

# Return to play following injuries in pro football: insights into the real-life practices of 85 elite practitioners around diagnostics, progression strategies and reintegration processes

Martin Buchheit,<sup>1 2 3</sup> Ryan King,<sup>1</sup> Adam Stokes,<sup>1</sup> Benjamin Lemaire,<sup>2</sup> Adam Grainger,<sup>1</sup> Diarmaid Brennan,<sup>1</sup> Darcy Norman,<sup>1 4</sup> Anne Mäkinen,<sup>1</sup> Henry Ruggiero,<sup>1</sup> Andy Shelton,<sup>1</sup> Greg Sammons,<sup>1</sup> Michael Bridges,<sup>1</sup> D. McHugh,<sup>1</sup> Benoit Delaval,<sup>5</sup> Karim Hader<sup>1</sup>

<sup>1</sup>Kitman Labs, Dublin, Ireland

<sup>2</sup>Lille OSC, Lille, France

<sup>3</sup>HIITscience, Revelstoke, Canada

<sup>4</sup>US Soccer National Team

<sup>5</sup>Lens Football Club

Multi-disciplinary Teams | Diagnostic | Treatment | Progression | Return to Competition

## Headline

Player injuries have a dramatic effect on pro football teams' performance, which carries important financial damages in parallel (i.e., an average EPL team loses approximately £ 45 million per season due to injury-related decrements in performance) (9). Therefore, strategies aimed at reducing injury occurrence, and then accelerating to return to play and competition, is of primary interest to all practitioners working in elite teams (13, 15).

Following an injury, players enter into what is called the return-to-play (RTP) process, which is aimed at bringing them back to competition in the shortest time possible while reducing the risk of reinjury. The RTP process is generally composed of the following phases: diagnostic within hours to a few days following injury, treatment (healing phase) and injury-specific reconditioning (around the function of the injured structure), and finally generic and then football-specific conditioning that accompanies the return to training and competing. When it comes to enhancing these RTP protocols specifically, there have now been several key recommendations coming either from consensus statements (1) or Delphi surveys examining (hamstring) injury in professional football (19, 21). These excellent pieces of research have improved our understanding of the likely optimal (scientific) process to follow, including specific screening protocols and suggested cut off values for progression criteria and overall RTP decision-making, i.e., when to return to run, play, and compete (6) (e.g., eccentric hamstring strength relative to pre-injury benchmarks) (19, 21).

However, a large proportion of the provided information is hamstring-specific (11, 12, 18, 19, 21), and while the majority of teams were reported to often meet the criteria that they set to progress through the RTP continuum (6), many practical, real-life questions and challenges that practitioners face daily have not been examined yet.

It is well recommended that the RTP decision-making process should be shared between colleagues within the Multi Disciplinary Team (MDT) and with the technical staff and stakeholders. However, the actual processes within and outside the MDT in pro football have only been partially examined (6). Who makes the final decisions? How do practitioners from different departments (e.g., physio and conditioning coaches) share the workload and responsibilities with the injured players? How are diagnostics and delays communicated

and followed up with coaches? How often do players request an opinion from an external-to-the-club specialist? How often do players request to be trained by an external practitioner? How flexible are practitioners when it comes to actually following the ideal/theoretical progression protocols? Does player status and pressure from coaches and calendars affect all of the above?

Simple but highly recurrent logistical questions also deserve more examination, e.g., when do injured players train in relation to the main squad? Do they need to participate in team meetings? In the daily life of a MDT in a pro football club, all the above questions are often bigger pain points that strictly follow progression guidelines.

## Aim

This survey has been designed to gain insight into how practitioners approach, manage, and deliver the "return to play" process (RTP, as the overall rehabilitation process that leads to the generic idea of returning to 'play'), and how MDT approach the process and decision-making in the real-life conditions of elite football (soccer). More precisely, our aim was to answer key practical questions around clinical diagnosis, the use of progression criteria, players' reintegration with the group/competition, and finally, the overall organisation of the RTP process within the MDT.

## Methods

While more specific classifications have been used and involve different periods to return to run, train, play and even perform (6), we used the term RTP as that of the overall rehabilitation process. We assumed that it was probably not needed to go more into detail in the context of the present survey since we looked at questions at a higher level (i.e., diagnostics, progression criteria, logistics and reintegration).

The survey was made available in English and advertised via emails to the existing company customers and on social media in May 2022. The survey was then closed on 31st Dec 2022.

Importantly, injury management is both complicated and complex. The number of individuals working on the RTP and

the multi-faceted nature of injury (e.g., mechanism, type, and severity), rehabilitation approach and return to performance process simply cannot be boiled down to a “simple protocol.” Also, RTP is often qualified as “dynamic”, in the sense that sometimes RTP is expedited or delayed due to stage of the season status and team needs. To shed light onto real-life practices, we asked responders that they answer through a broad perspective of how they approach injury and rehabilitation and resist the temptation to think of specific examples.

Following the few demographic questions, the survey was made of the following four sections (with each containing about 15-20 short questions):

1. Clinical Diagnosis (18 questions)
2. Progression criteria (14 questions)
3. Reintegration with the group/competition (20 questions)
4. The organisation of the RTP process (logistics and context) (20 questions)

### Data analysis

Descriptive data are presented as percentages of the total number of responders. When multiple responses were allowed for a given question, the percentages sum up to more than 100%.

