Structuring the daily progression from return-to-run to full team integration

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Return-to-run progression | Criteria-based rehabilitation | Team integration | Microcycle | Performance optimization | Player conditioning | Rehabilitation protocols | Reinjury risk reduction | Sports medicine | End-stage rehabilitation | Sport-specific rehabilitation

Headline

Returning to running after injury is a critical phase in rehabilitation, yet there is limited guidance on how to structure this process beyond basic progression criteria related to muscle function and strength. While research, such as the work by Taberner et al. (2019) and Buckthorpe (2019), provides frameworks for transitioning athletes from rehabilitation to performance, there is little consensus on the optimal way to distribute running loads across days and weeks. Key considerations include the balance between training and rest days, the number of consecutive running days, and the progression of session content.

There is also limited guidance on how rehabilitation should account for injury-specific constraints, particularly considering that different tissues (e.g., muscle, tendon, and bone), regional locations (e.g., hamstring, calf, and quad), and severities have distinct recovery timelines and loading tolerances. Similarly, little information is available on how running reintroduction should be adjusted based on an athlete's positional and tactical demands to ensure that physical conditioning aligns with sport-specific requirements (Taberner 2025a, 2025b). Beyond external workload measures, the role of internal responses, such as neuromuscular fatigue and overall readiness, in guiding daily adjustments remains largely unexplored. Given these gaps, a structured yet adaptable approach is needed to optimize return-to-run programming while minimizing reinjury risk.

Aim

This paper outlines a structured approach to reintegrating players into running, progressing from initial individual sessions to full team participation. Rather than focusing on a specific injury type, it takes a broad perspective, recognizing that the core challenge remains the same: balancing load, recovery, and reintegration. Key principles of session frequency, progression strategies, and the integration of sport-specific running demands are presented to provide a flexible framework adaptable to various injury contexts.

Starting with the end goal in mind

In phase one of returning to the pitch, it is crucial to acknowledge that significant preparatory work should be completed beforehand. This often includes tissue-specific strength and conditioning in the gym, which can be completed with controlled running exposure on treadmills, including anti-gravity treadmills (AGT). As demonstrated in our work (Saniel & Buchheit 2025), AGT can facilitate the safe development of a chronic running load, mirroring the volume of the initial weeks of on-field running while also providing metabolic conditioning and preventing spikes in load.

The return-to-run process must start with the end goal in mind: aside from the obvious need to prepare the athlete for competitive match demands, the goal should also be to replicate the team's microcycle. This requires a progressive transition from isolated training days to consecutive training blocks, regardless of the periodization model used by the coach. While some teams follow a two-day high-intensity acquisition block before tapering, others train at high intensity for three or even four consecutive days before match day (Buchheit 2021 & 2024, Delgado-Bordonau et al., 2014) (Figure 1).

Given the variability in team typical periodization (Buchheit 2021, Figure 1), the rehabilitation process should follow a stepwise progression, initially focusing on isolated controlled sessions before gradually increasing training density and complexity (Figures 2 and 3). The progression often begins with non-consecutive training days (Figure 2A & B), allowing for recovery and adaptation, before transitioning to structured blocks of 2 (Figure 2C, D, E & F), 3 (Figure 2 G & H), and eventually 4 consecutive training days (Figure 2I). The timing of this progression is guided by injury recovery and the goal of replicating the team's microcycle. Importantly, Figure 2 illustrates a load progression example following a long-term injury, ultimately leading to reintegration into a team model with either 2 or 4 consecutive training days (Figure 1C), with the match occurring in the 2F (2 consecutive training days) or 2I (3 consecutive training days) load progression examples.

In sports with high match running volumes such as AFL, training structures often involve consistent 6-7 day cycles with typically a maximum of two consecutive training days (Figure 3). These differences highlight the need to tailor rehabilitation plans to both the demands of the sport and the team's scheduling constraints while also considering the individual player's typical training demands rather than relying on team averages.

Of note, the overload progression shown in Figure 2 is designed to prepare the player for match participation as a substitute (<45 minutes, Buchheit 2023a). This explains why match demands do not significantly exceed training loads, as the focus is on gradually building capacity and integrating into the team's typical training microcycle as quickly as possible rather than immediately matching full-game demands. However, in certain situations and environments, players need to be prepared for more substantial match participation. Figure 3 shows an overload progression designed to prepare for match demands in excess of most training loads and focuses on building the tolerance of the player to a larger singular session within a weekly microcycle. However, accurately determining mechanical stress during rehabilitation is complex, as the mechanical response of proteins is not solely triggered by direct external forces. This makes it difficult to quantify precisely the true mechanical load of training and rehabilitation (Gabbett & Oetter, 2025). Effectively managing the running recovery process requires careful daily monitoring of both loading variables and the body's response to these loads. Loading variables encompass neuromuscular and metabolic demands, typically assessed using tools like GPS devices, heart rate monitors, and ratings of perceived exertion (RPE). However, these methods have limitations that are beyond the scope of this discussion (Impellizzeri 2019). To gain a comprehensive understanding, it's essential to also consider load response metrics, which can be categorized into systemic indicators—such as creatine phosphokinase (CPK) levels, physiological responses to submaximal exercise and wellness assessments—and structure-specific indicators, including clinical markers and neuromuscular fatigue assessments like thermography and other neuromuscular evaluations (Gabbett and Oetter 2025, Taberner 2025b).

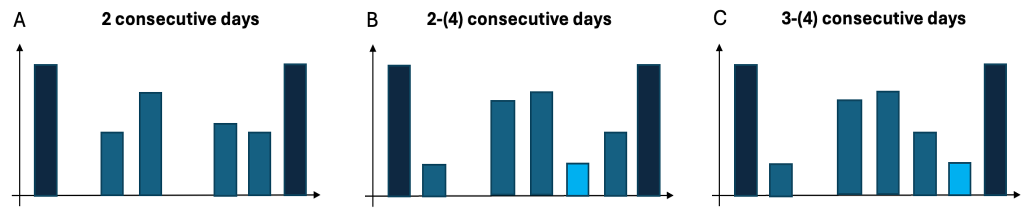

Fig. 1. Typical load distribution of team training across different microcycle approaches in elite football (soccer), emphasizing the need to prepare for training blocks ranging from 2 to 4 consecutive days. In microcycles B and C, a very light day is included, which may function as a recovery day. Therefore, in microcycle B, the loading pattern rather aligns with a 2-day block, while in microcycle C, the structure primarily follows a 3-day block. The bars represent overall load progression (volume × intensity) to illustrate training dynamics but do not include specific GPS metrics, RPE, or match demand ratios, as these are metric-specific and difficult to generalize.

