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Ready OR Not?

RETHINKING RETURN TO PLAY

ADVANCING SAFE AND EFFECTIVE ATHLETE RECOVERY

Presenter *Aneurin Robyn*

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2007: SPT
2013: Mphil
2022: PhD

MY JOURNEY SO FAR

Idasvallei Primêr

Kwalifiseer as Fisioterapeut

Boland Rugby Seniors

WP Rugby Juniors and Stormers

2007

2013

2022

1994

1999

2004

2006–2010

2011–2014

2011–2016

2015–2019

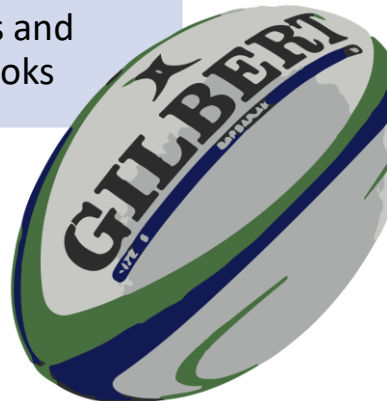
2020–2023

Hoërskool Stellenbosch

Boland Rugby Juniors

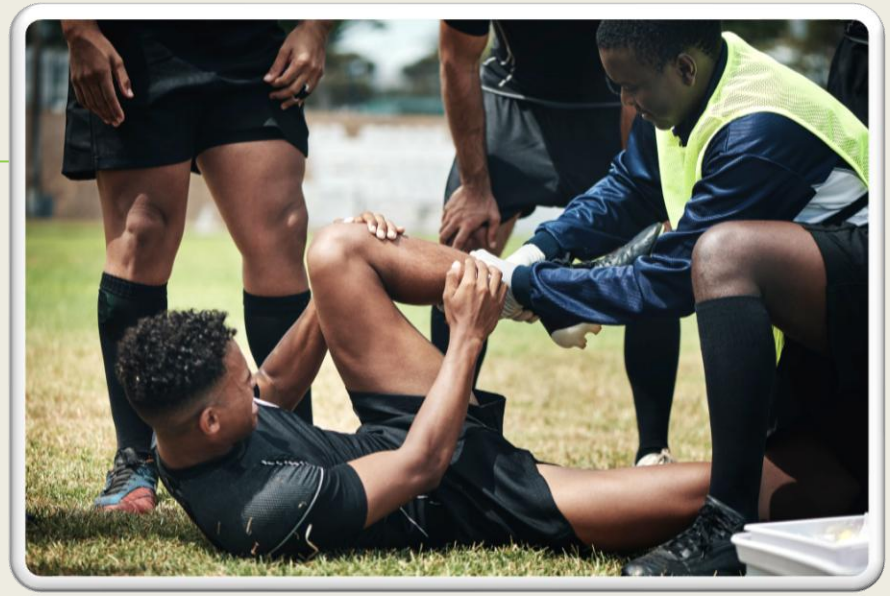
Junior Springboks

Stormers and Springboks



What is Return to Play (RTP)?

- RTP is the **process** of **safely** returning an athlete to sport following injury. It **combines** medical clearance, physical recovery, functional testing, and mental readiness to ensure a successful and sustainable return.



Key Phases of RTP

Injury Management Phase

Rehabilitation Phase

Return to Participation

Return to Sport

Return to Performance

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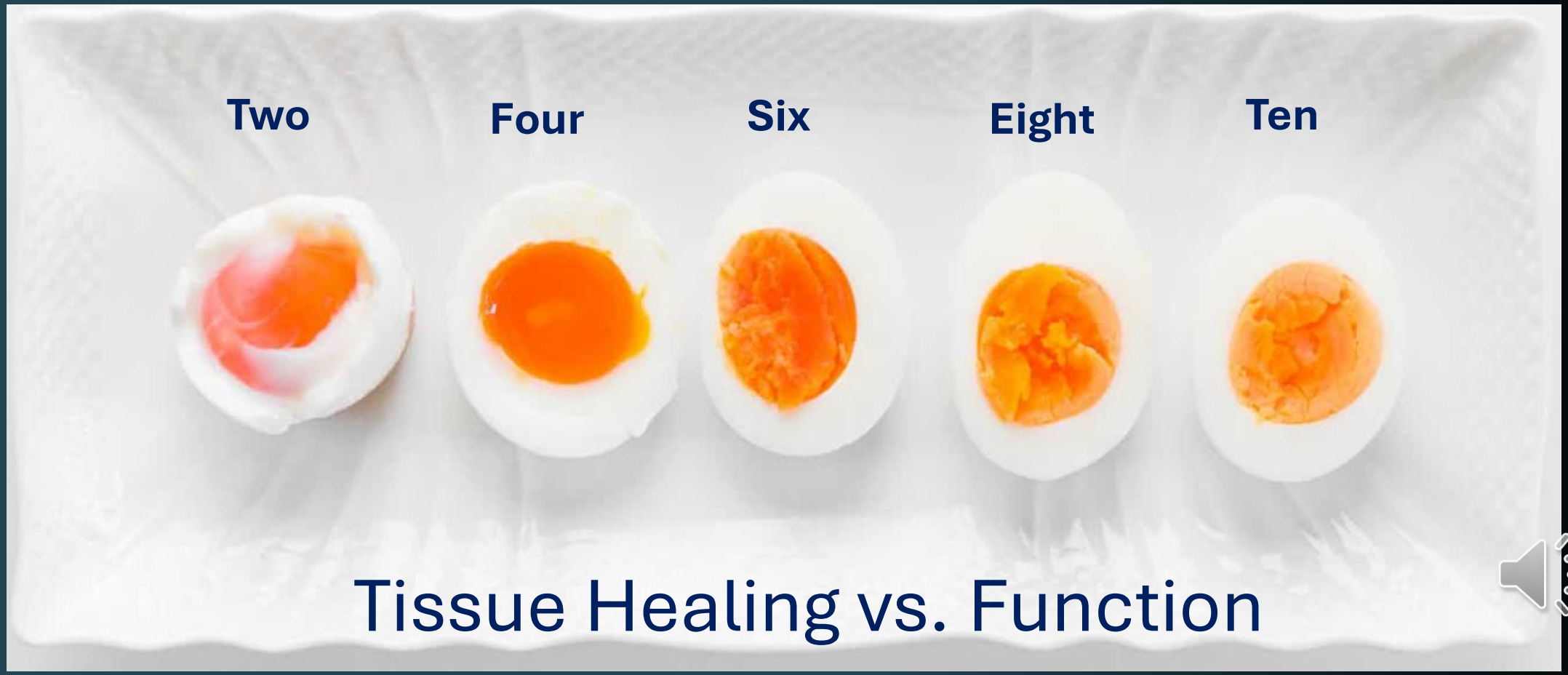
FOUNDATIONS OF RTP

“It’s tough to make predictions, especially about the future.”

Yogi Berra

When Is The Player Ready?



RTP Overview

RTP is an evidence-based, staged process designed to safely return athletes to sport after injury.

It addresses physical recovery, mental readiness, technical skill, and cognitive decision-making.

Modern RTP is criteria-based, not just time-based, as time alone poorly predicts safe return.

- (Ardern et al., 2016; Buckthorpe et al., 2023).

Definition Continuum

- Return to Participation →
- Return to Sport →
- Return to Performance.

Many Definitions and Interpretations

RTP = Resume Participation

The process by which an injured athlete **resumes participation** in sport or physical activity. It typically includes a **staged progression**, ensuring physical, psychological, and functional readiness.

RTS = Resume Sport / Competition

The point at which the athlete resumes training or competition at their **pre-injury level**.

This is often seen as a **milestone** within the broader RTP process.

RTPerf = Regain / Surpass Pre-Injury Performance

The stage **beyond RTS** where the athlete not only returns to competition but **regains** or surpasses their previous level of **performance**.

This includes full physical, technical, tactical, and psychological capacity, and may take several months beyond RTS.

Key point

While RTP and RTS focus on participation, RTPerf focuses on **quality of performance** and the athlete's ability to meet or exceed pre-injury benchmarks.

It is critical that clinicians and performance staff **distinguish these phases**, set appropriate **expectations,** and monitor athletes carefully to avoid premature return, which increases reinjury risk.

Importance: Clear Communication - Aligned Expectations

RTP for the every day Medic

Q: *What's the most common mistake in RTP decision-making?*

A: <u>Rushing return based on time</u> rather than meeting objective + psychological criteria. We need to **<u>balance</u>** tissue healing, functional tests, and mental readiness — **<u>time alone is not enough</u>**.

Q: *How do you address an athlete's fear of reinjury?*

A: First, **<u>acknowledge</u>** it as normal. Then use **<u>tools</u>** like the ACL-RSI or I-PRRS, mental skills training, graded exposure to sport tasks, and reassurance from the medical + coaching team.

Q: *Which technology has made the biggest impact on RTP in the last 5 years?*

A: <u>Wearable</u>s (GPS, IMUs) for external load and asymmetry tracking, and **<u>force plates</u>** for objective strength/power testing. Also, **<u>cognitive tools</u>** like SpeedCourt are reshaping return-to-performance strategies.

Q: *When should psychological readiness be assessed?*

A: Ideally **<u>throughout</u>** rehab, not just at the end. Early screening helps tailor **<u>interventions</u>**, and repeated measures track progress.

READINESS ASSESSMENTS

RTP Criteria

Pain-free movement

Adequate strength and endurance

Functional stability

Psychological readiness

Clearance by medical team

Consequences of poor RTP decisions

Balancing Safety and Performance

RTP Key Questions in Decision-Making

Key Questions Identified in Literature

- What combination of objective measures best determines physical readiness?
- How can psychological readiness be effectively measured and integrated?
- How can we reduce the high re-injury rates observed post-RTP?
- Should RTP timelines be standardized or entirely individualized?
- What role should athlete risk tolerance and shared decision-making play in clearance?

Why These Questions Matter

- Despite advances in testing and criteria, no universal RTP standard fits all athletes, sports, or injury types.
- Psychological, social, and contextual factors remain difficult to quantify and integrate.
- Even physically cleared athletes remain at heightened injury risk if psychological or functional deficits persist.

