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Short Communication

Tele-orthopaedics in India: Bridging the divide, navigating the risks

Naveen Jeyaraman[1,2], Swaminathan Ramasubramanian[1], Madhan Jeyaraman*[1,2]

[1]Dept. of Regenerative Medicine, Agathisha Institute of Stem cell and Regenerative Medicine (AISRM), Chennai, Tamil Nadu, India
[2]Dept. of Orthopaedics, ACS Medical College and Hospital, Dr MGR Educational and Research Institute, Chennai, Tamil Nadu, India

Abstract

Tele-orthopaedics in India has transitioned from pandemic-driven necessity to a vital healthcare modality addressing rural-urban disparities. This editorial explores its evolving clinical applications—trauma triage, post-operative monitoring, tele-rehabilitation, pediatric screening, and virtual mentoring—highlighting efficiency gains and accessibility. However, limitations persist: the absence of tactile examination compromises diagnostic accuracy, while infrastructural and socio-cultural barriers hinder equitable access. The 2020 Telemedicine Practice Guidelines provide a legal framework, delineating drug prescription categories, consent protocols, and documentation standards, with strict prohibitions on narcotics and mandates for data privacy. The future lies in a "Phygital" model integrating digital tools with selective physical assessment. Emerging technologies like AI-driven imaging, wearable sensors, and blockchain-secured records promise to enhance remote care without compromising clinical rigor. Ultimately, tele-orthopaedics must be wielded with discernment—extending reach without diluting responsibility—to ensure that virtual consultations uphold the same standards as in-person care, safeguarding both patient outcomes and medico-legal integrity.

Keywords: Tele-orthopaedics, Artificial intelligence, Phygital model

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1. Introduction

Orthopaedics has always been tactile. Palpating a fracture, stressing a ligament, assessing joint warmth: these actions define our specialty. Yet the past five years have forced a seismic recalibration. Tele-orthopaedics, once dismissed as novelty, has become clinical necessity.1 The COVID-19 pandemic accelerated this shift, but the underlying pressure was already building. India's healthcare demographics demanded it.

Seventy percent of India's population lives in rural areas, yet orthopaedic surgeons cluster in urban centers. Patients traverse hundreds of kilometers for routine follow-ups, bearing what we might call a "distance penalty." The pandemic normalized video consultations, digital imaging transfers, and remote rehabilitation out of sheer survival.[2,3] Now, with the immediate crisis behind us, we face harder questions. Is tele-orthopaedics sustainable, or merely stopgap? Can a screen substitute for examination? What legal landmines await the unwary surgeon? This communication examines the clinical applications proving their worth, the limitations threatening diagnostic accuracy, and the medico-legal framework every Indian orthopaedic surgeon must master.

2. Current Applications: Maturation Beyond Crisis Mode

Tele-orthopaedics has evolved into a multi-stage ecosystem addressing distinct phases of patient care.

2.1. Trauma triage

Rural "spoke" hospitals staffed by general practitioners can now access specialist opinion from urban "hub" centers instantly. High-resolution X-rays and injury photographs allow experts to guide local doctors through fracture reduction and splinting while determining transfer necessity. This "Tele-Trauma" model optimizes resource allocation. Minor stable fractures receive local management; high-priority injuries transfer immediately. Overburdened tertiary centers gain breathing room.[4]

*Corresponding author: Madhan Jeyaraman
Email: madhanjeyaraman@gmail.com

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Table 1: Clinical applications of tele-orthopaedics in India

Application	Clinical utility	Optimal scenario	Limitations
Trauma Triage	Expert guidance for rural fracture management; reduces unnecessary transfers	Stable fractures, soft tissue injuries requiring specialist opinion	Cannot assess neurovascular status adequately; relies on local provider skill
Post-operative Follow-up	Wound monitoring, ROM assessment, pain evaluation	Routine post-op checks; complication screening	Misses deep infections, subtle joint instability
Tele-rehabilitation	Guided exercise therapy; compliance monitoring	Elderly patients, arthroplasty rehabilitation	Cannot correct improper technique in real-time; requires baseline patient mobility
Pediatric Screening	Gait analysis, deformity assessment	CTEV screening, angular deformities	Age-dependent cooperation; requires parental assistance

Table 2: Telemedicine drug prescription categories under 2020 guidelines

Category	Description	Orthopaedic examples	Prescription rules
List O	Over-the-counter medications	Paracetamol, topical NSAIDs, calcium supplements	Freely prescribable; no restrictions
List A	First-line medications for initial consultation	Simple analgesics, NSAIDs, Vitamin D, bisphosphonates	Prescribable during first video consultation
List B	Add-on medications for follow-up	Chronic osteoporosis management, maintenance therapy	Requires established doctor-patient relationship
Prohibited	Narcotics, psychotropic substances	Tramadol, codeine combinations, controlled opioids	Cannot be prescribed via telemedicine; invites NDPS Act liability

2.2. Post-operative monitoring

Surgical wounds lend themselves to remote assessment. Requiring patients to travel solely for wound inspection wastes time and resources. Pilot studies across rural India demonstrate effective monitoring through secure photographic platforms.[5] Superficial infections and dehiscence become visible early. Range-of-motion estimates, though less precise than goniometry, guide rehabilitation adjustments. This represents tele-orthopaedics at its most efficient.

2.3. Rehabilitation and pediatric screening

"Physio-tech" platforms enable physiotherapists to guide exercises via video.[6] Elderly osteoarthritis patients and arthroplasty recipients, for whom travel poses hardship, benefit substantially. Pediatric screening for clubfoot, genu varum, and genu valgum works surprisingly well. Parents position children before cameras; surgeons assess gait and limb alignment, triaging which cases demand urgent intervention.[7]

2.4. Education and mentoring

Virtual grand rounds, webinars, and telementoring have democratized knowledge. Surgeons in tier-2 and tier-3 cities observe complex procedures without expensive travel.[8,9] The skill gap narrows. **Table 1** summarizes these applications with their strengths and optimal use scenarios.