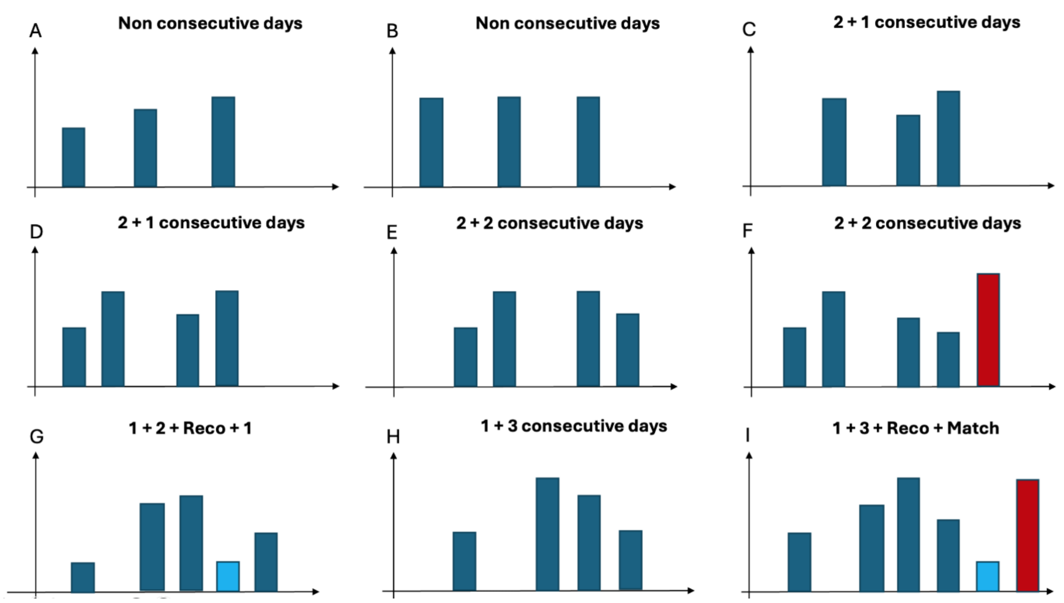

Fig. 2. Examples of loading structures and progressions in elite football (soccer), starting from non-consecutive training days and advancing to 2-, 3-, and 4-day training blocks. Progression between phases is guided by injury recovery and the ultimate goal of replicating the team's microcycle (Figure 1C). The light blue bars indicate active recovery days, where the player is present on the pitch but with minimal physical load (e.g., simple tactical work). The red bar indicates a match, likely played as a substitute. The bars represent overall load progression (volume × intensity) to illustrate training dynamics but do not include specific metrics such as GPS variables, RPE, or match demand ratios, as these are metric-specific and difficult to generalize.

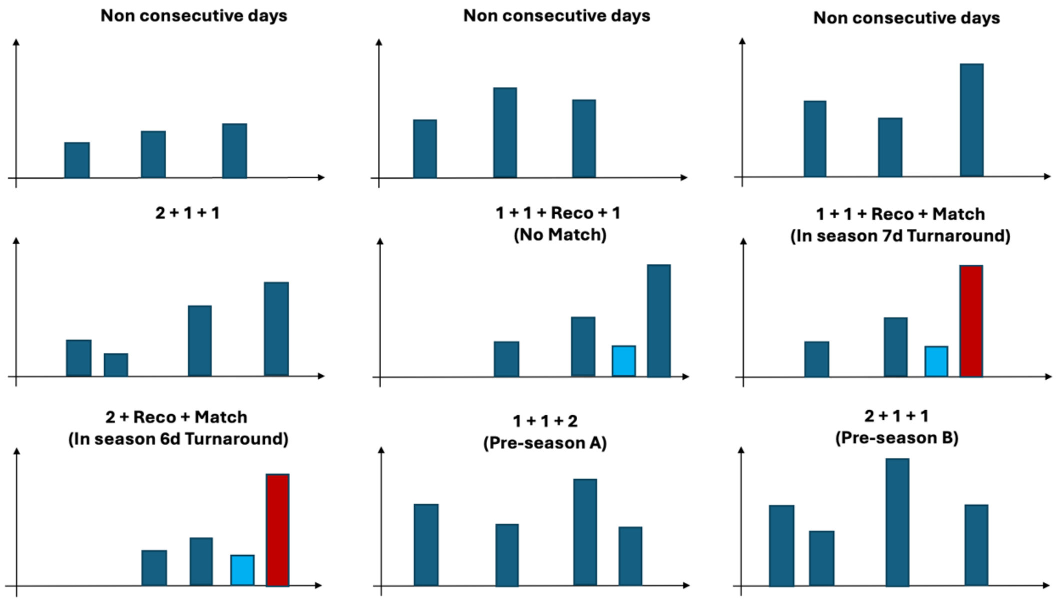

Fig. 3. Examples of loading structures and progressions for a sport characteristic of very high match running volumes (i.e., AFL), consistent 6-7 day turnarounds between matches, generally no more than 2 consecutive training days, and where initial return to competition typically requires significant (>60 minutes) match participation. The light blue bars indicate active recovery days, where the player is present on the pitch but with minimal physical load (e.g., simple tactical work). The red bars indicate matches. The bars represent overall load progression (volume × intensity) to illustrate training dynamics but do not include specific GPS metrics, RPE, or match demand ratios, as these are metric-specific and difficult to generalize.

Injury-specific considerations for weekly session planning

Different injuries and tissues require specific considerations in return-to-run programming, influencing weekly exposure, running structure, and progression (Gabbett and Oetter 2025). These considerations largely depend on the necessary recovery time between consecutive training exposures.

Shorter between-session recovery requirements

- **Bone stress injuries** (e.g., tibia, metatarsals, femur) need short, frequent running sessions instead of single high-load days, as bone mechanosensitivity declines after 20 loading cycles but recovers within 4–8 hours. This allows for two shorter exposures in a day before progressing to consecutive training blocks.
- **Cartilage injuries** recover relatively quickly (30 minutes to a few hours) but are sensitive to cumulative impact. They require progressive increases in volume while avoiding back-to-back high-load days early on.