Key Takeaway

Ongoing key questions in RTP highlight the need for ***multidisciplinary, individualized, and dynamic decision-making models***, where no single test or measure can dictate readiness alone.

Common Injuries and Challenges

ACL Reconstruction

- Key risk = ≥30% reinjury within 2 years;
- Requires ≥90% quadriceps symmetry, hop test battery
- ACL-RSI >65.

Hamstring Strains

- High recurrence in first 2–4 weeks
- Assess eccentric strength (NordBord)
- Sprint Mechanics
- Neural Tension.

Ankle Sprains

- Test SEBT
- Y-Balance
- Cutting
- Landing
- Proprioception deficits are common

Shoulder Instability

- CKCUEST
- Rotator Cuff Strength
- Throwing / Contact Progressions
- Assess Scapular Control

Example

Practical Soccer Player – Hamstring RTP

Week 1–2	Week 3–4	Week 5–6	Week 7+
Jog ~2 km	Accels ~4 km	HSR ~6 km	Full training
RPE ≤3	RPE 4–5	RPE 6–7	RPE 7–8
sRPE ≤60	sRPE 120–150	sRPE 180–210	sRPE 210–240

Focus → Gradual Return → Objective + Subjective Monitoring

Training Load Progression Framework

Phase 1 Rehab Initiation
- Low impact, mobility, isometrics

Phase 2 Early Load
- Cycling, BW strength, pool work

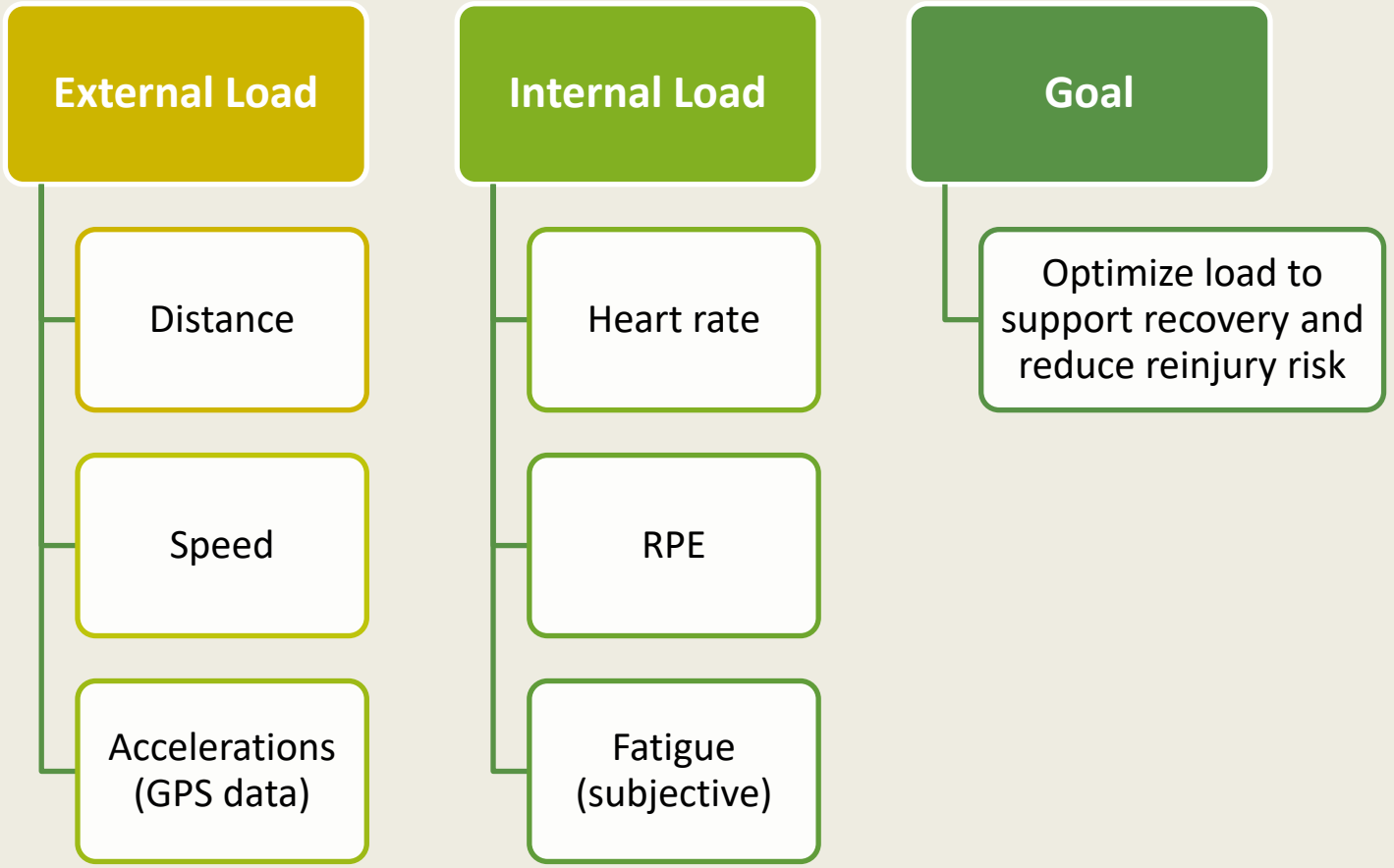
Phase 3 Strength + Neuro
- Resistance training
- Balance

Phase 4: Functional Training
- Plyos
- Cutting
- Sport Drills

Phase 5: RTP
- Full training + monitoring

Criteria → Strength ≥90% → Hop Test → Psychological Readiness

Understanding Training Load in RTP



Monitoring Tools and Key Metrics

Acute:Chronic Workload Ratio (ACWR)

- Optimal Range: 0.8 to 1.3 (sweet spot)
- >1.5 = Increased Injury Risk

Session RPE (sRPE)

- RPE × Session Duration
- Tracks Subjective Training Stress

GPS/Wearables

- Distance
- HSR
- Load Zones
- Accelerations

Key Considerations

Individualize progression

Monitor load with GPS + sRPE

Test under fatigue

Prioritize communication with all stakeholders

Focus

RTP is not just clearance - it's performance restoration.

