A NEW KNEE CARE PARADIGM

Evidence-Based Biomechanical Markers Provided by KneeKG

<table>
<thead>
<tr>
<th>Osteoarthritis</th>
<th>Patellofemoral Syndrome</th>
<th>ACL injury</th>
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<td>• Dynamic flexion contracture - Compensation strategy to stabilize knee</td>
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Testimonials from orthopaedic surgeons

“The KneeKG™ is an unbiased test to show what we did had a significant clinical benefit to the patient.”
- Dr. Thomas M. DelBarbarino, MD, New England Musculoskeletal Institute at UCONN Health, CT

“Being able to assess the condition of the knee in normal motion is the best use for the KneeKG™. We can’t get this information from an MRI, CT scan, or X-ray.”
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3 EASY STEPS for the RIGHT INFORMATION and the RIGHT CARE.

Case Study: Painful TKA
**Painful TKA**

- 72 y/o man (BMI: 25.3; height: 6 feet; weight: 187 lbs)
- Right knee pain appeared about 12 months post-TKA surgery with right lateral hip pain
- Treating orthopaedic surgeon associated pain to “loose” knee. Recommended exercise & brace
- Patient saw no benefit from general strengthening and bracing
- Intermittent pain persists with swelling; reports bone-on-bone type of noise
- Symptoms increase during lengthy standing posture, walking, and squatting

**CLINICAL EVALUATION:**
- Full ROM (0° of hyper-extension to 118° of flexion)
- Joint effusion 1+
- Tenderness at extremes of ROM
- Ligamentously stable knee
- Weakness of quadriceps and hamstrings (4/5)
- Weight-bearing x-ray shows that prosthesis remains in good position with no evidence of loosening or osteolysis

**KNEEKG TEST REPORTED:**
1. Varus functional static alignment of 3.5°
2. Varus dynamic alignment at heal strike of 2.6°
3. Varus dynamic alignment during stance of 2.9°

**Final results (6 months post-treatment)**
1. Static functional varus alignment > IMPROVED (from 3.5° to 0.3°)
2. Dynamic varus alignment at heal strike > IMPROVED (from 2.6° to 0.8°)
3. Dynamic varus alignment during stance > IMPROVED (from 2.9° to 0.3°)

**IMPRESSION:**
1. Right knee s/p total knee arthroplasty
2. Weak Core Muscles
3. Proprioception Deficiency

**RISK FACTORS FOR OSTEOARTHRITIS:**
1. Varus deformity in static and dynamic states indicated an increased risk for medial compartment wear of total knee arthroplasty.
2. No indicators of lateral compartment OA at this time
3. No indicators of patellofemoral compartment OA at this time.

**PLAN:**
KNEEKG results were discussed with patient today and the following plan was outlined for rehabilitation.

A. Core and quadriceps strengthening
B. Proprioception, balance and gait training with physical therapist
C. Hinge Knee Brace for any instability issues.

Additional education materials to include management of osteoarthritis and information about osteoarthritis were given to patient today.

**TREATMENT PRESCRIBED BASED ON FINDINGS**
- Goal: adaptation/retuning with biofeedback to correct dynamic varus alignment
  - Limit the Trendelenburg type gait that lateralizes the iliotibial band of the affected leg
  - Strengthening of quadriceps, hamstrings and the hip abductors

**Patient reports no more pain and return to adequate level of physical activity and longer walks. Patient also reports no pain getting in/out of the car. Patient addressed mechanical markers increasing stresses on the medial compartment of the right knee.**

Dr. David J. Covall, orthopaedic surgeon, GA, USA

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**KNEEKG TEST AND REPORT**

**INTERPRETATION REPORT**

**COMPARISON PRE AND POST TREATMENT**

KneeKG test performed by PA, PT, OT, technician
20-25 minutes for 1 knee
35-40 minutes for bilateral exam

Prepared by a PA or PT taking into account clinical examination and KneeKG test
(training provided by Emovi)

A post-treatment/follow-up KneeKG test allows to document therapy efficacy and adjust the treatment plan accordingly
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Osteoarthritis
- Dynamic flexion contracture
  - Increases joint TF & PF loads
  - Increases tension & loads on quads
  - Reduces endurance
- Varus-valgus thrust
  - Increases odds ratio of OA progression by 3-4x
- Varus-valgus alignment
  - Increases TF loads
- Internal tibial rotation offset
  - Shifts load-bearing regions

Patellofemoral Syndrome
- Dynamic flexion contracture
  - Increases PF stress
- Varus-valgus alignment
  - Alters patellar tracking
- Valgus collapse
  - Increases Q angle
  - Lateralizes the patella
- External tibial rotation
  - Increases Q angle
  - Lateralizes the patella
- Rapid internal tibial rotation
  - Increases PF shear stress

ACL injury
- Dynamic flexion contracture
  - Compensation strategy to stabilize knee
  - Increases PF stresses
- Shift towards internal tibial rotation
  - Shifts TF load-bearing regions
  - Increases risk of OA
- Variability in internal/external tibial rotation
  - Sign of instability
- Varus thrust
  - Potential posterolateral instability

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