrosoleus strength
- Straight foot
- Foot in line with knee (appropriate plantarflexion vector)

AND reduce knee flexion force:

- Hamstring lengthening if appropriate
- Eliminate static knee contracture
• Improve quadriceps strength and power

Best success in crouch is PREVENTION! Avoid overlengthening or isolated lengthening of Achilles. Limited success restoring fully upright gait once crouch is well established especially when static knee contracture present.

Distal Femoral Extension Osteotomy first described in 1913 by Osgood for cases of old infection, polio, fracture

Patellar Tendon Shortening described in 1933 by Chandler, revised by him in 1940, further by Roberts and Adams in 1953.

Best recent description these techniques presented by Selber at POSNA, Vancouver, 2000, then technique further refined by Stout, Gage, Schwartz, Novacheck, 2008.

Indication for distal femoral osteotomy with patellar tendon shortening:

Ambulatory patient with cerebral palsy with persistent stance phase knee flexion during gait and fixed flexion deformity of the knee.

Important to maximize the plantar flexion knee extension couple prior to addressing the knee as indicated. Procedures often include:

• Foot osteotomy
• Tibial rotation osteotomy
• Subtalar or triple arthrodesis

Procedure for distal femoral osteotomy:
• Lateral approach to femur
• Subvastus approach
• Determine amount of extension desired, and rotation
• Place chisel (if blade plate) or template (if distal femoral locked plate) as far distally as you can WITHOUT injuring the physis
• This will determine the amount of extension so careful measurement is important
• Cut the distal femur – can cut a wedge, a trapezoid, or simply do this perpendicular
• Place the plate, rotate if indicated, and affix to shaft of femur
• Remove spike of bone posteriorly
• Beware lengthening the path of sciatic nerve (shorten bone where needed)

Procedure for patellar tendon shortening:

• Extend incision over patellar tendon
• Carefully incise the paratenon for repair later
• Cut the patellar tendon off the distal pole of the patella
• Resect distal 5 mm of patella to fresh bleeding surface
• Pull patella distally so that distal pole reaches the tibio-femoral joint (finger in the notch) and overlap tendon
• Resect the overlapped amount of tendon
• Place two Mitek suture anchors (super anchor) in the patella and then Krackow stitch (one laterally and one medially) along patellar tendon
• After tying the Mitek sutures use 0 Vicryl for whip stitch where necessary
• Repair paratenon

Post operative regimen:

• Cast or splint in mild flexion to avoid sciatic stretch
• Mobilize at 3 – 4 weeks in hinge knee brace to restore flexion
• FWB at 6 weeks
• Floor reaction braces for the first six months