Objective Testing

RTP Objective Testing

Strength and Flexibility Testing

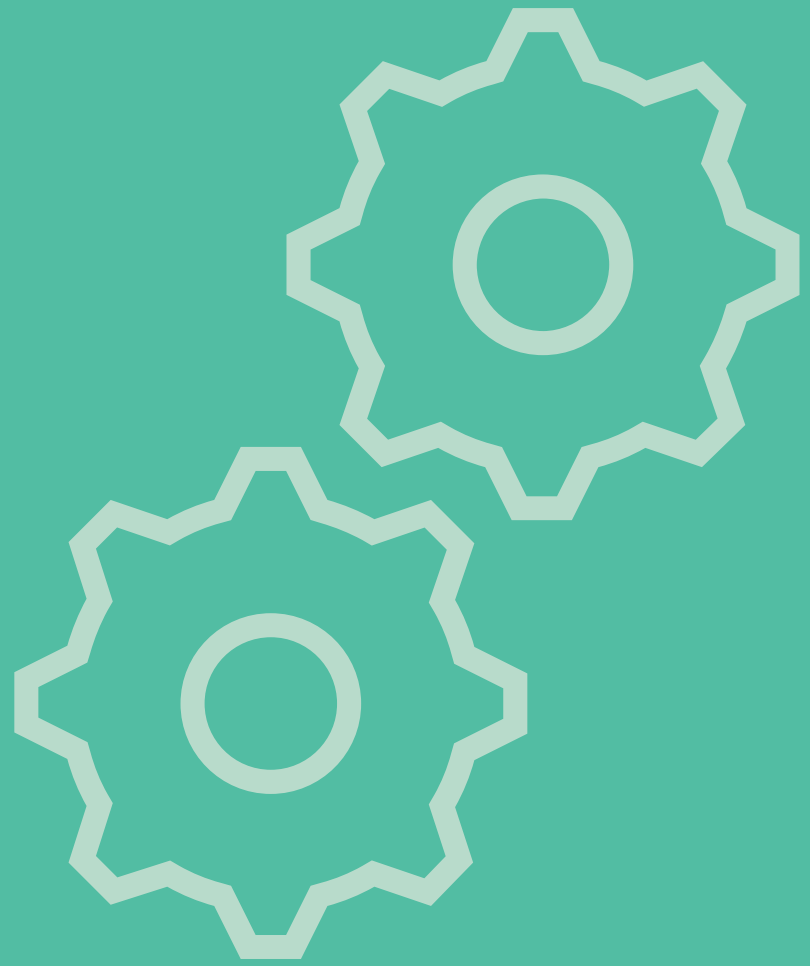
Jump, Hop and Balance Testing

Agility and Sport-Specific Drills

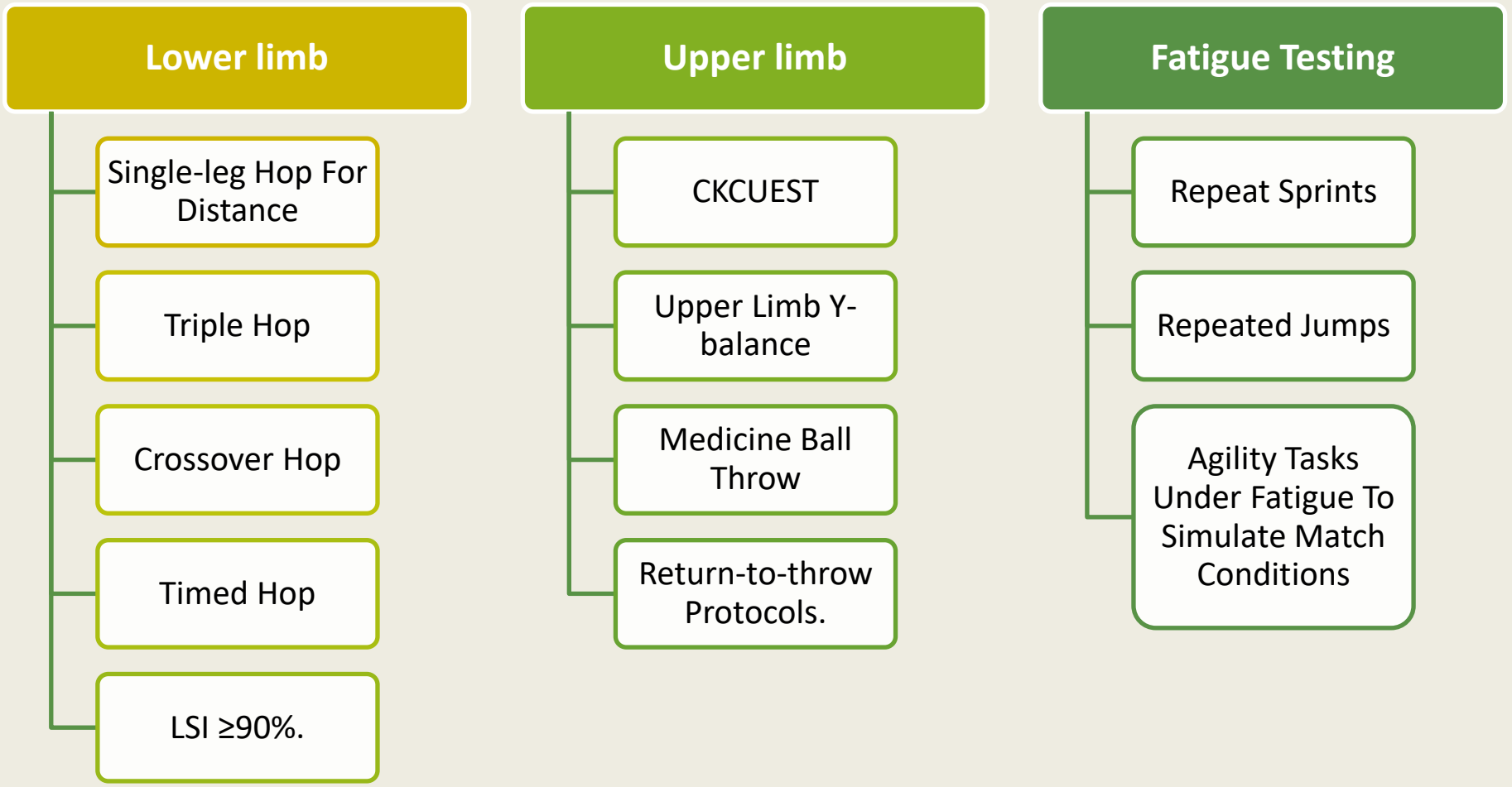
Limb Symmetry Index and Force Measurements

Strength	Power	Agility / Speed	Load Monitoring
Isokinetic dynamometry, handheld dynamometers (HHD), NordBord; LSI ≥90%.	ForceDecks asymmetry <10%, reactive strength index (RSI), CMJ performance.	SpeedCourt change of direction, T-test, Illinois agility test; assess acceleration, deceleration, COD.	GPS for sprint distance, high-speed running, accelerations/decelerations, player load.

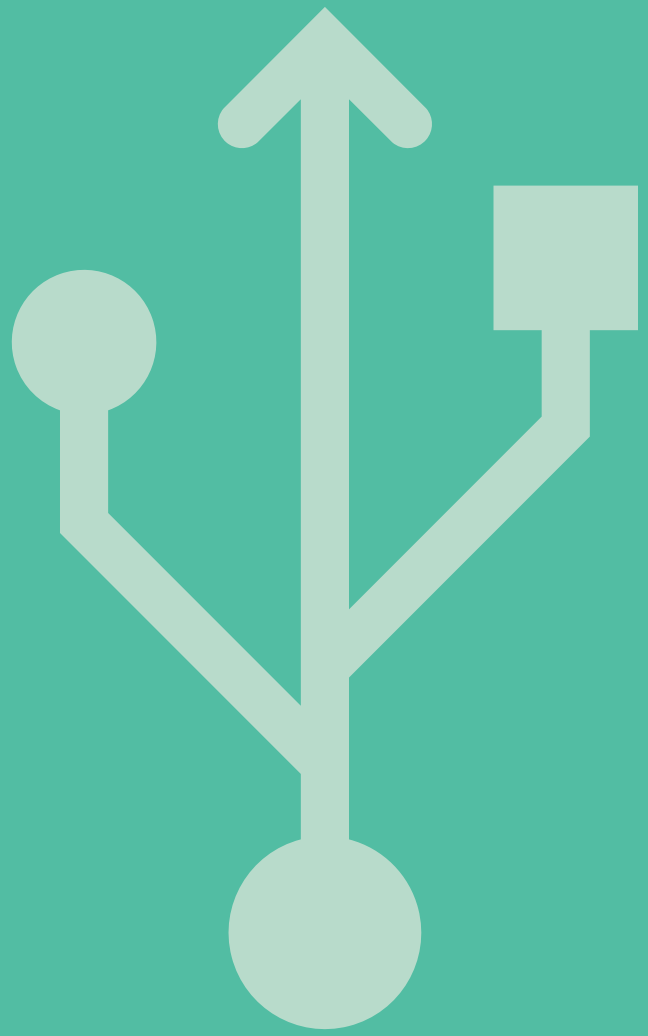
Functional Testing



RTP Functional Testing



Technology



RTP Role of Technology

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- Wearables and sensors
- GPS tracking
- AI injury risk prediction
- Tele-rehabilitation tools
- Data-driven decision-making (Data analytics in RTP)
- Telehealth and Remote Monitoring
- Blood Biomarkers and Muscle Oxygen Monitoring
- Artificial Intelligence (AI) and Predictive Analytics
- Virtual Reality (VR) and Augmented Reality (AR)
- Take-Home Recommendations

RTP Technology

1. Wearables and Load Monitoring

- GPS trackers (e.g., Catapult, STATSports) to monitor running distance, sprints, accelerations
- Inertial Measurement Units (IMUs) to track movement quality, asymmetry, jump height
- Heart rate monitors to assess cardiovascular recovery
- **Example: Tracking return-to-sprint volume in hamstring rehab**

2. Force Plates

- Measure ground reaction force, asymmetries, jump height, landing mechanics
- Identify deficits during hopping, jumping, cutting tasks
- **Example: Checking symmetry in single-leg jumps post-ACL**

3. Motion Capture and Biomechanics

- 3D motion analysis systems (Vicon, Qualisys) for joint kinematics
- Markerless motion capture (DARI, Kinotek) for clinical use
- **Example: Analyzing gait, running, or cutting mechanics**

4. Cognitive and Reactive Training

- SpeedCourt, FitLight, BlazePod, NeuroTracker platforms
- Combine physical and cognitive challenges to improve decision-making, reaction time
- **Example: Reactive agility drills for team-sport athletes**

RTP Technology

5. Telehealth and Remote Monitoring

- Wearables + mobile apps to track home exercise and symptom reports
- Video check-ins with clinicians for monitoring progress
- **Example: Post-concussion graded activity monitored remotely**

6. Blood Biomarkers and Muscle Oxygen Monitoring

- Monitoring markers of muscle recovery, inflammation (e.g., creatine kinase, lactate)
- Near-infrared spectroscopy (NIRS) for muscle oxygenation
- **Example: Monitoring recovery after eccentric loading**

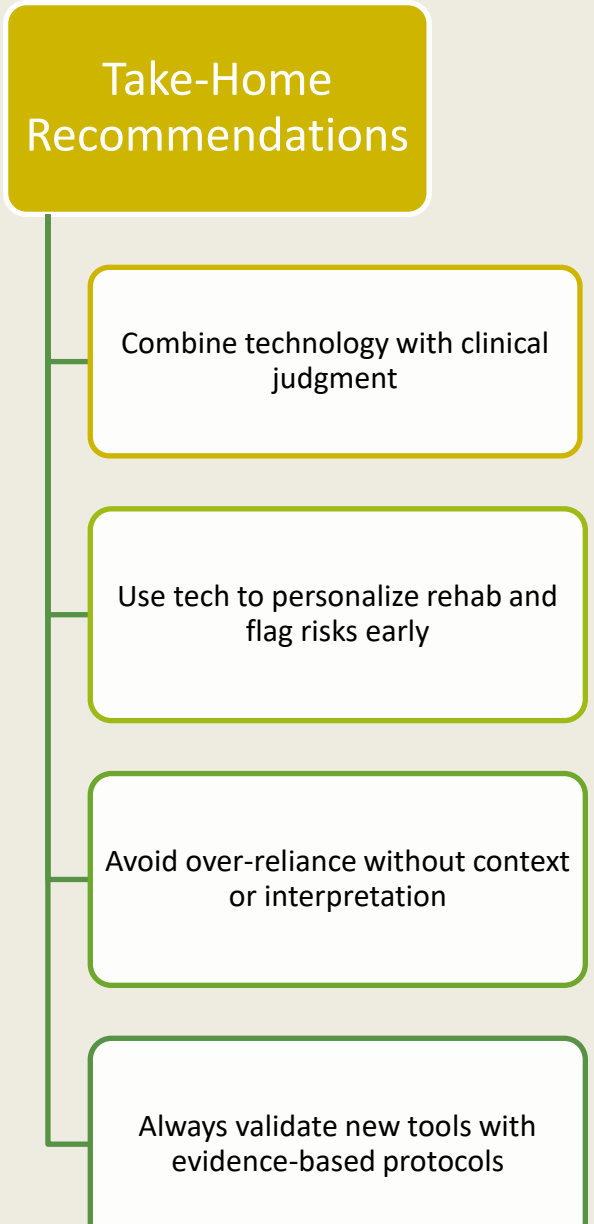
7. Artificial Intelligence (AI) and Predictive Analytics

- AI models analyze data to predict injury risk and recommend rehab progressions
- **Example: Workload-injury prediction models in football, rugby**

8. Virtual Reality (VR) and Augmented Reality (AR)

- VR for psychological readiness and cognitive rehab
- **Example: VR exposure therapy post-ACL to reduce fear of movement**

RTP Technology



Psychological Testing

Psychological Readiness

Tools

ACL-RSI (cutoff ~65–70), Tampa Scale for Kinesiophobia (TSK-11), confidence ratings.

