

Unit 2: Musculoskeletal System

Musculoskeletal System for Kalari Uzhichil

1) Bones: classification, structure, and key bones relevant to Kalari Uzhichil

Classification - Bones are grouped by shape because shape predicts load-behaviour and injury risk during manual pressure and movement drills: **long** (femur, humerus), **short** (carpals, tarsals), **flat** (scapula, ribs, cranial plates), **irregular** (vertebrae), **sesamoid** (patella), and **pneumatic** (air-filled skull bones such as frontal, maxilla). In Kalari, long bones transmit strike and stance forces; flat bones provide broad muscle anchors; sesamoids improve leverage (patella in knee extension).

Macro-structure - The outer **compact (cortical) bone** resists bending; inner **spongy (trabecular) bone** dissipates impacts and hosts marrow. **Periosteum** (pain-sensitive, well vascularised) nourishes bone and anchors fascia; **endosteum** lines the medullary cavity. In compact bone, **osteons** with concentric lamellae carry vessels—this is why sustained pressure should slide **with** fibre orientation rather than jab across periosteum.

Key bones in Kalari contexts -

- **Spine:** cervical mobility (head positioning), **thoracic** rib coupling (breath/power transmission), **lumbar** load sharing (Chavitti footwork).
- **Pelvis & hip:** ilium/ischium/pubis form a ring—any tilt alters hamstring and psoas tone.
- **Lower limb:** femur (torsion affects knee tracking), **tibia-fibula** (ankle stability), **talus/calcaneus** (shock absorption; plantar fascial line starts here).
- **Shoulder girdle:** **scapula** (gliding base for arm power), **clavicle** (load bridge), humerus (lever).
- **Ribs & sternum:** chest mobility affects diaphragmatic drive and vagal tone—central to calming strokes.
- **Cranial bones & mandible:** temple, brow, and jaw interfaces matter for headache, bruxism, and Sthapani work.

2) Major joints: types, structure, and movements

Types -

- **Fibrous (synarthrosis):** minimal movement (skull sutures).
- **Cartilaginous (amphiarthrosis):** limited glide/cushion (intervertebral discs, pubic symphysis).
- **Synovial (diarthrosis):** free movement with a capsule—**plane** (intercarpal), **hinge** (elbow, ankle), **pivot** (atlanto-axial), **condyloid** (wrist), **saddle** (thumb CMC), **ball-and-socket** (shoulder, hip).

Structure - Articular **hyaline cartilage** reduces friction; a **fibrous capsule** and **synovial membrane** produce lubricating fluid; **ligaments** stabilise; some joints have **labrum** (shoulder/hip) or **menisci** (knee) to deepen sockets/distribute load. Manual depth must respect the capsule's orientation; cross-fibre work near ligament attachments is precise and short to avoid sprain.

Movements to monitor and cue - Flexion/extension, ab-/adduction, internal/external rotation, circumduction; forearm **pronation/supination**; ankle **dorsi/plantarflexion** and **inversion/eversion**; scapular elevation/depression, protraction/retraction, upward/downward rotation. Kalari chuvadukal test multiplanar integrity—e.g., **Neeta** requires hip extension + ankle dorsiflexion + thoracic lift in one frame.

3) Skeletal muscles: structure, function, and contraction basics

Hierarchy - Muscle → **fascicles** → **fibres** (cells) → **myofibrils** → **sarcomeres** (A/I bands). **Actin-myosin** sliding shortens



sarcomeres when Ca^{2+} binds troponin (after acetylcholine triggers depolarisation at the neuromuscular junction and the sarcoplasmic reticulum releases Ca^{2+}). **ATP** powers cross-bridge cycling and detachment.

Neural control & sensors - Motor units recruit from small to large (fine control → power). **Muscle spindles** sense rapid stretch (increase tone); **Golgi tendon organs** sense tension (inhibit tone). Uzhichil uses **slow press-on-exhale** to damp spindles, and **sustained end-range holds** to recruit Golgi-mediated relaxation.

Fibre types (functional view) - Type I (slow, fatigue-resistant: postural endurance), Type IIa (mixed), Type IIx (fast, powerful, fatigue-prone). Kalari blends I (stance) and II (kicks), so therapy alternates nourishing heat (for I fibres' perfusion) with targeted release for II-chain adhesions.

Fascia - A collagen-elastin continuum that transmits force between muscles (e.g., superficial back line from plantar fascia to occiput). Viscosity drops with warmth and rhythm—hence long forearm glides before precise thumb work.

4) Major muscle groups involved in posture and movement (Kalari lens)

- **Deep core canister** - diaphragm, transversus abdominis, multifidi, pelvic floor—coordinates breath, spinal stiffness, and safe force transfer.
- **Hip stabilisers** - gluteus medius/minimus, deep rotators (piriformis group)—prevent knee valgus during **Neeta** lunges; weakness shows as femoral adduction/internal rotation.
- **Hip extensors & flexors** - gluteus maximus, hamstrings vs. iliopsoas, rectus femoris—balance dictates pelvic tilt.
- **Knee tracking** - vastus medialis obliquus (VMO), vastus lateralis, popliteus—guide patella and unlock knee.
- **Ankle-foot complex** - gastrocnemius/soleus, tibialis anterior/posterior, peroneals, intrinsic foot—maintain arches and shock absorption for Chāṭṭa hops and rope-supported Chavitti work.
- **Spinal extensors & lateral stabilisers** - erector spinae, quadratus lumborum—often hypertonic with desk posture; respond to ulnar-forearm glides.
- **Scapular control** - lower/middle trapezius, serratus anterior, rhomboids, levator scapulae—scapular upward rotation and retraction for weapon forms; manual release of pectoralis minor and subscapularis restores overhead range.
- **Shoulder rotator cuff** - supraspinatus, infraspinatus, teres minor, subscapularis—centres humeral head; cross-fibre thumb work is brief and specific.
- **Neck balance** - deep neck flexors vs. SCM/scalenes—key for forward-head correction.