3. Limitations: Confronting the "Touch" Deficit

Enthusiasm must not blind us to tele-orthopaedics' inherent vulnerabilities.

3.1. Physical examination loss

Our specialty depends on palpation and provocative maneuvers. The Lachman test for anterior cruciate ligament injury, McMurray's test for meniscal tears, assessment of compartment tension: none translate to video. A screen cannot transmit joint "end-feel" or quantify muscle power accurately. Diagnoses requiring these maneuvers court error. Telemedicine becomes "history-heavy, exam-light," forcing over-reliance on imaging.[10] Ordering MRI for every knee pain that clinical examination could resolve wastes resources and exposes patients to unnecessary procedures. Certain conditions resist remote diagnosis entirely. Early compartment syndrome, subtle ligamentous instability, and occult fractures demand physical assessment. Missing these carries catastrophic consequences.[11,12]

3.2. Technical infrastructure

India's digital divide persists. Rural hamlets lack reliable high-speed internet. Poor bandwidth produces pixelated video, audio lag, and dropped connections. Patient-uploaded images often disappoint: X-rays photographed against window light become unreadable. Subtle fractures vanish in glare.[12]

3.3. Socio-cultural barriers

Effective tele-consultation requires digital literacy absent in large population segments. Many patients need "assisted telemedicine," where healthcare workers or family members facilitate calls. Without this scaffolding, the system excludes

precisely those it aims to serve. A "trust deficit" compounds matters. Indian patients culturally equate care with physical presence and touch. A doctor on screen may seem less invested, undermining treatment compliance.[13]

4. Medico-legal Framework: The 2020 Guidelines

The Telemedicine Practice Guidelines 2020, released by the Board of Governors superseding the Medical Council of India, established the legal foundation.[14] These guidelines clarified responsibilities while introducing specific liabilities.

4.1. Drug prescription categories

The guidelines stratify medicines into lists critical for pain management, orthopaedics' daily bread. **Table 2** summarizes 2020 guidelines for telemedicine drug prescription categories.

The Prohibited List constitutes a minefield. Orthopaedic surgeons accustomed to prescribing stronger opioids for acute trauma or post-operative pain must recognize that doing so via tele-consult explicitly violates guidelines. Criminal liability under the Narcotic Drugs and Psychotropic Substances Act follows.

4.2. Consent and documentation requirements

Patient-initiated calls imply consent. However, intrusive advice or procedures (even remotely guided) require explicit consent recorded through audio, video, or email. Documentation standards must be rigorous. Prescriptions need digital format including registration number, patient details, and timestamps.[15] WhatsApp messages stating "Take Tab X" hold no legal weight. Screenshots, shared images, and formal prescriptions require archiving. In litigation, absent records offer no defense.

4.3. Standard of care and liability

The law demands equivalent standard of care regardless of consultation mode. Surgeons cannot claim inability to palpate limbs as automatic absolution. Guidelines mandate converting tele-consults to in-person visits when physical examination proves critical for diagnosis. Failing this constitutes negligence. Treating a "sprained ankle" via video that proves to be a Maisonneuve fracture invites negligence claims if the surgeon neglected recommending X-rays or physical review when symptoms misaligned with history.[16,17]

4.4. Data privacy

The impending Digital Personal Data Protection Act raises stakes for casual platform use. WhatsApp, despite end-to-end encryption, is not a dedicated Electronic Medical Record system. Lost or hacked phones breach patient confidentiality. Surgeons must migrate toward dedicated telemedicine applications ensuring data encryption and compliance with Indian privacy frameworks (DISHA, Personal Data Protection Bill).[18]

5. Future Directions: The "Phygital" Model

The path forward lies in hybrid "Phygital" care: physical examination when necessary, digital for everything else.[19,20] We stand at the threshold of "Digital Orthopaedics." Artificial intelligence algorithms will screen patient-uploaded X-rays for fractures before surgeon review. Gait analysis from video will quantify limp objectively. Wearable technology will transmit real-time activity data and range-of-motion measurements, filling voids left by absent physical examination.

Machine learning models trained on thousands of knee X-rays can flag osteoarthritis severity or detect subtle fracture lines humans miss. These tools augment, not replace, clinical judgment. The surgeon remains decision-maker, but equipped with computational allies.

Blockchain technology may eventually secure patient data more robustly than current platforms. Decentralized health records accessible only through cryptographic keys could eliminate privacy concerns while enabling seamless specialist consultation.

6. Conclusion

Tele-orthopaedics in India has evolved from a crisis response into a vital tool for bridging rural-urban healthcare gaps. Its success hinges on responsible implementation by surgeons who recognize when physical examination is indispensable, strictly follow the 2020 Telemedicine Guidelines, and maintain rigorous documentation. While screens cannot replicate palpation or stress testing, they can extend care to underserved regions, reduce travel burdens for elderly patients, and support remote education. The "virtual hand" must complement—not replace—the physical one. Surgeons must wield telemedicine with discernment, ensuring that remote consultations meet the same standards as in-person care. Legal accountability remains unchanged; negligence in virtual settings invites real-world consequences. As digital tools expand our reach, our ethical and clinical responsibilities must remain steadfast. Tele-orthopaedics has arrived—not as a substitute, but as a strategic extension of care. Its future depends on how wisely and thoughtfully we integrate it into everyday orthopaedic practice.

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