Fear of reinjury is the #1 psychological barrier to RTP (Ardern et al., 2013).

Interventions

Mental rehearsal, graded exposure, goal setting, referral to sports psychologist.

Cognitive and Reactive Readiness

Dual Task Drills

Combine motor and cognitive demands (agility + decision making).

Visual Motor Tools

FitLight, SpeedCourt reactive agility, neurocognitive apps.

Research

Cognitive-motor training improves neuromuscular control, reducing reinjury (Grooms et al., 2015).

RTP Psychological Readiness

Screening for fear, anxiety, low confidence	**Building confidence**	**Mental health support**
Psychological validated tools (ACL-RSI, TSK)	**Provide mental health support**	**Reinforce athlete self-efficacy**

ICE BREAKER - RTP for the every day Medic

Q: Do you always need technology to make RTP decisions?

A: No - technology enhances decision-making but **doesn't replace** clinical judgment.

Prioritize **validated** clinical tests and use tech as a support tool, especially in elite sport.

Q: What's the minimum safe time to RTP after ACL reconstruction?

A: The evidence suggests waiting at least 9 months reduces reinjury risk, but decisions should also include strength, hop tests, and psychological readiness.

Q: How do you involve the coach in RTP?

A: Keep **communication open throughout rehab**, explain criteria-based progression, and align on a graded return to team activities. **Coaches can help** rebuild athlete confidence.

EVIDENCE-BASED
RTP FRAMEWORKS

Evidence-based Frameworks

StARRT Framework

Biopsychosocial Model

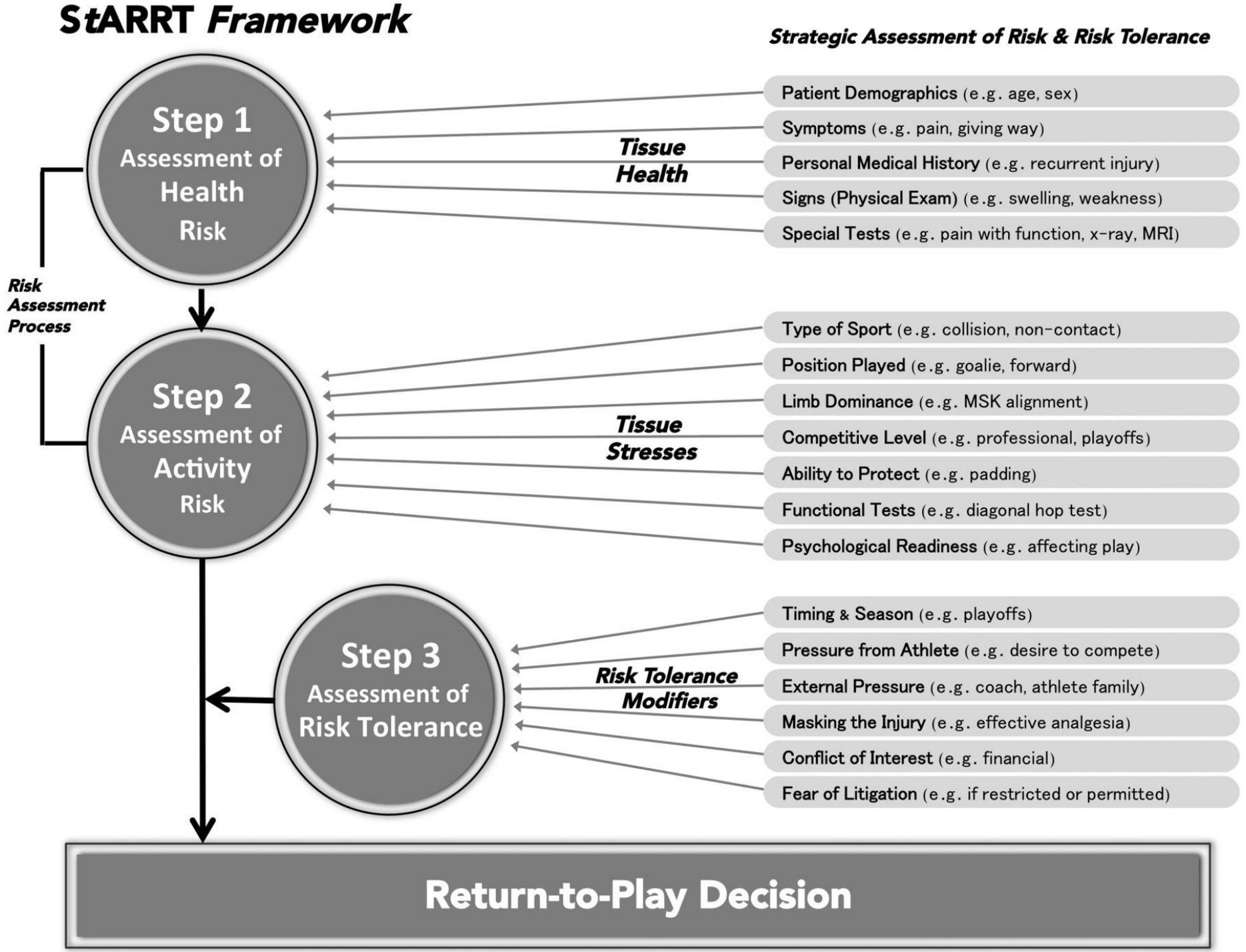
Three-Pillar Approach

Key point

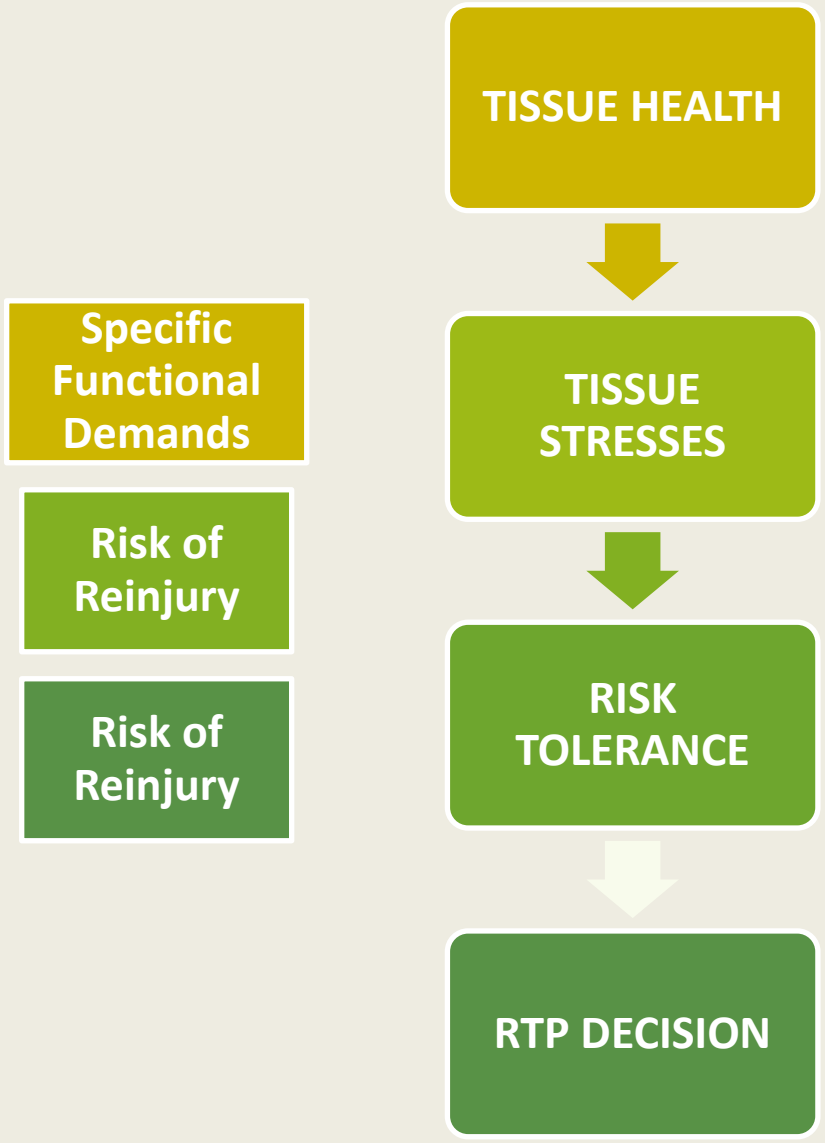
A structured framework helps guide RTP decision-making, ensuring a safe and evidence-based process.

Several models have been proposed to standardize this approach.

StARRT Framework


StARRT Framework
Strategic Assessment of Risk & Risk Tolerance
Step 1
Assessment of Health Risk
Tissue Health
Patient Demographics (e.g. age, sex)
Symptoms (e.g. pain, giving way)
Personal Medical History (e.g. recurrent injury)
Signs (Physical Exam) (e.g. swelling, weakness)
Special Tests (e.g. pain with function, x-ray, MRI)
Risk Assessment Process
Step 2
Assessment of Activity Risk
Tissue Stresses
Type of Sport (e.g. collision, non-contact)
Position Played (e.g. goalie, forward)
Limb Dominance (e.g. MSK alignment)
Competitive Level (e.g. professional, playoffs)
Ability to Protect (e.g. padding)
Functional Tests (e.g. diagonal hop test)
Psychological Readiness (e.g. affecting play)
Step 3
Assessment of Risk Tolerance
Risk Tolerance Modifiers
Timing & Season (e.g. playoffs)
Pressure from Athlete (e.g. desire to compete)
External Pressure (e.g. coach, athlete family)
Masking the Injury (e.g. effective analgesia)
Conflict of Interest (e.g. financial)
Fear of Litigation (e.g. if restricted or permitted)
Return-to-Play Decision

StARRT Framework



STEP 1

Health Risk Assessment

Evaluate

- Tissue healing
- Load capacity

Check

- Strength
- ROM
- Stability

Example

ACL

- Quad strength = 85% (target ≥90%)
- ROM full
- Swelling resolved
- Hop test deficit