Longer between-session recovery requirements

- **Tendinopathies** require slower progression to consecutive high-load days, with at least 48 hours between intense stretch-shortening cycle activities to allow collagen synthesis and prevent excessive degradation. Equally important is monitoring tendon pain and sensitivity on a session-by-session basis.
- **Hamstring injuries** need careful monitoring of high-speed running. Controlled exposure to sprinting, with 48–72 hours between sessions, is essential to manage residual fatigue, mitigate eccentric stress, and maintain active muscle extensibility.
- **Calf injuries** demand close tracking of running volume, as excessive loading can quickly lead to fatigue. The early phases should limit back-to-back running days before progressing to consecutive sessions.
- **Groin injuries** require a cautious progression with initial alternating training days to monitor response and prevent overload, especially due to the high demands on adductors during directional changes.
- **Knee injuries**, including meniscus or ACL post-surgery rehab, require structured exposure to deceleration and braking forces and may necessitate alternating field-based and strength-focused days, particularly in the early stages of on-field training, to manage total knee load.

Throughout this process, injury-specific clinical assessments—such as pain response, localized tissue tolerance, neuromuscular function, and structural integrity tests—are essential for validating each progression step. These assessments and recovery timelines guide a stepwise approach to weekly running exposure, progressing from isolated sessions to multi-day training blocks while balancing load and recovery to minimize reinjury risk.

Injury-specific considerations for phase progression

While the overall structure of return-to-run programming remains consistent, the time spent in each phase likely varies depending on the injury type.

Shorter phases and faster overall progression

- **Low-grade thigh muscle and low-grade joint injuries** typically require only one week or even one session per phase, with a focus on running volumes and appropriate progressions of accelerations, decelerations, high-speed running, sprint distance, or kicking load (with each locomotor pattern related to a specific injury type; see above).

Longer phases and slower overall progression

- **Knee and ankle ligament injuries** require the longest duration in each phase, with an extended early phase involving minimal explosive distance and primarily linear running. Also, consider the progression of acceleration and deceleration intensities. Each phase is lengthened to allow a gradual reintroduction to partial and then full-contact work, progression of pre-planned to unplanned change of direction drills.
- **High-grade hamstring injuries with tendon involvement** need a slower build-up, with a couple of weeks in each phase. This includes a gradual progression of high-speed running and careful management of back-to-back loading on consecutive days.
- **Hip and groin injuries**. Progression of pre-planned change of direction angles to unplanned change of direction work. The integration of technical work (particularly in managing passing, shooting, and crossing movements) should be slow and tailored to players' daily responses.
- **Calf injuries**. Even slow-paced, continuous runs can place significant stress on the calf muscles. Therefore, it's essential to increase running volumes slowly, allowing the muscles to adapt without undue strain. Similarly, when advancing accelerations, the ankle plantar flexors are crucial for generating the propulsive force needed to enhance forward momentum. These muscles also necessitate a careful and progressive buildup to handle increased demands effectively.

It is important to note that these guidelines are general, as each injury presents unique challenges. The time spent in each phase and the specific rehab goals depend not only on the injury itself but also on the mechanism of injury (e.g., kicking, COD, acceleration, or top-end speed), which ultimately shapes the rehabilitation process.

Muscle fiber type: An additional layer in return-to-run progression

The pioneering work of Wim Derave and his team in Belgium has highlighted the important role of muscle fiber type in athletic performance and recovery (Bellinger 2020, Lievens 2020 & 2022, Van Vossel 2023). A player's muscle fiber type profile significantly influences how they respond to and recover from intense exercise. Fast-twitch dominant athletes experience greater acute neuromuscular fatigue for the same workload compared to slow-twitch athletes and take longer to return to baseline. This affects not only within-session fatigue but also recovery between sessions, especially when combining gym and pitch work on the same day. Consequently, fast-twitch players may require lower training loads and slower progression, particularly when transitioning from alternating to consecutive training days. Considering fiber type can help optimize load management, minimize excessive fatigue, and reduce injury risk. Assessing muscle fiber type is beyond the scope of this paper, but readers are referred to the work of Gareth Sandford for further guidance for a field-based approach (Sandford 2021).

Different approaches to return-to-run progression

Return-to-run programming can follow different philosophies. An intensity-first approach prioritizes early exposure to high-intensity efforts, such as accelerations and high-speed running, before gradually increasing volume. In contrast, a volume-first approach follows a more traditional progression, starting with lower-intensity running and progressively building toward maximal efforts. A balanced approach, which the authors consider the preferred method, integrates both strategies by providing graded early exposure to high-intensity demands while systematically increasing volume. This approach allows for greater flexibility, making it easier to adjust training loads based on daily monitoring, player response, and evolving rehabilitation needs while still maintaining a structured and progressive return to full training.

Gradual reintegration: from individual sessions to full team training

Over consecutive weeks, this progression should also apply to reintegration with the team. Initially, the player may complete only individual running sessions, then gradually participate in selected team sessions while maintaining some individual work, before fully reintegrating into team training (Figure 4). This ensures a gradual increase in exposure to both physical and tactical demands, aligning with the required training loads in terms of volume, intensity, frequency, specific contents, and duration while minimizing re-injury risk.

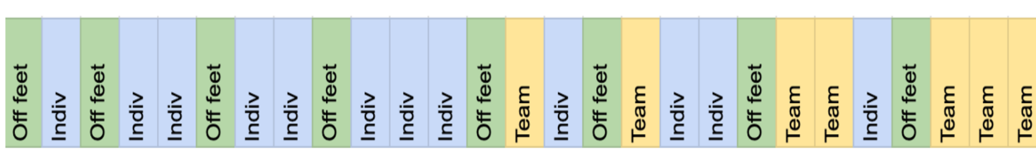

Fig. 4. Example of a progressive load structure for reintegrating a player into team training, illustrating how individual and team sessions are scheduled within a team following up to three consecutive training days (i.e., scenario C from Figure 1). Certain sequences, such as off-feet/individual/off-feet and off-feet/individual/individual/off-feet, may be repeated multiple times before advancing to the next phase. The progression shown here is for conceptual purposes.