## Results

### Demographics

Overall, we received 92 responses - however, for the current manuscript, only responses related to professional football were analysed (e.g., only 1st or 2nd league data were used, n = 85).

Each practitioner’s position and role were first reclassified using the model suggested by Buchheit and Carolan (3) (Figure 1). They were working in all top leagues in Europe, the USA, South America and Asia. All top-level leagues were represented with more than 40% of the respondents working in either the English Premier League, La Liga, Ligue 1, Serie A or the Bundesliga. The completion time was 15 minutes on average.

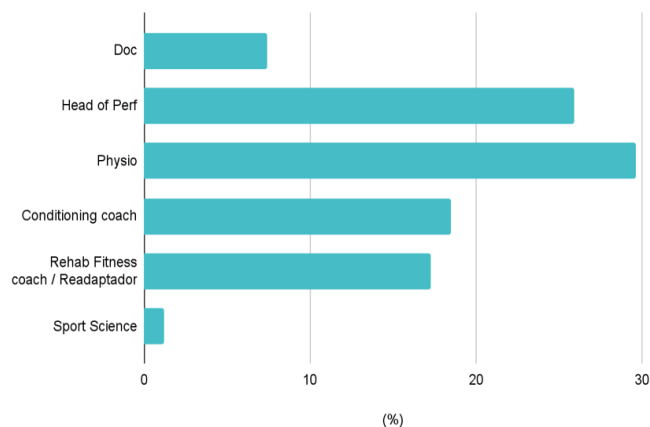


Fig. 1. Responders’ roles.

## Responses

Because of the variability in responders’ profiles and approaches (Figure 1), it was difficult to run a sub-group analysis; therefore, all 85 responses were analysed together. We nevertheless believe that this variability in practitioner profiles is actually beneficial to our aim, which was to draw a complete and generic picture of the practices within a MDT.

### Clinical Diagnosis

When it comes to diagnostics, practitioners admitted to relying most of the time on diagnostic imaging, but only if there was a feeling for the scan to be really required (Figure 2). In fact, scans are a readily available resource in many football clubs, yet as we know scans are not always necessary and if we scan we are likely to find something, which perhaps may not be related or helpful in a low-severity injury situation. In fact, as nicely put by Orchard et al. (16) "It has long been recognised that even gross pathological derangements, such as osteoarthritic joints, intervertebral disc protrusions and rotator cuff tears, can sometimes be completely asymptomatic. Thus, physicians must always remember to ‘treat the patient, not the scan’". Doctors tend to be open to asking for opinions from colleagues outside of clubs (with the more severe the injury, the more inclined they are to ask for help, Table 1), and even sharing information with external-to-the-club professionals (e.g., players’ personal physios). There are likely many reasons why doctors might consult externally, and a possible reason for this practice may be that seeking other opinions may increase doctors’ authority when it comes to negotiating expected lay-off times with important players and coaches. In a situation when stakes are high, doctors can gain confidence in their decision with second opinions - this definitely helps them to face adverse situations. While practitioners may also need to accept that they may not know what they know and therefore, show open-mindedness and humility (4), the drivers for medical consultation might not always be driven by altruistic sentiment. Is consultation with external practitioners in the best interest of the player or is it safeguarding a practice embedded within medical practice? Getting a diagnosis wrong could be costly both to the club, player and very damaging to the practitioner’s reputation as well as bringing the club’s medical department and its staff under unwanted negative scrutiny.

Delays announced are intended to be honest (>85% of responses, Figure 3) and refined as the RTP progresses (>45%, Figure 4). The necessity to provide ranges of dates rather than an exact date comes from the fact that the duration of the RTP phases, and hence the date to return to train needs sometimes (moderately severe injury, >14-<28 days) and often (severe injury, >28 days) to be adapted in relation to the actual progression of each individual player (Table 2). With these flexible strategies, delayed timeframes are more readily met (70%, Table 2).

Anecdotally, the predicted duration of the RTP was also admitted to being sometimes influenced by coach pressure, calendar and importance of upcoming games, and player’s status (with the more important and senior the player, the greater the potential impact on predicted delays) (Table 3). Nevertheless, whether expediting the RTP is actually linked to recurrence rates wasn’t examined in the current survey. Examining in detail subsequent injury/re-injury within 2 weeks/re-injury within 2-3 months in those specific cases is an interesting follow-up to the current question.

An important point that likely sums up this external pressure and that wasn’t examined in the present survey is how players themselves handle both being injured and outside of

the playing group. This likely has an effect on how long it takes to RTP and how the MDT works in supporting the player from a physiological and psychological perspective.

Finally, it may also have been worth exploring how this external-to-the-MDT pressure drives improved rehab processes. It could be hypothesised that without this external pressure, practitioners may be inclined to take a more conservative approach, leading to less forthcoming advancements in rehab protocols.

Advancement in the rehab process is communicated daily (>50%) to weekly (>20%) to the head coach (Figure 5), mainly during physical in-person meetings (60%, Table 3). Phone calls and text messages are also used sometimes, but not emails or Athlete Management Systems. (Table 4).