Decision

- More Rehab Needed

STEP 2

Activity Risk Assessment

Assess Sport-Specific

- **Demands**
- **Risk**

Is the Sport

- High-Contact
- Pivoting
- Cutting

Example	Soccer Midfielder	Decision
	High cutting, pivoting load	Training Allowed
	Low-contact training = low risk	No Match
	Competitive match = high risk	

STEP 3

Tolerance Risk Assessment

Consider

- Athlete's and Team's risk tolerance

Context

- Season
- Competition
- Pressure

Example

Championship Final

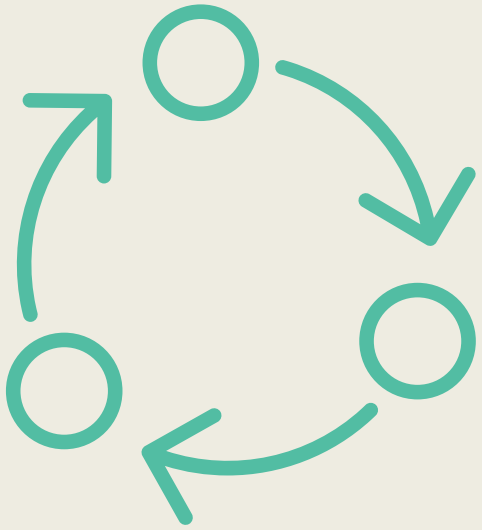
- Athlete motivated despite borderline clearance
- Coach under pressure