Progressing session content: from building injury-specific running loads to the physical demands of team training and matches

In the early stages, each session tends to target a specific physical capacity, such as high-speed running, acceleration, deceleration, or change of direction, with a strong emphasis on minimizing (re)injury risk. The most demanding session for the injured area is always performed first, ensuring the athlete is fresher and less fatigued, reducing reinjury risk. Table 1 shows the example of training content progression following a hamstring injury, starting with isolated sessions that target and allow controlling specific physical demands, such as high-speed running, acceleration, and deceleration. The progression then advances to consecutive training blocks (Figure 2), gradually increasing training density while offering a safe sequence of neuromuscular demands (HSR performed the day before Acc/Decels). In the final stages, sessions replicate the demands of full team training (HSR then performed the day after Acc/Decels, as per the team dynamic, Buchheit 2024b), integrating multiple physical demands simultaneously, as reflected in GPS metrics.

Finally, it is also important to differentiate between quantitative (total distance, HSR and sprinting distance) and qualitative (decelerations, changes of direction, sprints patterns and more importantly, sport-specific movement patterns) aspects of running in rehabilitation. This distinction directly influences the neuromuscular impact of each session, which is probably the most important aspect to consider when planning the overall progression.

Different injuries require specific locomotor progressions, which can be tracked using GPS metrics to guide rehabilitation (Buchheit & Simpson 2017, Buchheit 2023a). For example, careful progression of high-speed running (HSR) is essential following a hamstring injury (Table 1), while managing mechanical work (MW), particularly decelerations, is crucial after a rectus femoris injury (Buchheit & Mayer, 2019). More precisely, locomotor volumes focusing on the injured muscle are often first developed in a controlled setting (e.g., generic running and individual sessions) before progressing to team training.

This is why these volumes are increased before addressing patterns related to the non-injured muscle (Figure 5). For example, high-speed running (HSR) is introduced earlier in a safer way, while decelerations after a hamstring injury are postponed until full volume is achieved in team training.

Additionally, playing position adds another layer to individualizing rehabilitation, as positional demands influence both the volume and type of locomotor load required for return to play (Figure 5). Wide defenders (WD) and central midfielders (MD), for example, have different running profiles, requiring tailored session progressions to ensure readiness for match demands.

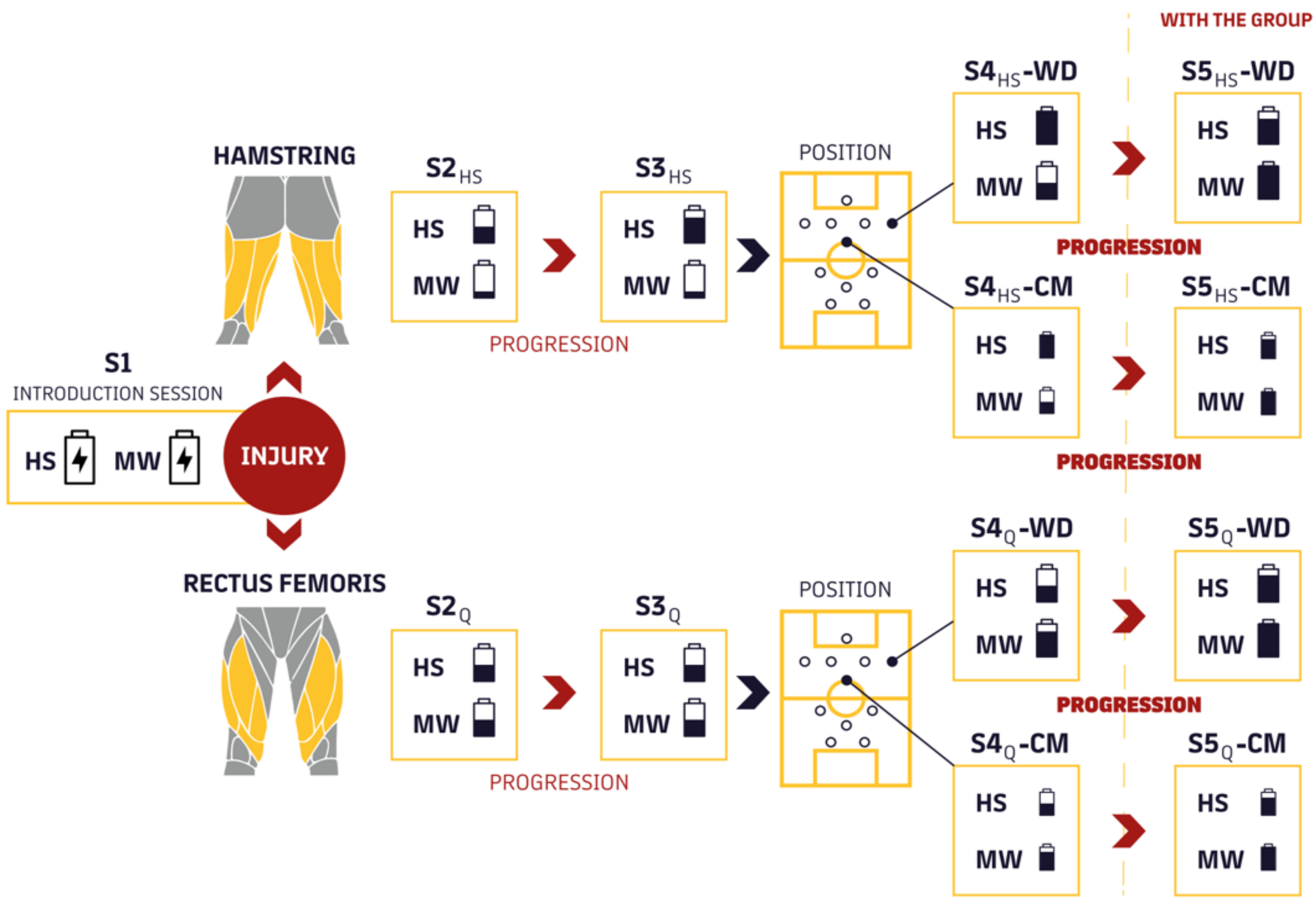

Fig. 5. **Example of four sequential return-to-play (RTP) load progressions (S), illustrating changes in high-speed running (HSR) and mechanical work (MW) volume in elite football (soccer) players. The sessions are designed for two common muscle injuries—hamstring and rectus femoris—and adapted for two different playing positions: wide defender (WD) and central midfielder (MD). The battery icons represent match demands for one half, with the colored portion indicating the relative volume completed in each session. The total number of sessions required per phase varies based on injury severity and context. Figure taken from Buchheit & Mayer, 2019.**

Table 1. Example of training content progression following a hamstring injury, beginning with isolated sessions that focus on specific physical demands such as high-speed running (HSR), acceleration, and deceleration. The first session shown is the first to target HSR (following a day off for optimal freshness) rather than necessarily the first session on the pitch. Initial sessions emphasize controlled exposure to neuromuscular load through acceleration and deceleration drills or HSR, interspersed with a day off. The progression then advances to consecutive training blocks, gradually increasing training density while offering a safe sequence of neuromuscular demands (HSR performed the day before Acc/Decels). In the final stages, sessions replicate the demands of full team training (HSR then performed the day after Acc/Decels, as per the team dynamic, Buchheit 2024b), integrating multiple physical demands simultaneously, as reflected in GPS metrics.