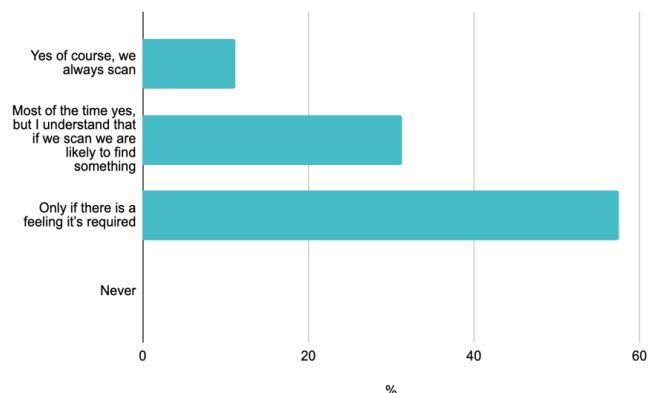


Fig. 2. Is there a need to typically 'always' scan injuries?

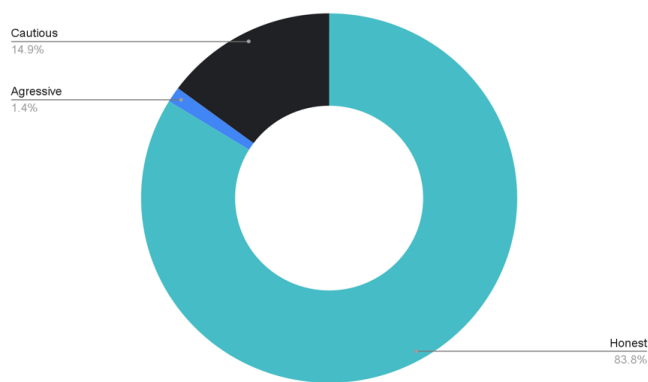


Fig. 3. Strategy when communicating the expected duration before the athlete will return to play.

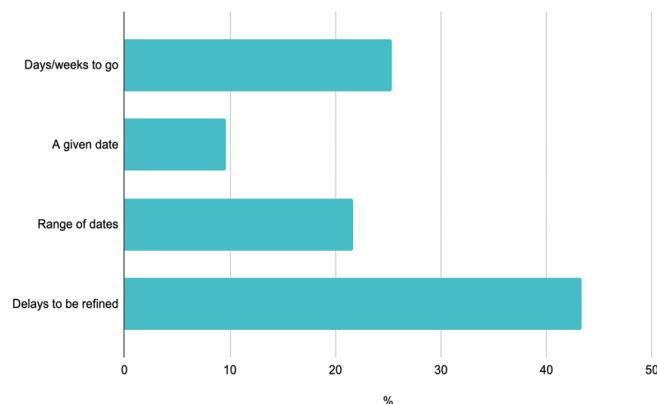


Fig. 4. How the expected duration for the player to get back to competition is communicated.

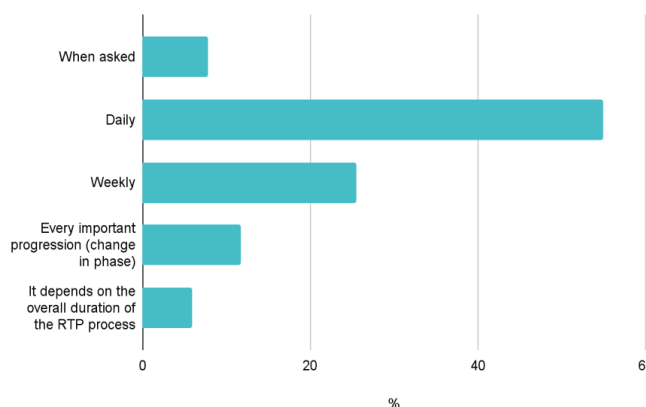


Fig. 5. How often does the medical team update the head coach about the advancements of the rehab?

### Progression criteria

When it comes to progressing during the RTP, the very large majority of practitioners (95%) reported using baseline measures collected when players were healthy as references (Figure 6). These tests come generally from the literature with objectives of physical profiling and injury surveillance (Table 7).

Return-to-play goals are defined by doctors and physios (>50% for both, Figure 7) and are generally process- and performance-driven (Figure 8). The way the overall RTP plan and associated key performance indicators (KPI) are set off the back of the injury diagnostic seems to be well spread among practitioners (Table 6): decisions were made either collectively (whole MDT), within discipline, and/or by the individual leading the RTP. This echoes Dunlop (6) findings, where 80% of the decisions were reported to be shared by at least two practitioners.

Given that RTP goals are set by physios and doctors rather than guided by sports science- and performance-related practices, but given that performance staff are also responsible for (at least some parts of) the rehabilitation process, whether clinicians consult performance staff on the performance goals they set is of the highest importance. Lack of alignment and vision can result in a tension between these discipline approaches; therefore, there is a need for highly collaborative