Decision

- Delay Return if reinjury Risk is High

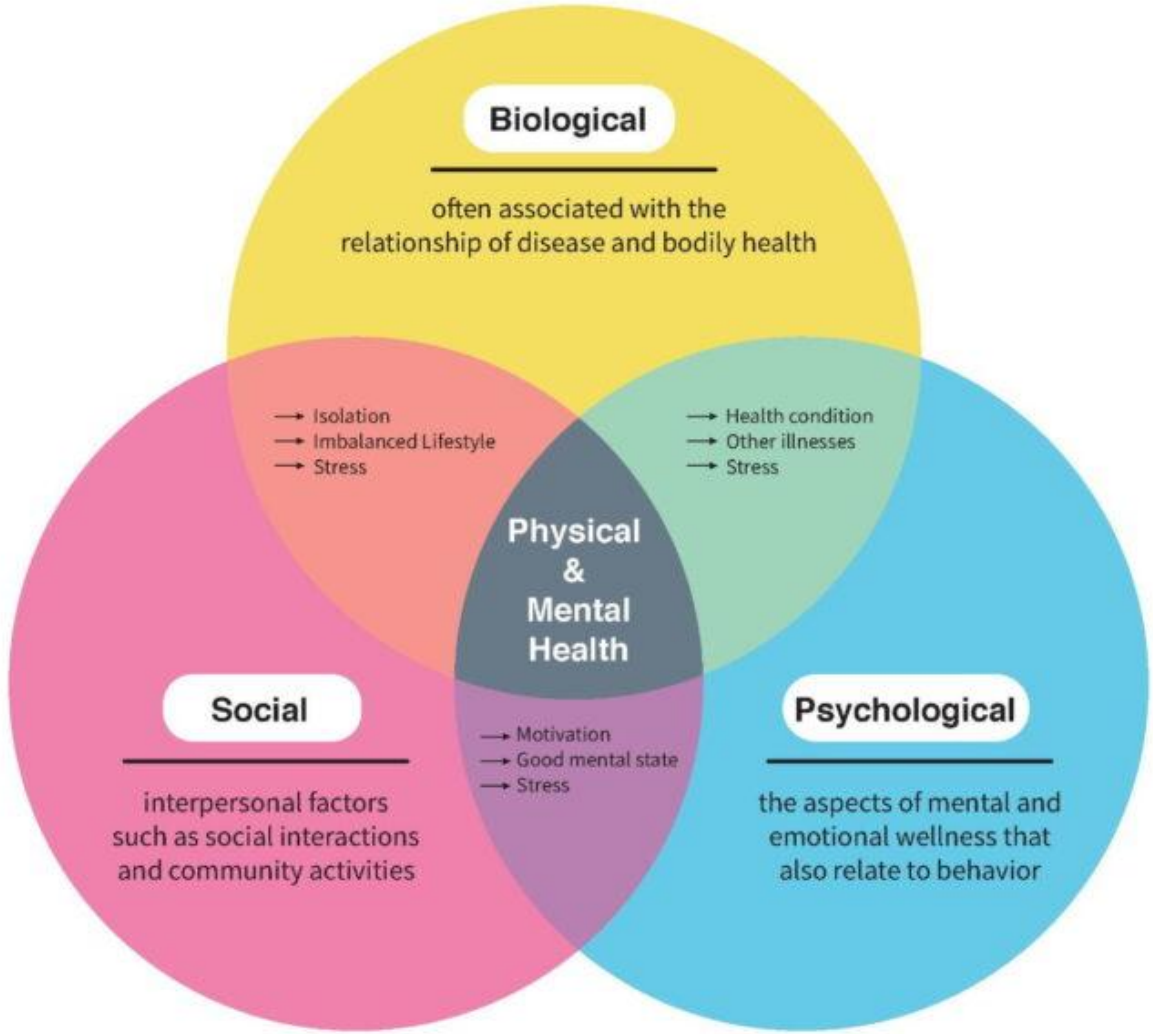
Outcome

Summary



Biopsychosocial Model

Biopsychosocial (BPS) model



Graphic: Chrystie Tyler

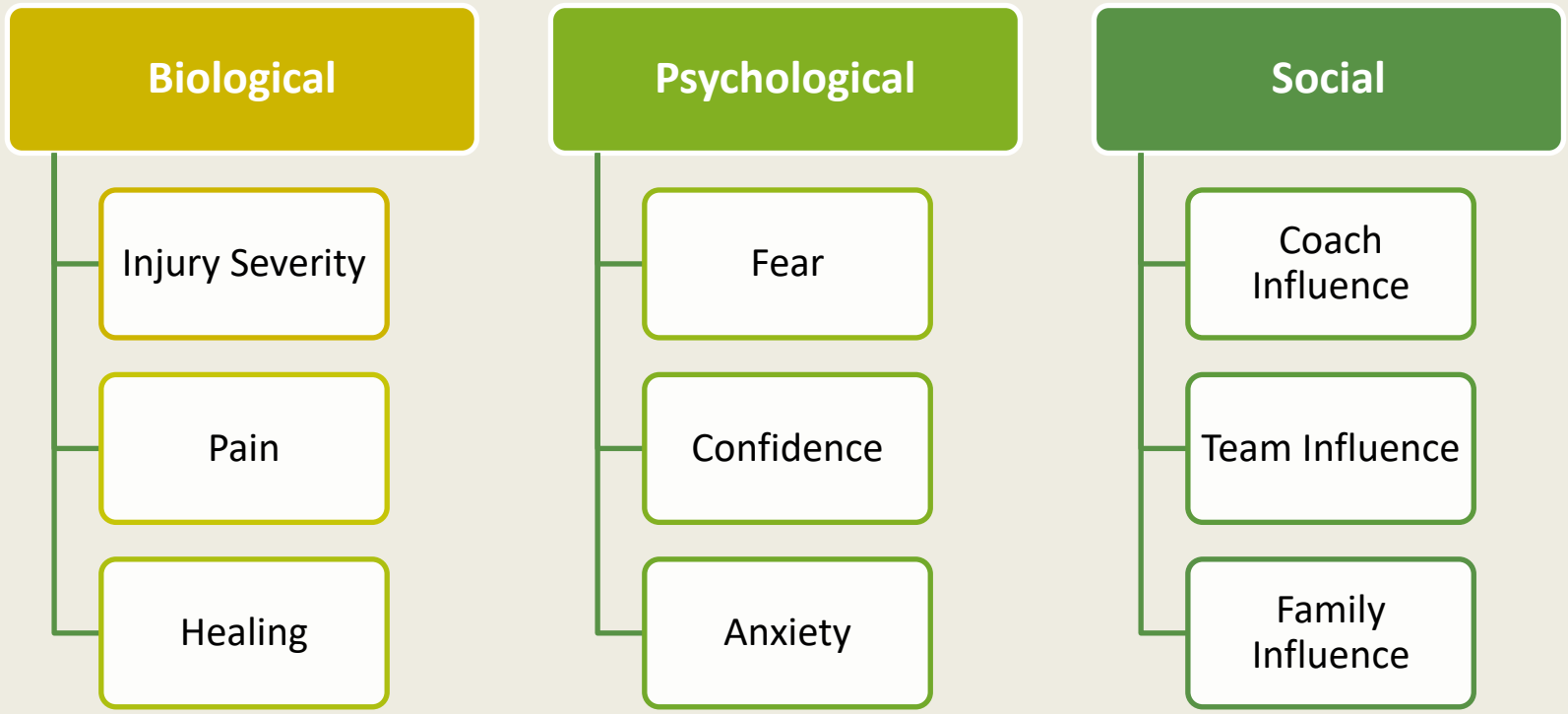
Biopsychosocial Model

Biopsychosocial Model Integrates

Focus

Whole Athlete

Not just Tissue Healing



ACL

Soccer Player

Evaluate

- Whole Athlete

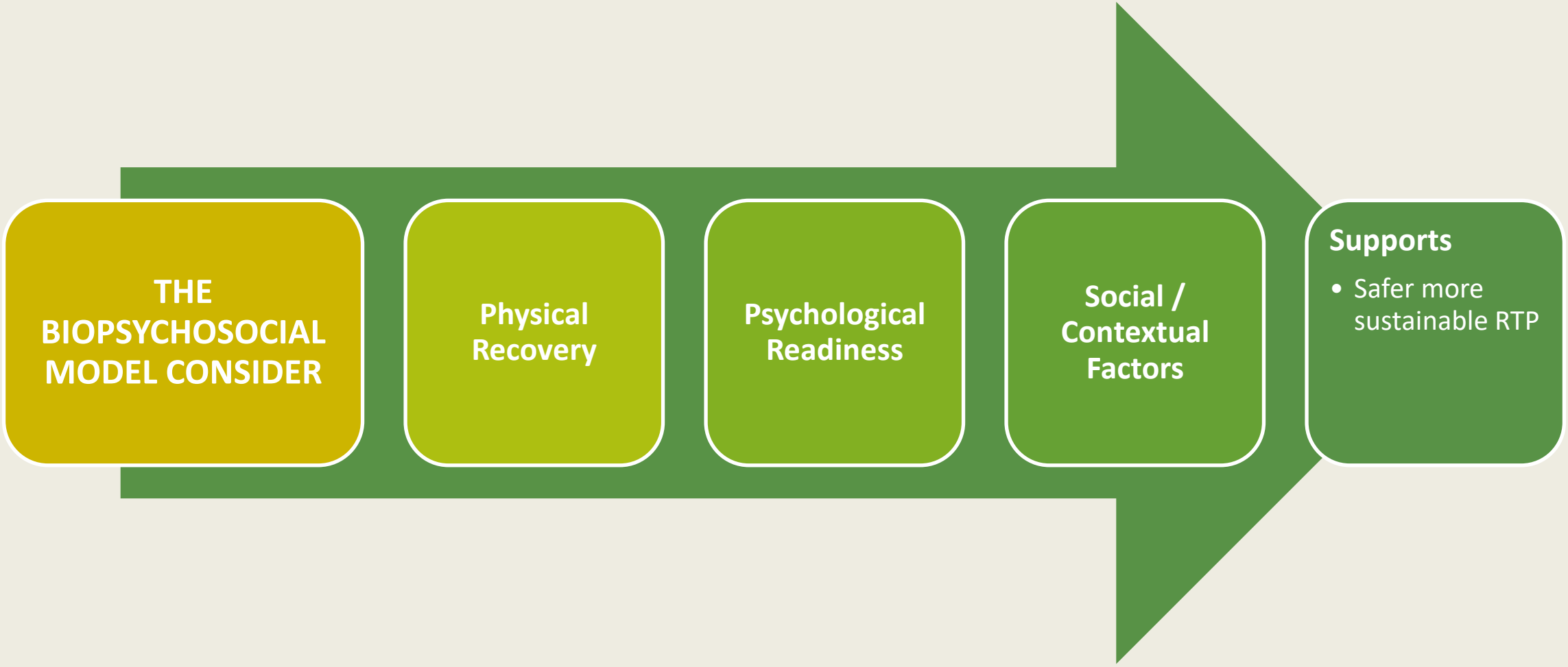
Check

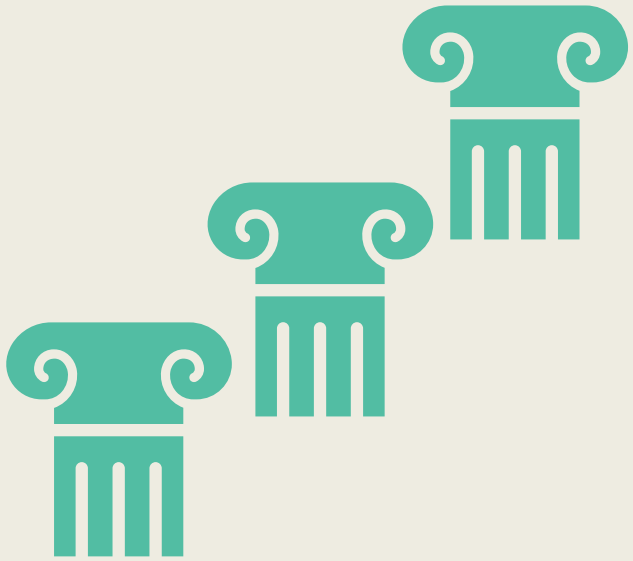
- Not just Tissue Healing

Biological	Psychological	Social	Decision
Quad strength 90%, hop tests passed	60/100 confidence (ACL-RSI), fear of pivoting	Team under pressure for tournament	Physically cleared but needs confidence building → extend rehab 2–4 weeks

Outcome

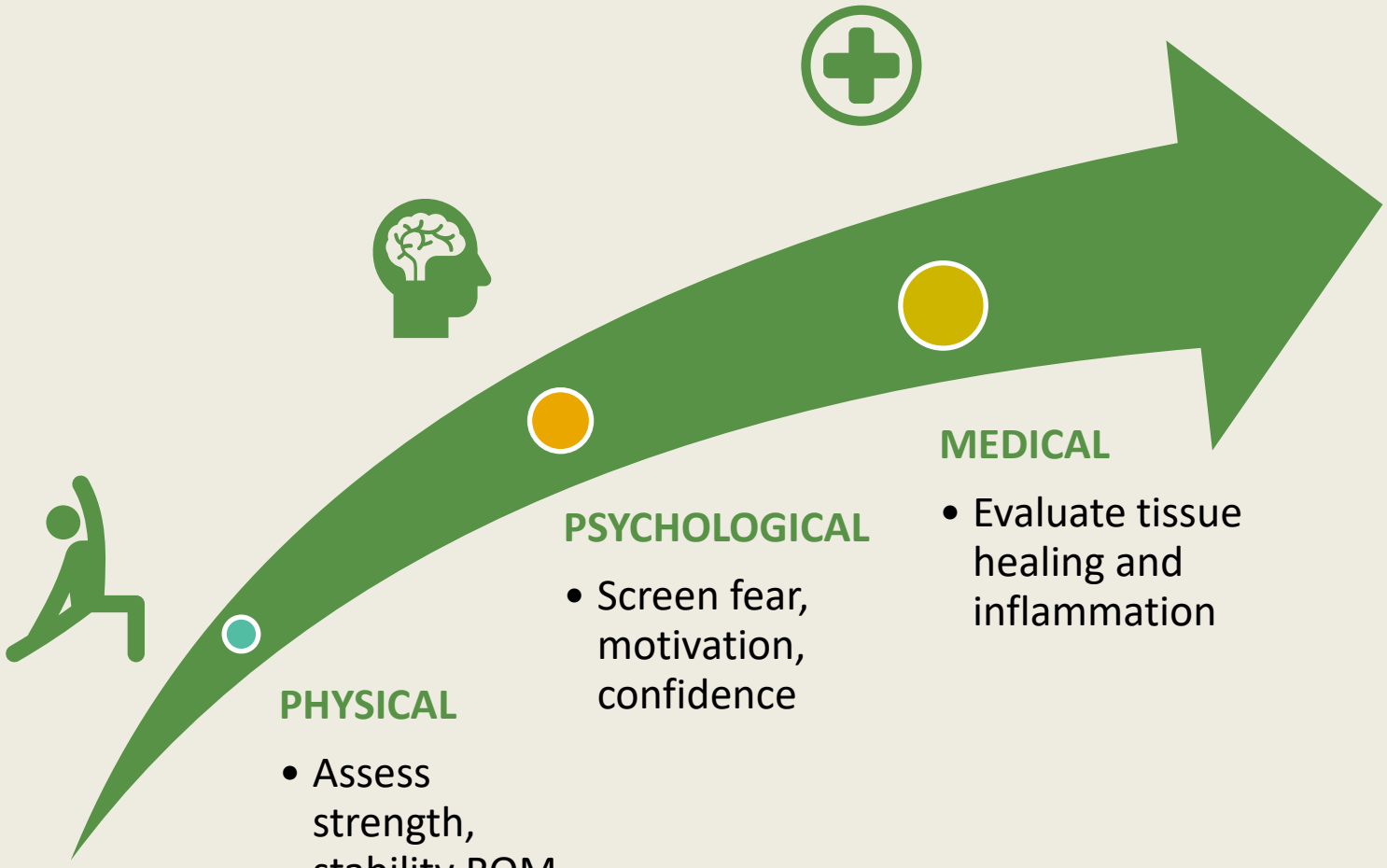
Summary





Three-Pillar Approach

Three-Pillar Approach



PHYSICAL

- Assess strength, stability ROM

PSYCHOLOGICAL

- Screen fear, motivation, confidence

MEDICAL

- Evaluate tissue healing and inflammation

INTEGRATES

Objective Physical Measures

- Strength
- Balance
- Functional Tests

PSYCHOLOGICAL READINESS

- Confidence
- Fear
- Mental State

SPORT SPECIFIC FUNCTIONAL READINESS

- Skill Execution
- Movement Quality
- Decision-Making

Example

Sprinter

Hamstring Injury

Objective

- Nordic strength ≥90% LSI, negative MRI, pain-free high-speed sprinting

Psychological

- 85/100 Confidence
- Low fear

Sport-Specific

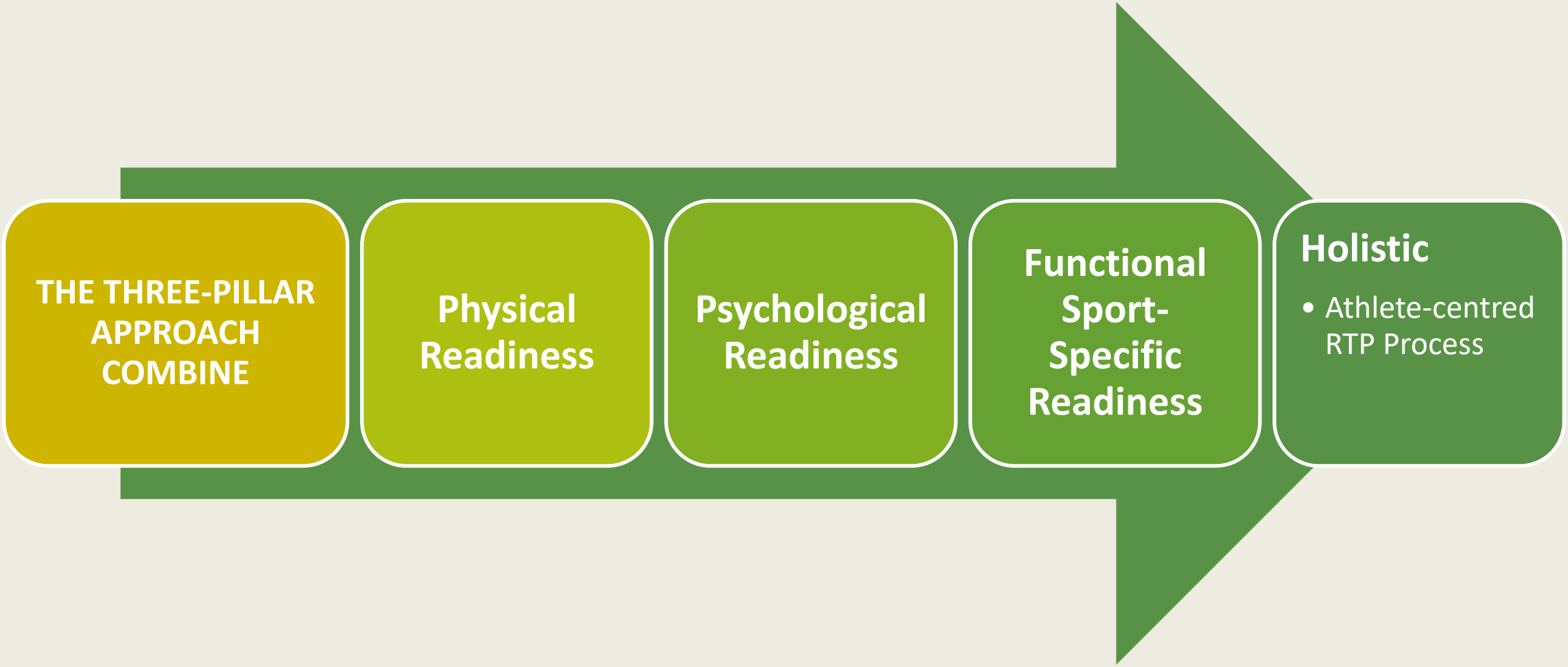
- Complete Sprint Drills
- 95% Maximum Effort Practice