Off feet
HSR
Off feet
Acc/Decels
Off feet
HSR
Acc/Decels
Off feet
HSR + Vmax
Acc/Decels
Off feet
Acc/Decels + HSR (Vol-)
HSR (Vol+) + Vmax
Off feet

Progressing from pure physical training to integrated technical and tactical drills

A structured return-to-run process should progressively transition from purely physical sessions to drills that integrate technical and tactical elements (Armitage 2022, Buchheit 2023a, Buckthorpe 2019, Taberner 2019, 2025a, 2025 b, Buchheit & Mayer 2019) (Figure 6). This process reflects the interaction between intensity, complexity, and volume of the work performed and how the progression of these three factors is manipulated throughout the on-field rehab process (Harries 2024). The control-chaos continuum (CCC) (Taberner 2019), for example, provides a framework for this progression, moving from highly controlled environments to game-representative scenarios that gradually increase not just the physical but also the perceptual and neurocognitive demands. While this integration is essential—since no isolated training can fully replicate the cognitive load of team play—it must be balanced with the player's confidence and psychological readiness.

Rehabilitation also presents an opportunity to refine aspects of a player's game that are often overlooked when fully fit. This period can be used to develop individual technical skills and tactical awareness, particularly for players who may not have time to focus on these elements during regular training (Allen 2021, Taberner 2025a & 2025b). For detailed guidance on drill design and exact programming, which will vary by sport and discipline, readers are referred to the works of Allen et al. (2021) and Taberner et al. (2025a, 2025 b). However, overloading players with complex drills too early should be avoided, as they may first require simpler, confidence-building sessions where the intensity of athletic actions (eg, accelerating, decelerating, and changing direction) can be safely progressed to regain rhythm and trust in their movement.

Beyond distance-into-zone GPS metrics

The traditional distance-into-zone approach for replicating match demands is outdated and overly simplistic, as it fails to account for when and how these distances are accumulated during a game (Buchheit 2024a). Simply summing distances in predefined speed zones does not reflect the true intensity, distribution, or tactical context of high-intensity efforts. In a 90-minute match, sprint efforts and mechanical load fluctuate based on game phases, whereas short training sessions often condense these efforts into unrealistic patterns (Figure 7).

A more effective approach is to shift from static distance metrics to evaluating intensity over shorter timeframes (e.g., 1-, 3-, or 5-minute blocks, Figure 8) (Buchheit & Mayer 2019, Buchheit 2023b), which better captures the most demanding periods of play (MDPs) (Rico-González 2021, Lino-Mesquita 2025). Importantly, since players often return as substitutes, building full match-volume capacity may not be the most pressing objective of rehabilitation. Players can, however, face high-intensity bursts even during a 20-minute appearance, so preparing them to tolerate the most intense periods over shorter durations (e.g., 1, 3, or 5 minutes) should be a priority. A few examples of load progression and associated GPS metrics for different scenarios described in Figure 2 are shown in Tables 3, 4, and 5, with targets provided in terms of both volume and MDP.

However, defining MDPs remains complex, as they are highly variable across matches (Novak 2021) and influenced by a combination of external load, internal responses, tactical actions, and contextual factors. Lino-Mesquita (2025) emphasizes that MDPs should probably not be treated as fixed benchmarks but rather as evolving reference ranges to help design training sessions that account for individual and match-to-match variability. While exploring the full complexity of

MDPs is beyond the scope of this manuscript, a further advancement in load monitoring is to assess the volume or time spent within specific MDP intensity zones, similar to heart rate load monitoring (Mandorino 2024) (Table 3 and 4).

Additionally, GPS data provide only a measure of external load, offering limited insight into the true internal strain on muscles and tendons (Buchheit & Simpson 2017, Buchheit 2024a). They do not account for specific movement patterns, such as the neuromuscular load and strain associated with actions involving the ball or curved sprinting. These movements can generate significant centripetal accelerations without noticeable changes in speed, imposing high mechanical demands that are not reflected in conventional GPS metrics (Buchheit & Simpson 2017, Buchheit 2024a). This limitation shows the importance of including cognitive and sport-specific drills, rather than merely meeting GPS metric targets. Future research should refine return-to-play monitoring strategies by integrating multiple data sources to better replicate the true demands of match play.