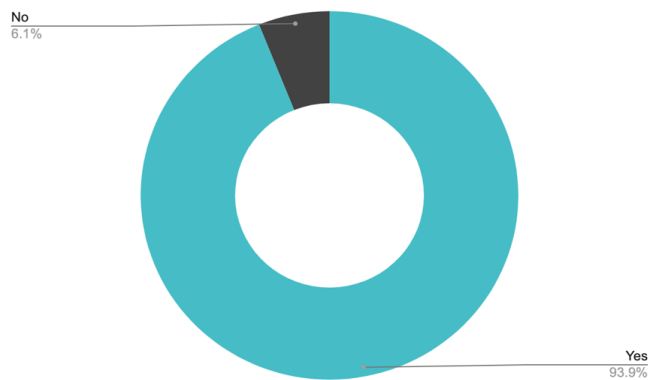
teamwork. When targets and goals are set by medical staff at the outset of the RTP in the absence of discussion with the broader MDT (Performance Staff) this could potentially limit the holistic management of the player and stifle their overall physical maintenance and rehabilitation. When decisions are made about the plan or goals prior to broader discussion across the team this potentially limits the opportunity for debate, dissenting views and discussion across the MDT reducing the need for collaboration whilst forcing the team to early convergence on the suggested course of action. All of which could deliver sub optimal outcomes for the player. Overall, a very close alignment between colleagues is required to guarantee the alignment between the process, the anticipated outcomes and final performance.

These KPIs logically often inform players' progression across the RTP and are perceived as more important than the duration initially set in partnership with the performance/coaching staff (Table 7). The most important driver for players' progression is their progress measured against baselines or return to function measures, and not overall time loss and injury duration (Table 8). The typical baseline measures that practitioners may use as benchmarks have been well-described in the literature, and include, for example, function, measures of strength or validating certain targets in terms of work in the gym or on the pitch (6, 19, 21).

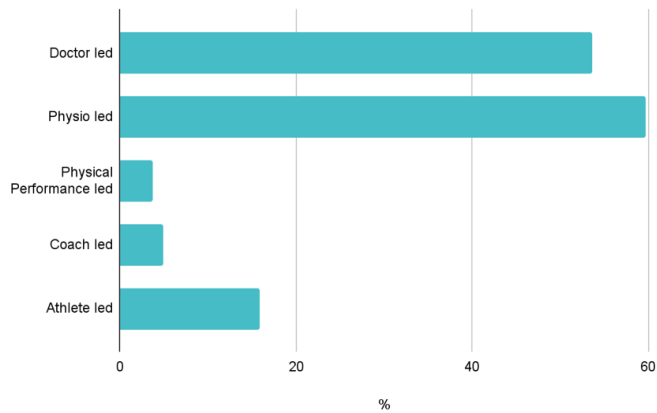
Function, players' response to daily work, initial diagnostic and perception and confidence of players were rated as the top four most important criteria used to organise daily work during the entire RTP process (Table 9) - with the majority of practitioners re-assessing those milestones (bi)weekly (Table 10 and Figure 9).

Progression is based on subjective and objective criteria which are to be achieved to move from one stage to another - and not set in stone as per the time-frame announced initially by the physician (Table 11). Practitioners are also content to move to the next phase when some criteria are not met, as long as the load is adapted and they can "catch up on the way" (Table 12).

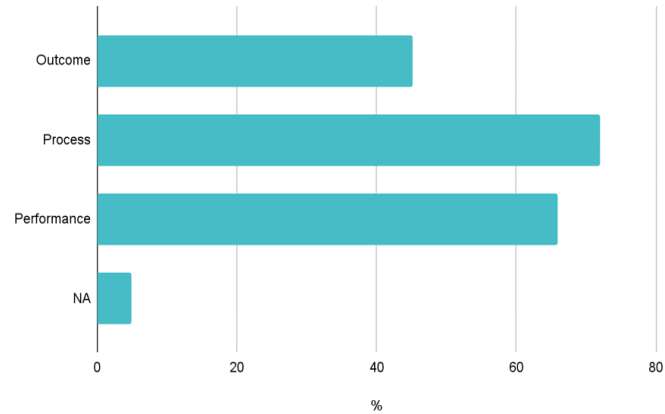
The speed of progression may however be sometimes accelerated for senior and important players (but less so with junior players) (Table 13).



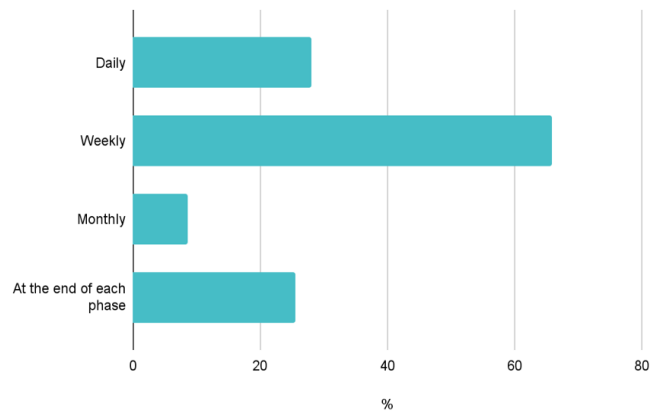
**Fig. 6.** Do you assess baseline tests, diagnostics and monitors of healthy athletes/the squad and establish norms to inform RTP when an injury happens?



**Fig. 7.** How are the initial RTP goals set?



**Fig. 8.** Post injury, what type of goals are set at the beginning of the RTP by the MDT (Multi Disciplinary Team).



**Fig. 9.** How often do practitioners review case conference complex injury (+28 days) and return to play with the athlete and as an MDT across the RTP process.