Decision

- Meets Criteria across all 3 Pillars
- Cleared for Competition

Outcome

Summary



RTP vs RETURN TO PERFORMANCE

Example

Rugby Player

25 Year-old Rugby Player returns Post-Shoulder Reconstruction

RETURNS

- **Cleared** For non-contact drills
- **Progresses** to contact training
- **Full Match Play**

ASSESSMENT

- Each phase assessed using physical testing (strength, ROM), psychological scales, and sport-specific skills.

CONTACT

- Athlete spends 3 additional weeks in graded contact drills before final clearance.

Key Takeaway

Emerging RTP frameworks offer ***structured, multi-phase, holistic approaches*** to RTP, aiming for safer, performance-based, and sustainable returns.

RTP Performance Metrics Post Return to Play

Key Findings

Many athletes experience a performance decline even after meeting RTP criteria.

Objective monitoring post-RTP is critical to identify lingering deficits.

Common metrics tracked

- Match statistics (e.g., distance covered, sprint count).
- Strength and power tests (e.g., force plate jumps, isokinetic testing).
- GPS-based load tracking (e.g., accelerations, decelerations).

RTP Performance Metrics Post Return to Play

Why it Matters?

Athletes may appear recovered but underperform due to residual physical, psychological, or neuromuscular deficits.

Performance monitoring helps adjust training loads, prevent reinjury, and identify athletes at risk of drop-off.

Example

A professional footballer returns from hamstring injury

Cleared for match play

GPS data shows sprint counts 20% lower than pre-injury baseline

Force plate testing shows 10% asymmetry in single-leg countermovement jump.

Intervene with targeted strength and sprint drills while playing limited minutes.

Key Takeaway

Performance metrics post-RTP should be routinely monitored to ensure not just safe return, but effective return to prior performance levels.

ADVANCED TOPICS IN RTP

Emerging Concepts in RTP

Fatigue Monitoring
- Test under fatigue (e.g., post Yo-Yo)

Dual-Task Testing
- Reaction + movement (SpeedCourt, BlazePod)

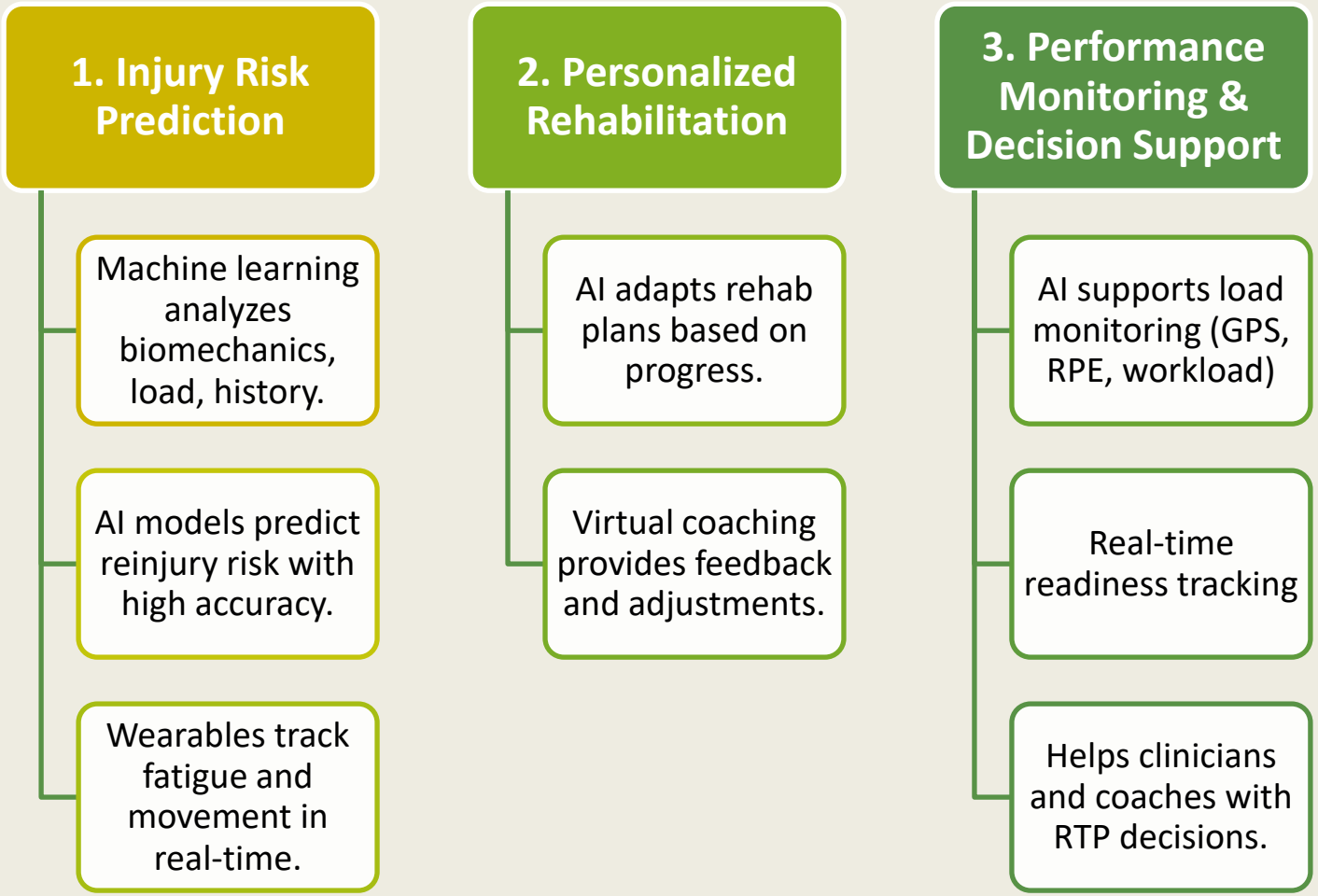
Tech Integration
- GPS, force plates, sRPE, HRV

Long-Term RTP Tracking
- Monitor 4–6 weeks post clearance

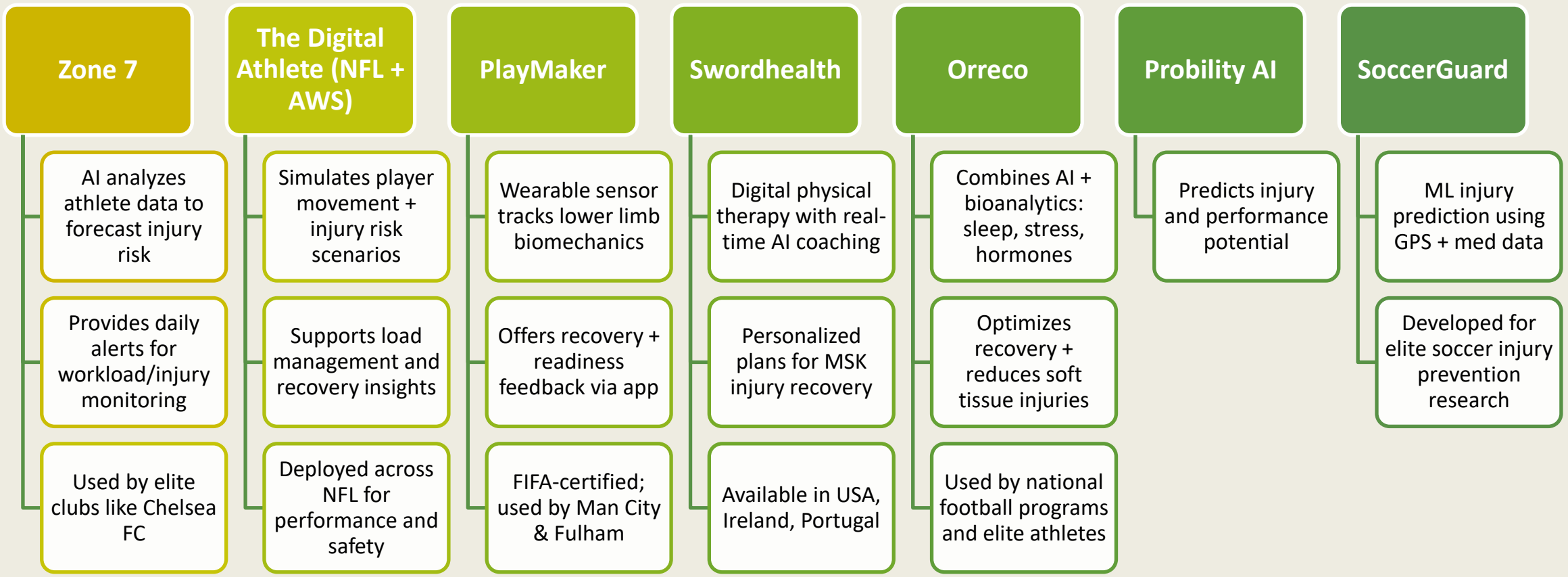
RTP Dashboards
- Clear data for decision-making (e.g., symmetry, ACWR, psych readiness.