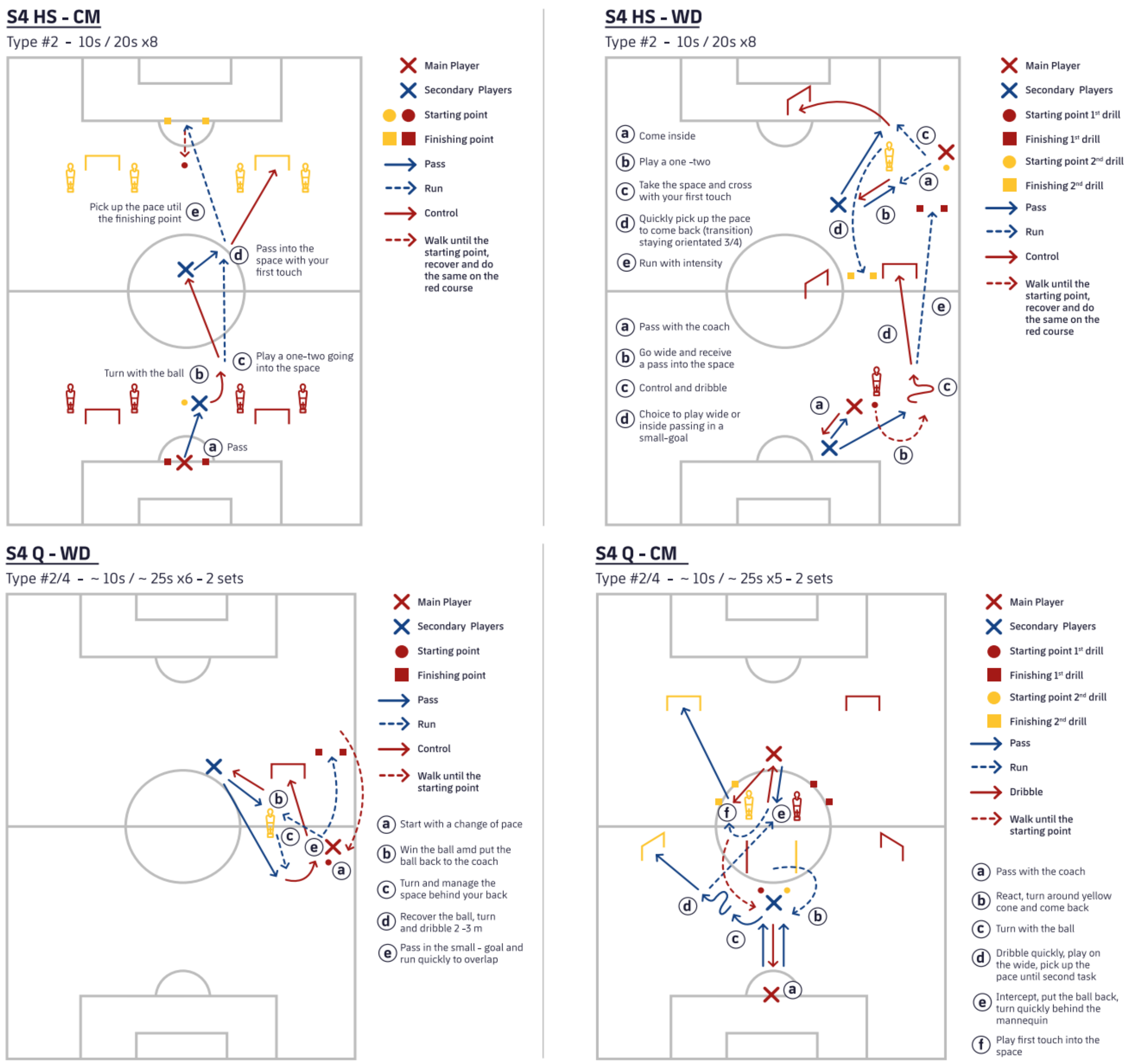

Fig. 6. **Schematic illustration of each of the sequences described in Figure 5 for session S4HS-WD, S4HS-CM, S4Q-WD, and S4Q-CM. Figure taken from Buchheit & Mayer, 2019. These drills are often used to target player-specific MDPs (Tables 3 and 4, Figure 8).**

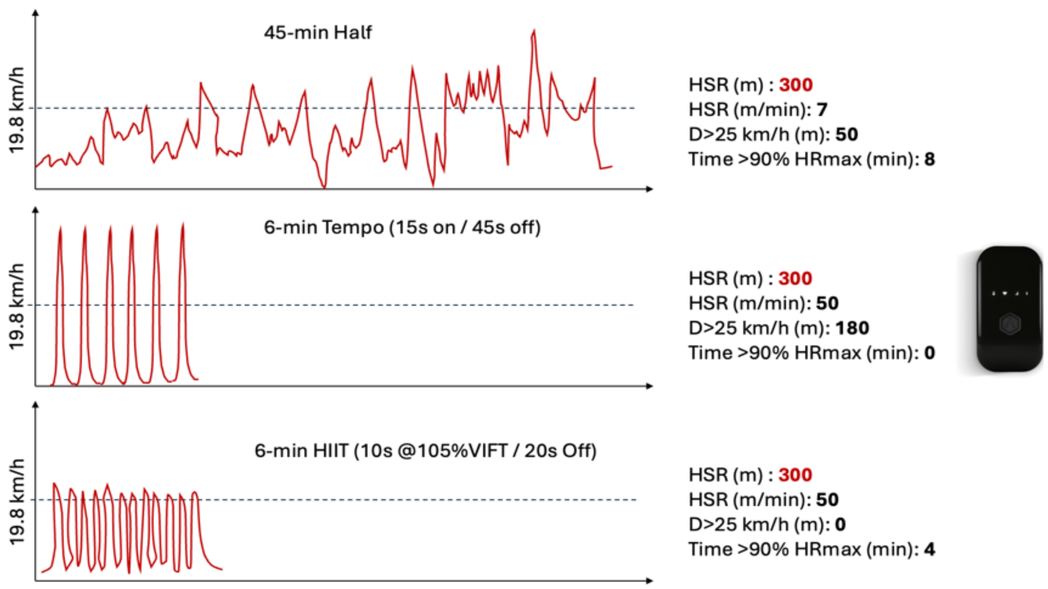

Fig. 7. Three theoretical examples of how 300 m of high-speed running (HSR, >19.8 km/h) are accumulated in different scenarios: a typical match (1st half, upper panel), a tempo run (middle panel), and a high-intensity interval training (HIIT) session (lower panel). Although the total HSR distance is identical across all three examples, the patterns of accumulation differ greatly. The match distributes HSR over 45 minutes, whereas the tempo run and HIIT session condense the same distance into just 6 minutes. This illustrates the limitations of relying solely on distance-into-zone metrics, as it overlooks the vastly different intensity and distribution of efforts. VIFT: speed reached at the end of the 30-15 Intermittent Fitness Test (Buchheit 2021).

