

Dynamic Clinical Measurements

Gait, Functional & Movement-Based Assessment for Orthotic Prescribing

Dynamic assessment captures foot and lower limb function during movement — revealing compensatory patterns, loading behaviour, and mechanical inefficiencies that static assessment cannot detect. This reference covers the key dynamic tests used in podiatric biomechanical assessment: what they measure, how to perform them, how to interpret findings, and their orthotic prescribing implications. Use alongside the Static Clinical Measurements reference (M7) for a complete assessment picture.

Static vs Dynamic Assessment

Static measurements (RCSP, NCSP, ADF, FPI-6) define structural deformity and joint range. Dynamic measurements reveal how the foot compensates and loads during real movement. Both are essential — static assessment informs the prescription starting point; dynamic assessment confirms its effect and identifies functional drivers that static findings cannot explain.

1 Visual Gait Analysis (Observational)

Definition	Systematic visual observation of gait to identify deviations, compensatory strategies, and mechanical inefficiencies at each segment and during each phase of the gait cycle.
How to Perform	Observe patient walking on a flat surface, barefoot and in footwear. Assess from posterior, anterior, and lateral views. Evaluate: heel strike pattern, midstance position (calcaneal eversion, arch posture, tibial alignment), propulsion (abductory twist, hallux function), swing phase mechanics, and upper body/hip compensation. Repeat with orthosis in situ for comparison.
Key Observations — Rearfoot	Calcaneal eversion at heel strike and midstance; abruptness of midstance pronation; calcaneal inversion during propulsion; abductory twist (medial rotation of foot at toe-off).
Key Observations — Forefoot	Toe-off mechanics (hallux load, windlass activation); forefoot loading pattern; early heel rise; forefoot abduction.
Key Observations — Proximal	Tibial bow/rotation; knee valgus/varus; hip drop (Trendelenburg); trunk lean; arm swing asymmetry.
Orthotic Implication	Abductory twist → increased pronation control needed. Early heel rise → equinus management (heel raise). Hip drop contralateral side → possible LLD or gluteal weakness — check with standing block test. Forefoot abduction → midfoot collapse, consider medial flange. Antalgic gait → identify pain source before prescribing.

2 Single-Leg Heel Rise Test

Definition	Assessment of tibialis posterior, calf complex strength and STJ supination during functional single-leg standing on tip-toe. Tests the ability to invert the calcaneus during heel rise — a key indicator of tibialis posterior function.
How to Perform	Patient stands on one leg. Ask them to rise onto the toes of that foot 10–25 repetitions. Observe: calcaneal inversion during rise, heel height achieved, number of repetitions possible, pain reproduction. Compare bilaterally.
Normal Finding	Smooth calcaneal inversion during rise; heel rises to equivalent height bilaterally; able to complete 10–25 repetitions without pain or fatigue asymmetry.
Abnormal Findings	Failure to invert calcaneus — suggests tibialis posterior dysfunction (PTTD); reduced repetitions or pain — tendinopathy or weakness; excessive valgus maintained throughout — significant loss of STJ supination capacity.
Grading	Grade 1 = cannot perform at all; Grade 2 = partial rise only, no inversion; Grade 3 = full rise but no inversion; Grade 4 = full rise with partial inversion; Grade 5 = normal full rise with complete inversion.
Orthotic Implication	Grades 1–2 → maximum rearfoot control orthosis plus physio referral; medial flange, rigid shell, deep heel cup. Grade 3 → semi-rigid to rigid with medial control. Grade 5 → rearfoot control as guided by static findings only.

3 Windlass Test (Jack's Test)

Definition	Assessment of windlass mechanism function — the ability of passive hallux dorsiflexion to tension the plantar fascia and raise the medial longitudinal arch. Distinguishes functional hallux limitus from structural hallux rigidus.
How to Perform	Patient weightbearing (standing) or NWB (supine). Passively dorsiflex the hallux at the 1st MTPJ. Observe: arch height change (should rise), STJ supination response, pain reproduction, and range available. Compare WB vs NWB dorsiflexion range.
Positive Test (WB)	Hallux dorsiflexion is restricted in weightbearing but available NWB — indicates functional hallux limitus (FHL). The orthosis is loading the 1st ray, preventing dorsiflexion.
Negative Test / Structural Rigidus	Dorsiflexion restricted in BOTH WB and NWB — structural hallux rigidus. Joint pathology rather than functional loading.
Normal Windlass Response	Hallux dorsiflexion raises the arch and supinates the STJ — confirms intact windlass mechanism.
Orthotic Implication	FHL (positive WB only) → Reverse Morton's / kinetic wedge to facilitate 1st ray plantarflexion and restore windlass. Structural rigidus → Morton's extension to limit dorsiflexion. Intact windlass but excessive pronation → arch support and posting as guided by static assessment.