### Reintegration with the group/competition

Physiotherapists and doctors tend to validate (approve) the return of the player to training. When it comes to validating return to play (competition) with the team, the head of performance, the player and the head coach were also heavily consulted and involved (Table 14). Nevertheless, while it may be intuitive that for the last phases of the process (i.e., return to competition), performance practitioners would get more involvement, the physios remained the practitioners reported to be the most involved (>70 vs. 40%), suggesting that they are really at the core of the process with their ability to keep a global picture of all consecutive phases of RTP. Our present results extend those of Dunlop et al. (6), who reported that 80% of the teams they surveyed use a shared decision-making approach involving at least two people. Although out of the scope of this research, it is worth considering who has final decision-making responsibility around key transitions across the RTP process, how consensus of decision is sought and where accountability for the decisions lies. It is clear that clinicians play a vital and central role across the RTP and yet progression through the process when conveyed through a clinical decision-making lens may polarise perceptions, skew the overall picture or filter critical information on which objective "evidence-informed" performance decisions might be made.

An interesting finding was to see the almost nonexistent involvement of a psychologist (<2%, Table 14) while, on the other hand, "perception and confidence of players" was rated in the top four most important criteria to be used to organise daily work during the entire RTP process (Table 9). This may be related to the fact that the "perception and confidence of players" may not need to be assessed by such a professional (at least in the eyes of the MDT practitioners). Anecdotally, psychologists are not yet well "accepted" in pro football and are often only involved as part-time staff or consultants. In fact, in the absence of such practitioners, physios are generally the ones indirectly in charge of this psycho-emotional monitoring. They may use some specific (wellness) questionnaires (14) and assess this confidence themselves, simply by asking how players feel, performing some manual muscle and movement/function testing when they check in in the morning and examining players' responses to specific exercises in the gym/pitch. As discussed in the next section, this practice justifies the need to have a clearly-defined referent person that oversees the entire process.

Once back with the team and training, players were reported to train in an "adapted" manner (i.e., reduced overall load, restrictions to perform some forms of exercise) for a few days to a maximum of a week following low-severity injuries (<14 days). When injuries were moderate-to-severe (>14 - <28 days), the training was adapted for at least a week, and following severe injuries, a minimum of two weeks (Table 15). Overall, the longer the injury, the longer the time required to train in an adapted manner, which is likely related to the need to progressively rebuild players' chronic load.

In a real-life scenario, following low-severity injuries (<14 days), it appears that players are sometimes selected in the group for competition without having met the majority of the most important criteria described in Table 9 (Table 16). Following moderate-to-severe (>14 - <28 days), the tendency was similar (i.e., most of the important criteria were sometimes not reached), with the exception of maximal speed exposures that appeared to be compulsory (46% reported that this never happens). Following severe injury, almost all important criteria were reported to be met (Table 16). Overall, maximal speed exposures and near-to-normal baseline (ROM, mobility, strength) values were clearly (about 10% consistently ahead

of other criteria) the most cited criteria to meet before returning to competition, suggesting that these criteria may be the most important ones for all the decision makers involved in RTP in the real world. That may show a shift in practitioners' way of thinking after several years of emphasis in the literature on the protective benefit of sprinting (i.e., the "vaccine" concept) (5, 7). Interestingly also, training with the team in a non-restricted way for three days to a week was a criterion two times more often missed than reaching near-to-normal group-based baseline strength/mobility/ROM values (Table 16). While this suggests a kind of hierarchy order between those criteria, it may also be related to the fact that while MDT practitioners have more or less the "control" of hitting those latter targets or not, they may be less uniquely influential in what happens on the pitch once the player is back with the team, i.e., it is the technical staff that generally takes more of the lead on that last part of the RTP process (Table 14).

In line with the very low involvement of psychologists in the process (Table 14), regardless of the severity of the injury, players were often reported not to perform a confidence check (interview/work with a psychologist or at least using specifically-designed questionnaires) (Table 16) - which is again at odds with the importance given to perception and confidence (Table 9). Since this is something that may be automatically/consistently checked/monitored by the physio in charge, before, during, and after the sessions, it may not be considered as a "real test" such as maximal speed exposures and ROM or strength asymmetries. Overall, our results are in line with those reported by Dunlop et al. (6), who reported that only 73% to 92% of the clinical and functional criteria, respectively, were actually met in players returning to train with the team (whether selected or not for matches).

The reasons why practitioners report putting players back in without meeting key criteria could not be examined in the present survey, but the external-to-the-MDT pressure discussed earlier (Tables 2 and 3) may play an important role. The player's status (e.g., senior, captain, important player) is obviously an important factor (Table 13), whether it's coming from the player himself (e.g., some players may have playing minutes as a KPI in their contract, others don't want to let teammates play at their position for fear of losing their place in the starting 11) or the coaching staff. Technical staff often tend to think that the player is ready when they see him training with the group and/or at least allow themselves the right to decide whether the player may be ready to compete or not. Another possible explanation for not meeting all criteria is that in some contexts, there may not be enough resources to do so, whether it's time and human resources (when injured player treatment and work are scheduled at the same time as the main squad, Table 21) or whether the appropriate materials and tools are not available (i.e., force plates and strength dynamometer are not available in every single elite club yet).

Finally, whether playing or competing while not having validated all the (expected) criteria effectively put players at higher risk of injury/re-injury within two weeks/re-injury within 2-3 months, and whether (re)-injury rates are actually higher in these specific cases is unknown - this is definitely an area of future research. Regardless of why players return to play before satisfying all the criteria set, this raises an important question over whether perfect protocols and processes are relevant in real world "messy" scenarios where complexity, unpredictability, subjectivity and human interaction exists. An extension of this question is what are the ramifications to the player and support staff when deciding to return players outside of the criteria they set and how do they weigh this risk?