5) Common musculoskeletal injuries and therapeutic considerations

Sprains (ligament) - often at ankle (**inversion**) and knee. *Acute (0-72 h)*: avoid deep pressure/heat; use cooling oil (e.g., Murivenna), elevation, distal lymph flush; **bandhana** (supportive strapping). *Sub-acute*: gentle cross-fibre on ligament edges; re-introduce heat (kizhi) only when swelling subsides. *Rehab*: balance drills, gradual **Aakka/Neeta** steps.

Strains (muscle-tendon) - hamstrings, calf, rotator cuff. *Acute*: light compression, no aggressive stretch. *Sub-acute*: longitudinal glides, then pin-and-stretch; restore eccentric control.

Tendinopathy - Achilles, patellar, lateral epicondyle. Use moderate, rhythmic friction along tendon lines, not on bony entheses; pair with **isometric** → **eccentric** loading in homework.

Myofascial trigger points/DOMS - after intense drills. Broad palm warming; avoid hard friction in first 24-48 h; hydration and light mobility.

Low back pain & sciatica (Vāta pattern) - release hamstring and gluteal lines; heel decompression along sacral track; avoid forceful lumbar extension. Check hip mobility and core timing.



Patellofemoral pain - VMO wake-up (tapping/short holds), ITB line glide, hip abductor strengthening; avoid deep pressure directly over patellar margins.

Plantar fasciitis - progress from calf release to plantar fascia; mobilise **talus/calcaneus** lines; morning towel curl drills; don't dig into the medial calcaneal tubercle acutely.

Shoulder impingement/rotator cuff - free thoracic spine and ribs first; scapular setting; short, gentle subacromial work; rotator cuff eccentrics.

Shin splints (MTSS) - reduce impact, cross-fibre along tibialis posterior; address foot pronation with intrinsic activation.

Red flags (refer, not massage) - suspected fracture/dislocation, progressive neuro deficit, cauda equina signs, uncontrolled cardiac/respiratory symptoms, hot swollen joint with fever, DVT signs (calf pain, redness, warmth, pitting edema).

Summary Tables

A) Bone classification & Kalari relevance

Class	Examples	Load Role	Therapy Note
Long	Femur, humerus	Levers for movement	Work along periosteal lines; avoid sharp shear
Short	Carpals, tarsals	Shock dispersion	Gentle joint play; respect small ligaments
Flat	Scapula, ribs	Muscle anchors	Free glide for scapular rhythm & breath
Irregular	Vertebrae	Complex motion coupling	Forearm glides parallel to paraspinals
Sesamoid	Patella	Improves tendon leverage	Track patella; don't press directly
Pneumatic	Frontal, maxilla	Lighten skull, resonate voice	Feather-touch at temples/brow

B) Synovial joint types, examples, movements

Type	Example	Primary Movements
Plane	Intercarpal	Glide
Hinge	Elbow, ankle	Flex/extend
Pivot	C1-C2	Rotation
Condyloid	Wrist	Flex/extend, ab/adduct
Saddle	Thumb CMC	Opposition + multiplanar
Ball-socket	Shoulder/hip	All planes + circumduction

C) Muscle & fascia essentials

Feature	What it does	Uzhichil cue
Sarcomere sliding	Produces force	Heat + rhythm improve perfusion
Spindle reflex	Guards fast stretch	Slow press on exhale to quiet
Golgi inhibition	Releases high tension	Sustained end-range holds
Fascia viscosity	Governs glide	Warm, long strokes first

D) Posture & movement muscle groups

Region	Key Muscles	Kalari Role
Core	Diaphragm, TVA, multifidi, pelvic floor	Breath-power integration
Hip	Glute max/med, deep rotators	Lunge stability, kicks
Knee	VMO, VL, popliteus	Patellar tracking, knee lock/unlock
Foot/ankle	Gastro-soleus, tibialis ant/post, peroneals	Arches, landing control



Region	Key Muscles	Kalari Role
Scapula	Lower traps, serratus ant., rhomboids	Overhead weapon form
Neck	Deep flexors, SCM, scalenes	Head control, balance

E) Injury → therapeutic pathway

Condition	Acute (0-72 h)	Sub-acute (Day 3-14)	Remodel & Return
Ankle sprain	Cool oil, bandhana, distal flush	Gentle cross-fibre, light heat	Balance drills, graded hops
Hamstring strain	Compression, no stretch	Long glides, pin-and-stretch	Eccentrics, Neeta lunges
Rotator cuff pain	Rest, scapular setting	Thoracic/rib mobility, cuff friction	Eccentrics, overhead retrain
Low back Vāta pain	Warmth to legs, heel decompression	Core timing, hip mobility	Load tolerance, chuvadukal flow

Key take-aways

1. **Bone shape and joint design dictate safe pressure angles and movement homework.**
2. **Muscle tone is a nervous-system event—press and breathe to talk to spindles and Golgi, not just fibres.**
3. **Fascia connects everything—warm long strokes before precision work.**
4. **For injuries, match the technique to the phase: calm first, mobilise second, strengthen last.**
5. **Use chuvadukal as both a screen and a prescription to lock manual gains into daily movement.**