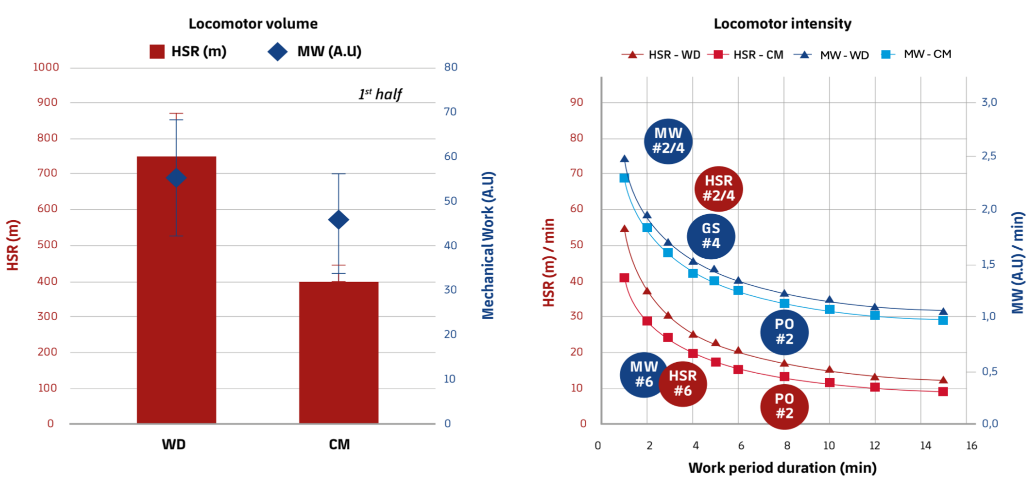

Fig. 8. Summary of worst-case locomotor demands (± SD) during Ligue 1 and Champions League matches (first half) for a wide defender (WD) and a central midfielder (CM, playing as a '6'). The left panel shows the peak running volume, while the right panel displays intensity, expressed as peak high-speed running (HSR) and mechanical work (MW, a compound measure of acceleration, deceleration, and changes of direction work, Buchheit & Simpson 2017) over periods of 1 to 15 minutes. For example, over a 4-minute block, a CM can cover up to 20 m/min of HSR, while a WD can reach 55 m/min over 1-minute periods. The blue and red circles represent specific training drills from designated sessions (Figure 6) that either exceed (overload) or fall below (underload) match intensity levels. Following the HIITscience framework (Laursen & Buchheit 2019), drill types #2 and #4 target both high neuromuscular and metabolic demands, while type #6 focuses on high neuromuscular load with lower metabolic strain. The figure also shows HSR and MW peak intensities from small-sided games (e.g., Game Simulation, GS, and possession-based games, PO; 4v4, 6v6, 8v8, and 10v10) used in the final return-to-play stage (Figure 5). Figure taken from Buchheit & Mayer, 2019.

Table 2. Examples of locomotor activity volumes during the early phase of return to run for a professional football (soccer) player (Figure 2A). During this phase, the focus is on safely and gradually reloading while integrating highly controlled technical drills to minimize movement variability (Taberner 2019). Since the athlete is not yet ready for high-intensity interval training (HIIT), conditioning can be supplemented with off-feet exercises such as SkiErg, Wattbike, Assault bike, boxing, and battle ropes. Pitch sessions follow a day-on, day-off structure with low load and intensity to allow full recovery and minimize the risk of adverse reactions in the injured area. TD: total distance, HSR: high-speed running (D $>$ 19.8 km/h), SD: sprint distance (D $>$ 25 km/h), ACC: accelerations ($>$3 m/s²), DEC: decelerations ($<$-3 m/s²), HI ACC + DEC: high-intensity accelerations and decelerations.

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
TD (km)	2.5-3.0		3-3.5		3.5-4		
HSR (m)	0		0		0		
SD (m)	0	Off Feet/UB Strength	0	Off Feet/UB Strength	0	Off Feet Conditioning	Recovery
ACC (#)	5-10		5-10		10-15		
DEC (#)	5-10		5-10		10-15		

Table 3. Examples of locomotor activity volumes and intensity during the mid-phase of return to run for a professional football (soccer) midfielder (Figure 2D). During this phase, the focus is on gradually increasing load and intensity while introducing back-to-back training sessions. Maximum velocity is progressively increased, and pre-planned multidirectional work is incorporated. High-speed running and high-intensity accelerations and decelerations are also introduced, with sessions designed to reach 80% of 3-minute most demanding periods (MDP) for this playing position. TD: total distance, HSR: high-speed running (D $>$ 19.8 km/h), SD: sprint distance (D $>$ 25 km/h), ACC: accelerations ($>$3 m/s²), DEC: decelerations ($<$-3 m/s²), HI ACC + DEC: high-intensity accelerations and decelerations. MDP: most demanding periods based on Rico-González (2021).

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
TD (km)	4-4.5	4.5-5.0		4-4.5	4.5-5.0		
TD/min 3 min MDP	120	120		120	120		
HSR (m)	50-100	200-300		100-150	250-350		
HSR/min 3 min MDP	21	30		21	35		
SD (m)	0	0-50		0	0-50		
SD/min 3 min MDP	0	2		0	2		
ACC (#)	30-40	20-30	OFF/ RECOVERY	35-45	20-30	Off Feet Con/ UB Strength	OFF/ RECOVERY
ACC/min 3 min MDP	3	2		3	2		
DEC (#)	30-40	20-30		35-45	20-30		
DEC/min 3 min MDP	3	2		3	2		
HI ACC + DEC (#)	60-80	40-60		70-90	40-60		
HI ACC + DEC/min 3 min MDP	6	4		6	4		

Integrating strength and physiotherapy work with running and pitch sessions

Merging running and overall pitch work with physiotherapy, running mechanics, motor control and strength work is the final piece in solving the return-to-run puzzle. Early in rehabilitation, scheduling strength sessions on alternate days between pitch sessions can help maximize strength adaptations by ensuring players are fresher and can lift heavier loads with better quality. This approach aligns with concurrent training research, which shows that strength gains are greatest when endurance and strength sessions are performed on separate days (Sale 1990, Murach 2016, Robineau 2016). However, alternating strength and running sessions on consecutive days can result in loading the injured tissue several days in a row without adequate rest. While this can work well for joint injuries, this continuous strain can be particularly concerning for soft tissue injuries, such as soleus muscle injuries, which endure significant stress even during slow-paced running. Incorporating mid-week and end-of-week rest days is therefore believed to be essential to support recovery and allow time for healing and adaptation.

As rehabilitation advances and the focus shifts toward increasing running volume and high-intensity activities (Figure 2C to 2I), strength training transitions into a complementary role. Strength sessions can then be scheduled on the same day as pitch training, but timing is key. Ideally, strength work should be performed before pitch training to optimize strength development (Gao 2023), but this may lead to fatigue before running, ultimately increasing the risk of reinjury. When running safety is a priority, strength sessions are typically scheduled after pitch work to maintain freshness, though this may compromise strength gains. In such cases, scheduling strength training later in the day, with several hours of recovery between sessions (Robineau 2016), is preferred. Although less effective due to possible accumulated neuromuscular fatigue, performing strength work immediately after pitch training is the most common approach due to its practicality (Enright 2015).