This is the first time that the actual minutes played by players during their first official match post-injury are examined. It was reported to be as a function of injury severity and playing position (Table 17). For all positions, the main playing duration was often 30 and sometimes 60 minutes following all injury severity, and almost never (60%-75%) 90 minutes after severe injuries (with the more severe the injury, the less often they tended to play 60 and 90 minutes). One notable between-position difference was that central defenders tended to play more often 60 minutes than the other positions, especially following low-severity and moderately-severe injuries. In fact, playing time for central defenders was equally distributed between 30', 60' and 90'. Additionally, for low-severity injuries, central defenders also tended to play 90' during their first official match post-injury more frequently than the other positions (2x more chances to do so: 44 vs. 16-19). This is likely related to the fact that central defenders often have a substantially lower locomotor match-related demand than other positions (e.g., total distance, high-speed running, sprints). A question that would deserve more attention in the future is why practitioners actually manage players returning from injury in terms of volume (minutes) and not intensity or specific repetitions of actions (e.g., high-speed running, changes of directions), where the load through the joint kinetic chain

is likely a greater risk factor. It would also be interesting to see how many unrestricted training minutes the players have prior to their first match (2) and when they are ideally "reintroduced" in the microcycle to participate in a full session.

Another interesting point when looking at minutes played post-injury (Table 17), is that the differences between positions tended to decrease as the severity of injury increases - which is likely related to the time needed to rebuild chronic load and exposure, and suggests that in this case, time loss is taken as a more important factor than acute positional demands.

Overall, and especially for low-to-moderate injuries that represent 70% of all injuries (8), the fact that 1) all criteria are not all met, and 2) players may play 60 or 90 minutes as their first match (which is going a bit against what would be expected) suggests that the observed practices may actually be reflective of the "real norm" in elite clubs. While beyond the scope of the present study, this may highlight gaps between the literature (ideal case scenario) and actual practices. As always, practitioners in elite sports are often at the front end and may sometimes detach themselves from evidence-based practices to offer what they feel are more relevant (and efficient) treatment and conditioning strategies (3).

**Table 1. Practices when it comes to sharing diagnostics outside of the club.**

	How often are you (the club/doc) asking for other opinions from colleagues outside of the club?		How often is the detailed injury assessment shared outside of the club (players' personal physios, etc)
	Moderately-severe injury (>14 - <28 days)	Severe injury (>28 days)	
Never	21	5	25
Sometimes	54	49	66
Often	23	38	8
Always	2	8	1

**Table 2. How often do practitioners adjust the duration of the RTP phases, and how often these delays are actually met.**

	Length of different phases		Return to play date		How often is the initial duration of the rehab that was announced, met?		
	Moderately-severe injury (>14 - <28 days)	Severe injury (>28 days)	Moderately-severe injury (>14 - <28 days)	Severe injury (>28 days)	Low-severity (<14 days) injuries	Moderately-severe injury (>14 - <28 days)	Severe injury (>28 days)
Never	0	0	4	0	1	1	2
Sometimes	58	51	71	63	16	20	30
Often	36	36	22	31	72	71	63
Always	6	13	4	6	11	7	5

**Table 3. Factors that may affect predicted duration before RTP.**

	Pressure from the coaching staff/head coach	Status of the player				Calendar/importance of the upcoming matches
		Junior	Senior	Captain	Scorer	
Never	21	57	22	22	19	2
Sometimes	63	33	56	51	46	70
Often	14	6	20	20	28	22
Always	1	4	2	7	7	6

**Table 4. Preferred medium to provide this information to the head coach.**

	In-person meeting	Phone call	Athlete Management System	Printed report/doc	Email	Text message
Not using	1	12	37	38	47	25
Use sometimes	4	51	34	35	31	47
Use often	35	30	10	19	9	19
Use always	59	7	19	7	13	8

**Table 5. How the appropriate tests and monitoring tools been are established? MSK: musculoskeletal.**

	How are the appropriate tests and monitoring tools established?
Evidence-based research	78
Injury Surveillance	52
Functional Movement Screens	28
MSK Screens	38
Physical Profiling	71

**Table 6. Key Performance Indicators against the injury diagnostic.**

	How does the MDT set and agree Key Performance Indicators (KPI) against the injury diagnosis?
MDT Case Review	43
They are set individually within disciplines	39
They are communicated by the individual leading the RTP	44

**Table 7. Decision making during the RTP process.**

	Do the established KPIs inform decision making on athlete progression across the RTP?	Does RTP duration initially set with the performance/coaching staff inform decision making on progression across the RTP?
Never	1	5
Sometimes	29	42
Often	48	33
Always	23	20

**Table 8. Drivers of players' progression.**

	What influences decision making across RTP the most?
Time Loss in tec-tac and competition	10
Overall duration of RTP predicted	11
Athlete's progress measured against baselines or return to function measures	80