4 Functional Movement Screen — Squat & Lunge

Definition	Functional movement assessments revealing lower limb alignment, ankle dorsiflexion availability, and hip/knee mechanics under load. Particularly useful for active/sports patients where orthotic prescription must consider functional demands.
Overhead Squat Assessment	Patient performs bodyweight squat with arms overhead. Observe: heel lift (equinus), knee valgus/varus collapse, trunk forward lean, arch collapse. Heel lift → ADF restriction (correlates with equinus findings). Knee valgus → hip abductor weakness + foot pronation contribution.
Lunge Assessment	Patient performs forward lunge. Observe: knee tracking over 2nd toe, tibial angle, ankle dorsiflexion. More functional than NWB ADF — reveals ADF in a closed-chain loading context. Compare with knee-to-wall result.
Step-Down / Single-Leg Squat	Patient steps down from a 20cm step on one leg. Observe: knee valgus, hip drop, tibial rotation, rearfoot eversion. Highly relevant for patellofemoral pain, MTSS, ITBS.
Orthotic Implication	Knee valgus on squat/lunge with excessive foot pronation → medial rearfoot control (posting + possible skive) combined with hip strengthening. Heel lift on squat → equinus confirmed — heel raise in orthosis plus stretching programme. Step-down valgus without pronation → hip weakness primary driver — orthotics may have limited benefit alone.

5 Pressure Plate / Pedobarograph Assessment

Definition	Instrumented plantar pressure assessment measuring the distribution, magnitude, and timing of ground reaction forces across the plantar surface during walking or running. Provides objective pressure data to complement observational gait analysis.
Key Metrics	Peak plantar pressure (kPa) by region; pressure-time integral; contact area; centre of pressure trajectory (COP path); loading rate; regional pressure asymmetry.
COP Trajectory	Normal: heel → lateral midfoot → metatarsal heads → hallux. Lateral deviation → supinated gait or pes cavus. Excessive medial deviation → hyperpronation. Shortened COP → early heel rise (equinus) or antalgic propulsion.
Forefoot Loading	Normal peak forefoot pressure distributed across met heads 1–5 with emphasis on met heads 2–3. Elevated met head 1 → hallux loading excess (FHL, hallux rigidus). Elevated met 2–3 → metatarsalgia, plantar plate risk. Elevated 4–5 → pes cavus, lateral overload.
Pre/Post Orthosis Comparison	Pressure plate is most useful for demonstrating orthotic effect objectively — compare pre-orthosis and post-orthosis data to confirm pressure redistribution achieved. Particularly valuable for diabetic, neuropathic, and metatarsalgia cases.
Orthotic Implication	Elevated focal met head pressure → met dome/pad, sulcus top cover, metatarsal aperture. Elevated heel pressure → deep heel cup, Poron heel cushion. Lateral overload → lateral wedge/valgus post. Medial overload → medial modifications as per static assessment findings. COP deviation → confirms rearfoot posting direction needed.

6 Quick Reference: Dynamic Tests Summary

Test	What It Measures	Key Abnormal Finding	Orthotic Implication
Visual Gait Analysis	Gait deviations, compensatory strategies	Abductory twist; Trendelenburg; early heel rise	Increased control; equinus management; LLD check
Single-Leg Heel Rise	Tibialis posterior function; STJ supination capacity	Failure to invert calcaneus; pain; asymmetry	Medial control level; rigid shell if Grade ≤ 2
Windlass / Jack's Test	Windlass mechanism; functional vs structural hallux limitation	WB restriction NWB available = FHL	Reverse Morton's / kinetic wedge
Overhead Squat / Lunge	ADF availability; lower limb alignment under load	Heel lift = equinus; knee valgus collapse	Heel raise; rearfoot posting + hip strengthening
Pressure Plate (Pedobarograph)	Plantar pressure distribution and loading	Focal met head peaks; COP deviation; asymmetry	Met dome; heel cushion; posting direction confirmed

Integrating Static and Dynamic Findings

Dynamic tests confirm, challenge, or refine static assessment findings. A foot with moderate RCSP eversion but low supination resistance and no abductory twist may require less orthotic control than the static measurements suggest. Always use dynamic findings to contextualise — and where necessary, override — static prescription starting points.