It is also worth noting that incorporating plyometric exercises and running mechanics drills into rehabilitation programs can also serve as a valuable complement to running loads, enhancing the overall recovery process. For instance, in cases of calf injuries where resuming running may be delayed, integrating high-volume, lower-intensity plyometric exercises can effectively bridge the gap. This approach simulates running volume, enhances tissue resilience and functionality, and prepares the calf muscles for the demands of running, facilitating a smoother transition back to full activity. However, accurately assessing the load during running mechanics sessions presents significant challenges, as these drills are not predominantly locomotor-based, rendering traditional tools like GPS less effective in capturing neuromuscular strain. To address this, there is a pressing need for innovation in wearable technology, particularly through the development of advanced accelerometers and other sensor-based devices, to enhance our ability to monitor and understand the demands of these specific training activities (Buchheit & Simpson 2017).

Overall, the timing of physiotherapy, strength, running mechanics, and motor control sessions relative to pitch work depends on the injury type and rehabilitation phase, ensuring the appropriate prioritization of each element. Ultimately, optimizing the scheduling of all these sessions requires tools to assess player readiness throughout the week and even within the same day (Taberner 2025b, Tito 2025, Wilkinson 2025).

Table 4. Examples of locomotor activity volumes and intensity during the final phase of return to run for a professional football (soccer) midfielder (simulating Figure 2F and match participation as a substitute). During this phase of on-pitch rehabilitation, load and intensity are further increased, and the microcycle is designed to closely mirror the team's regular training week. Reactive agility drills are commonly used, along with 1–2 exposures at >90% of maximum velocity. At this stage, the athlete may also participate in selected team training elements, such as warm-ups, passing drills, or serving as a bounce/neutral player (Figure 4). Progression from partial to full contact is introduced, with physical top-ups tailored to the specific goals of each session (e.g., HSR, acceleration, deceleration, explosive distance). The percentage of most demanding periods (MDP) is also increased to ensure the player is prepared to handle the highest intensity periods during matches upon return. TD: total distance, HSR: high-speed running (D > 19.8 km/h), SD: sprint distance (D > 25 km/h), ACC: accelerations (>3 m/s²), DEC: decelerations (<-3 m/s²), HI ACC + DEC: high-intensity accelerations and decelerations. MDP targets are based on Rico-González (2021).

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
TD (km)	5-5.5	5.5-6.0		5-5.5	2.5-3.0	5.5-6.0	
TD/min 3 min MDP	150	150		150	70	150	
HSR (m)	50-100	400-500		50-100	0	500-600	
HSR/min 3 min MDP	26	35		26	0	35	
SD (m)	0	50-100		0	0	80-120	
SD/min 3 min MDP	2	4		2	0	4	
ACC (#)	40-50	20-30	OFF/ RECOVERY	40-50	5-10	20-30	OFF/ RECOVERY
ACC/min 3 min MDP	3	2		3	1	2	
DEC (#)	40-50	20-30		40-50	5-10	20-30	
DEC/min 3 min MDP	3	2		3	1	2	
HI ACC + DEC (#)	80-100	40-60		80-100	10-20	40-60	
HI ACC + DEC/min 3 min MDP	6	4		6	2	4	

Conclusion

A structured return-to-run process is essential for safely and effectively reintegrating athletes into full team training. This approach follows a progressive model, beginning with isolated sessions that target specific physical capacities before advancing to controlled loading blocks with increasing training density. By carefully transitioning from single-session days to 2-, 3-, and eventually 4-day training blocks, players gradually adapt to the physical and tactical demands of the team's microcycle, ensuring readiness for competition.

Injury-specific considerations and players' fiber type play a crucial role in determining weekly exposure, session content, and overall progression. Different tissues recover at different rates (Gabbett and Oetter 2025), requiring tailored management of high-speed running, accelerations and decelerations, and overall load to minimize reinjury risk. The final piece of the puzzle is balancing strength and pitch work. Strength gains are maximized on alternate days, but when combined on the same day, doing strength before pitch preserves lifting quality but may cause fatigue, while strength after pitch is likely safer for running but may be less effective for strength development (Gao 2023).

Beyond physical conditioning, effective rehabilitation must also integrate technical and tactical elements, as match readiness extends beyond mechanical workload to include cognitive and decision-making demands (Buchheit M. & Mayer 2019, Taberner 2025a and 2025b). While GPS metrics provide valuable insights into external load volumes, traditional distance-into-zone analyses are limited in capturing the true intensity and distribution of efforts. Future approaches should emphasize locomotor intensity (and action density) over short timeframes and consider both quantitative (e.g., total sprint distance per minute) and qualitative (e.g., decelerations pattern, changes of direction in specific tactical contexts) aspects of running. By combining these elements with individualized response-to-load monitoring, practitioners can ensure a more precise, adaptable, and game-relevant return-to-play process.

Finally, while we present this framework as a foundational guide for practitioners, it's crucial to recognize that each injury is unique and requires a tailored approach; thus, this framework may never be replicated exactly in practice. Nonetheless, we believe it serves as a valuable starting point for developing individualized rehabilitation strategies.

Key points

- Return-to-run programming should be designed with the end goal in mind: safely and progressively rebuilding locomotor capacity while ultimately matching the demands of competition and the team's microcycle.
- Progression should move from isolated sessions to consecutive training blocks, balancing load and recovery.
- Session content evolves from focusing on specific physical capacities to integrating technical and tactical demands.
- Final-stage training should align with upcoming team training demands rather than injury constraints.
- Injury- and fiber type-specific considerations influence progression speed and load management.
- Different approaches (intensity-first, volume-first, or a balanced model) can be used, depending on the injury and team philosophy.
- Drills monitoring and programming should go beyond total distance in speed zones and focus on intensity over short periods (1-, 3-, or 5-minute blocks) to better replicate match demands.
- GPS data reflect only partially external load and miss internal strain and neuromuscular demands of specific movements, such as ball actions or curved sprints. This limitation shows the importance of including cognitive and sport-specific drills, rather than merely meeting generic GPS metric targets.
- The final piece of the puzzle is balancing strength and pitch work. Strength gains are maximized on alternate days, but when combined on the same day, doing strength before pitch preserves lifting quality but may cause fatigue, while strength after pitch is safer for running but less effective for strength development.
- This framework is a foundational guide for practitioners, but each injury requires a tailored approach.

Acknowledgments

We extend our gratitude to Enda King, Simon Wallace, Theodosia Palli, and Konstantinos Defteraios for their stimulating discussions, which have significantly influenced certain sections of this manuscript.

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