**Table 9. Importance of the different criteria used to organise daily work during the entire RTP process.**

	Not Important	Low	Moderate	Important	Very Important
Diagnostic	1	1	11	31	56
Function	1	2	5	27	65
ROM	1	1	28	43	26
Reported pain	0	4	29	39	29
Strength	0	5	13	47	35
Perception and confidence of player	0	2	11	34	53
Work done each day in the gym	1	4	35	41	19
Work done each day on the pitch	1	1	24	43	30
Response to work done each day	0	1	11	35	54

**Table 10. Organization of the RTP progression in relation to the defined criteria.**

	How is the progression organised in relation to the above criteria throughout the process?
Defined protocols and milestones to be met at the club level for each injury (transversal practices)	44
Reassess (bi)weekly the milestones to readjust the plan if needed	61
The physio in charge adapts daily as it comes	41

**Table 11. Progression in the different phases of the RTP**

	The progression in the different phases of the RTP is guided by:
At all costs, the timeframe announced initially by the physician	1
Based on subjective & objective criteria to be validated to move from one stage to another	82
The player's feedback on his sensations	17

**Table 12.** Degrees of flexibility when it comes to moving to the next phase when some criteria are not met.

	How flexible are you to move to the next phase when some criteria are not met?
It's compulsory	8
It's okay if the load is adapted and we can catch up on the way	57
It's a continuum anyway	35

**Table 13.** How does the status of the player affect the speed of progression during the RTP.

	Junior	Senior	Captain	Scorer
Never	54	27	28	27
Sometimes	26	40	38	37
Often	15	27	26	24
Always	6	6	9	12

**Table 14.** Practitioners involved in the validation of the return of the player to training and competition with the team (multiple choice).

	Return to team training	Return to competition
Player	46	54
Doc	69	67
Physios	74	73
Head of Perf	51	58
Conditioning coaches	27	37
Rehab Fitness coach / Readaptador	39	38
Psychologist	1	2
Assistant coach	5	8
Head coach	14	54
Sporting director/CEO	1	0
President	0	0

**Table 15.** How long do players train in an ‘adapted’ manner following different injury severity. NA: responses not offered for this injury severity.

	Low-severity injury (<14 days)	Moderate-severity injury (>14 - <28 days)	Severe injury (>28 days)
0	0	0	0
<3 days	44	9	2
<1 week	33	27	4
1 week	20	21	15
>1 week	4	43	33
>2 weeks	NA	NA	46

### Organisation of the RTP process

When it comes to practically organising the RTP process, there are many elements to consider and challenges to face that are never considered in typical research publications.

Head physios and physio were reported to have the greatest impact on the decision-making overall - both at the start (make the plan) and during (adjust) the RTP plan (Table 18).

With respect to the repartition of roles between the different practitioners in charge within the club, the majority of cases involved a sequential but collaborative handover of the player (38%), with physios in charge of the treatment and first steps of gym and pitch work, and then the conditioning coaches together with the physios were in charge of the rest of the gym and pitch work (Table 18). One referent physio is reported to be in charge of the entire process (86%) - whether he/she does the entire follow up himself/herself (42%) or rotates with colleagues (44%) is likely context-dependent (number of staff available, specific player) (Table 19). The need to have a unique person in charge/responsible for the overall process is likely related to the need to have a complete picture and integration of the different contents and outcomes, but importantly, this is also required to continuously monitor psychological-related indicators from the start to the end of the process (e.g., perception, confidence). This is in line with what was discussed in the previous section and the fact that physios tend to be indirectly in charge of the psycho-emotional aspect of the RTP.

It is also worth noting that the profile of the practitioners in clubs may directly influence the above dynamic and lead to variable levels of participation within the RTP process. On one hand, there are individuals that are certified in all areas from physiotherapy, athletic training to strength & conditioning that could therefore run the whole process - while on the other hand, some people are certified or specialised only in a specific area of the process. The geographical location of responders has also a likely influence on the responses, with European football clubs typically only having physios and doctors involved and far fewer athletic trainers and rehab specialists than clubs in the US for example.

The logistics behind the RTP process are also very likely context-dependent. Most practitioners reported that the time when players are called up depends on the day and session content (33%), but it may be more frequent to have them at a similar time (30%) or shifted by one hour or so (28%) rather than at completely different times than the main squad (i.e., 10% for the morning: team vs afternoon; injured player) (Ta-

ble 20). The fact that injured players come at times that are not too dissimilar from the team allows the coaching staff to be sometimes involved in some rehab drills (Table 21). Injured players can also often be involved in non-pitch-based tactical sessions (e.g., team meetings, etc., to keep them engaged) (Table 21). Finally, behind what may seem optimal on paper, staff availability may also often dictate this dynamic. When there are only a few practitioners at the club, they may already be busy with the group of healthy players at the main training time; in this case, there is often a need to schedule injured players later in the day to care for them.

In terms of RTP work and contents, players’ historical injury status is reported to be always considered when designing the RTP process - with special consideration given to additional development work around previous injury sites (Table 21). In fact, the RTP phase also gives players opportunities to do things they would not always have time to do when fit and while training with the group; players were reported to be often assigned additional development work (e.g., physical/tactical/mental depending on players’ needs and profiles). Finally, in accordance with Matt Taberner’s model (17), the majority of practitioners reported trying to replicate the dynamic/programming of the team workload with the individual player during rehabilitation (Figure 10).