Takeaway → **RTP now spans performance, psychology, and real-time load tracking.**

AI in RTP: Current Applications



AI Platforms Outline

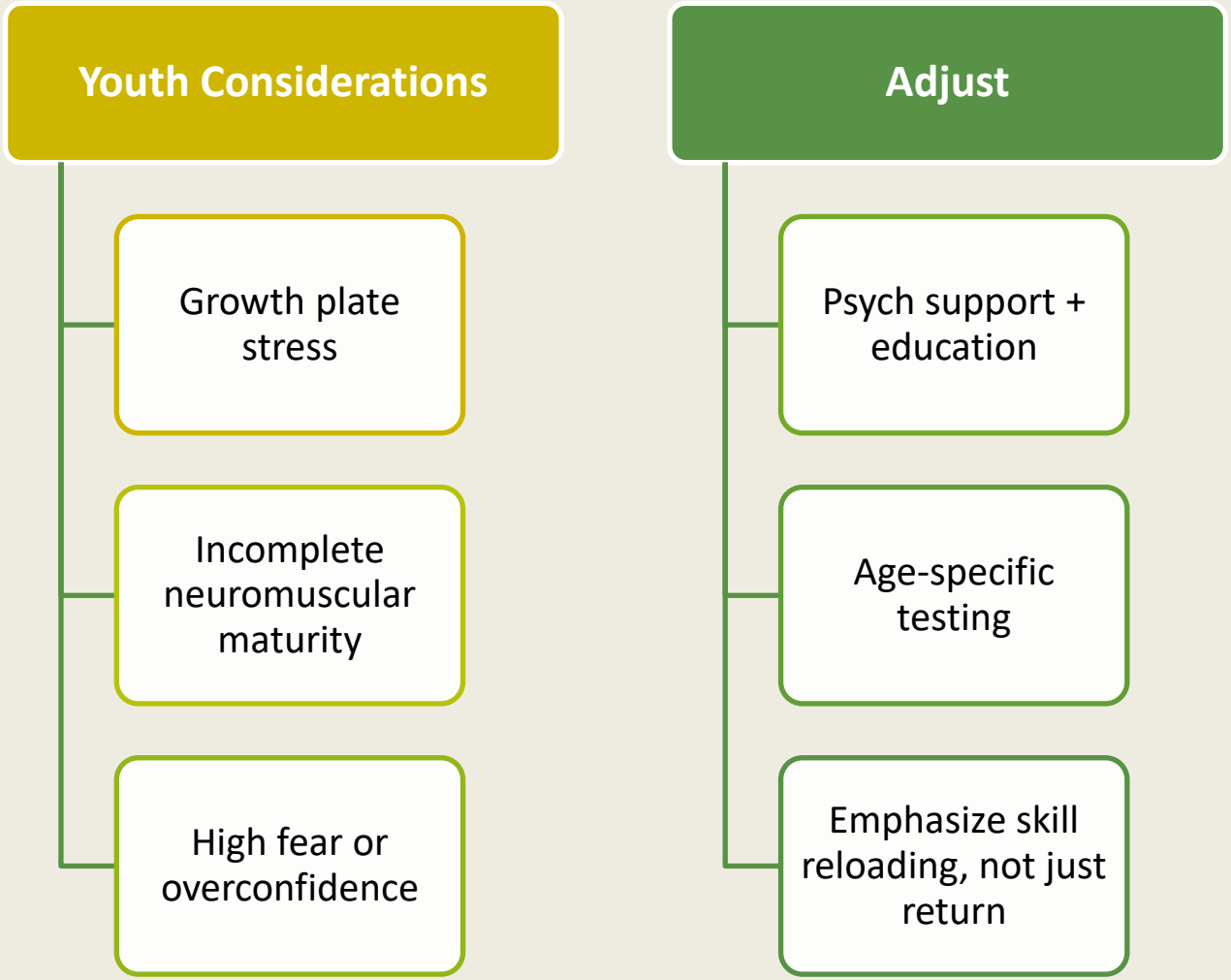


AI is transforming RTP by

Providing athlete-specific insights → **Supporting safer, smarter RTP timing** → **Reducing reinjury risk** → **Enhancing performance recovery**

Common theme → **Data-driven, personalized, and predictive tools supporting injury prevention and safe RTP**

RTP in Youth Athletes



Poll

What's your biggest RTP challenge?

A) Athlete impatience → B) Coach pressure → C) Fear of reinjury → D) Lack of objective tests

Poll 2

Why are cognitive and reactive tests important in RTP?

A) Predict muscle strength → B) Simulate decision-making → C) Measure bone healing

✅ **Correct: B - Decision-making, Agility**

CASE STUDIES AND APPLICATIONS

RTP Cased-Based Scenarios

ACL in Netball

- Pivot / Cutting Sport

Hamstring in Sprinter

- High-speed Demands

Shoulder in Rugby

- Contact + Overhead Recovery

Discuss rehab phases, test benchmarks, psych factors

Example

Clinical Cases

ACL Case

- 10-month post-op
- Quads index 96%
- Hop symmetry 95%
- ACL-RSI 75
- Phased return over 4–6 weeks

Hamstring Case

- 3-Week grade 2 strain
- Eccentric testing
- Pain-free sprints
- Neuromuscular control drills

Ankle Case

- SEBT symmetry ≥90%
- Cutting drills
- Hopping
- Plyometrics
- Reintegrate into training

Shoulder Case

- CKCUEST 20+ Touches
- Rotator cuff strength
- Throwing progression
- No apprehension

Example

Case: Application

A 21-year-old elite sprinter post-hamstring injury passes strength and flexibility tests but reports fear of maximum sprinting.

Clinical team questions

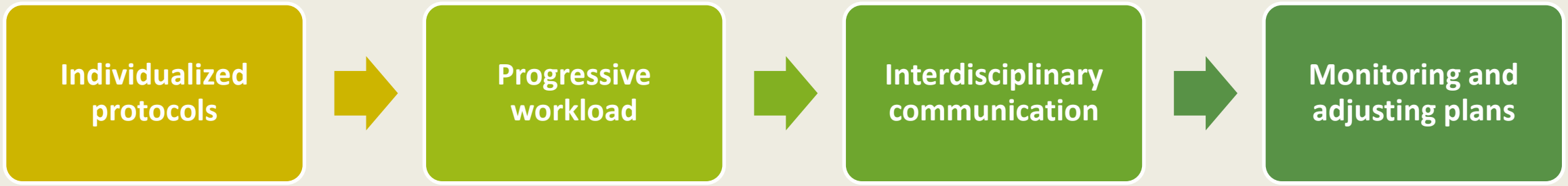
Should clearance be delayed for additional graded sprint exposure and psychological support?

Final decision

Progressive reintroduction to sprinting intensity with psychological readiness monitoring.

BEST PRACTICE AND PROTOCOLS

RTP Best Practices



RTP Best Practice Checklist

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SPRINGBOK

- Assess medical, physical, and psychological readiness
- Use objective testing for strength, agility, and function
- Include sport-specific drills and progressions
- Screen and support mental readiness
- Leverage technology to monitor progress
- Communicate clearly across athlete, coach, and medical team
- Individualize the protocol — no 'one-size-fits-all'
- Follow a phased, gradual return plan

RTP Best Practice Checklist - Athlete

- ≥90% limb strength symmetry (isokinetic, HHD, NordBord).
- Passed hop/agility/balance tests.
- Completed sport-specific drills under fatigue.
- Psychological readiness confirmed (ACL-RSI >65).
- Cognitive/reactive drills passed (SpeedCourt, FitLight).
- Pain-free, full ROM, no swelling.
- MDT clearance and gradual reintroduction plan.

Aspetar Sports Medicine Hospital

ACL Rehabilitation Protocol

- Criteria-based progression
- Strength ≥90% LSI, hop tests, psychological readiness
- Final clearance = strength + hop + agility + psychological tests

Hamstring Injury Protocol

- 6-Stage progression
- Nordic strength, high-speed running, sport drills
- Pain-free sprinting before RTP

FIFA Medical Network

General Principles

- Multidimensional RTP: strength, balance, psychological, sport readiness
- Incorporate FIFA 11+ prevention exercises
- Collaborative RTP decision (med team + coach + athlete)

Example Protocol

- Basic movement → functional drills → team training → unrestricted → competition

International Olympic Committee (IOC)

Core Elements

- RTP continuum: Participation → Sport → Performance
- Multidimensional assessment: health, activity, risk tolerance
- Shared decision-making

Key Consideration

- Athlete-centered, context-dependent, risk-informed

National Athletic Trainers' Association (NATA)

Key Recommendations

- Objective strength testing + functional assessment
- Testing under fatigue to detect hidden deficits
- RTP = process, not single decision point
- Gradual exposure to sport demands

Key Takeaway

- Criteria-based, multidimensional, athlete-centered RTP approach

FINAL INSIGHTS AND TAKEAWAYS

RTP Common Challenges

- **Premature return under pressure**
- **Fear of reinjury**
- **Muscle imbalances**
- **Poor sport-specific conditioning**

Evidence Gaps and Research Directions

Gaps In

- Long-term RTP success tracking
- Objective cognitive RTP testing
- Youth and female-specific RTP data

Future Focus

- Sensor integration
- Mental readiness markers
- Fatigue and decision-making models

CONCLUSION

Clinical Pearls

RTP is not just about clearing to play — it's about helping athletes return confident, prepared, and at their best.

Process / Checklist of best practices

RTP is a process, not a one-off decision.

Assess under fatigue to expose hidden deficits.

Consider athlete's goals, sport demands, competition level.

Communicate transparently with the athlete; involve them in decisions.

Q&A

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Thank You

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