The last critical element of the RTP process discussed in the survey was, as with the diagnostic, the potential involvement of external professionals. This is a critical aspect of RTP that to our knowledge has never been examined in the scientific literature. For example, players may sometimes (Table 22) ask to be rehabbed outside of the club with practitioners they are used to working, or enjoy working, with (i.e., previous club’s or personal physio, national team professional) or even renowned experts - the more severe the injury (and the longer the RTP), the greater the likelihood for this to happen. Because the decision to let the player go involves more than medical, treatment and conditioning elements, the head coach and the sporting director/CEO are also often involved (>40%), following the doctor and the physios (>60%, Figure 11). Depending on who the player is, this is made public or not (Figure 12).

There is always some sort of sensitivity to this, both internally and externally. Practitioners in clubs and media may take that as proof of mistrust from the players vs. the club’s employees - with players looking outside for “better” options than those offered at the club. While this may sometimes

reflect the reality, this is generally more driven by personal reasons that go above RTP efficiency. Factors such as players' culture and where they have come from likely play a big role. Expectations of how rehab is completed when a player is in a different country may play a part for example. Overall, the RTP is such a (psychologically) sensitive phase for players

that putting them in the best psycho-emotional environment possible is key, and working in their home town with health professionals with whom they have long-term relationships is probably not always a bad thing, especially if the unavailability time is long.

**Table 16.** How often players are selected in the group for a match \*without\* having met the different criteria, as a function of injury severity.

	Low-severity injury (<14 days)				Moderate-severity injury (>14 - <28 days)				Severe injury (>28 days)			
	Never	Some times	Often	Always	Never	Some times	Often	Always	Never	Some times	Often	Always
Near-to-normal individual baseline strength/mobility/ROM values (>85/90%) in his injured limb (in relation to previous historical measures, or large disbalance in relation to the other side)	28	49	14	8	34	46	17	4	47	35	7	11
Near-to-normal group-based baseline strength/mobility/ROM values (>85/90%) in his injured limb	26	51	17	6	33	47	18	2	47	33	7	12
Reached >90% maximal sprinting speed	37	37	13	13	45	33	15	7	54	22	11	13
Complete individual-specific sessions and complete some sorts of worse case scenarios in terms of locomotor demands	23	45	20	12	35	37	17	11	50	26	9	16
Trained fully with the team for >3 days	11	52	27	10	39	35	19	7	58	16	6	20
Trained fully with the team for >1 week	14	42	27	17	29	40	21	10	44	25	13	18
Performed a confidence check (interview/work with a psychologist or at least using specifically-designed questionnaires)	28	23	27	22	36	22	22	20	41	22	13	24
Used video to retrospectively look at the mechanism / mechanics involved in the injury	29	26	20	26	35	27	19	19	41	27	13	19

**Table 17.** Minutes that players coming back from an injury play in their first official match post-injury, as a function of injury severity and playing position.

		Central defender			Full back/ Winger			Midfielder			Attacking player		
		30 min	60 m	90 min	30 min	60 m	90 min	30 min	60 m	90 min	30 min	60 m	90 min
Low-severity injury (<14 days)	Never	13	5	20	5	8	42	3	1	34	3	4	43
	Sometimes	37	51	37	26	53	39	26	53	50	26	56	38
	Often	40	38	41	62	35	18	60	44	16	63	38	18
	Always	9	6	3	8	4	1	11	1	0	9	1	1
Moderate-severity injury (>14 - <28 days)	Never	9	14	43	5	19	62	4	16	54	4	17	59
	Sometimes	35	49	37	30	49	28	35	49	35	32	54	30
	Often	45	37	18	55	32	9	53	35	11	55	29	11
	Always	11	0	1	10	0	0	8	0	0	9	0	0
Severe injury (>28 days)	Never	14	26	64	10	36	77	8	38	76	7	38	71
	Sometimes	32	52	21	30	46	19	30	45	20	33	47	23
	Often	38	21	13	42	17	4	45	15	4	41	13	5
	Always	16	1	1	18	1	0	17	1	0	19	1	0

**Table 18.** Who has the greatest influence on the decision-making overall both at the start (make the plan) and during (adjust) the RTP plan?

	No impact	Low impact	Impact	Very high impact
Doc	5	17	41	37
Head physio and Physios	4	8	31	58
Head of Performance	7	14	44	36
Strength & Conditioning coach	7	28	54	11
Rehab Fitness coach / Readaptador	7	14	41	38
Head coach	17	53	22	8
Assistant coach	45	48	7	0

**Table 19.** Repartition of roles between the different practitioners in charge up to the partial integration with the team.

Who is in charge (up to the partial integration with the team)?		Among the physios:	
Physios in charge of the treatment only, then the conditioning coaches in charge of the gym + pitch work	26	One in charge of the player follows him through the entire part of his process	43
Physios in charge of the treatment and first steps of gym and pitch work, then the conditioning coaches in charge of the rest of the gym + pitch work	27	One lead, but they can rotate between them	44
Physios in charge of the treatment and first steps of gym and pitch work, then the conditioning coaches together with the physios in charge of the rest of the gym + pitch work	39	It's shared at all levels between the physios	13
A specific person ("readaptador" profile) looks after the entire process	8		

**Table 20.** When are injured players convocated?

During the RTP process, players are convocated in the majority of the case:		Days off	
Same time as the group	31	Same as the group	25
A slight shift from the group (e.g., 1h earlier or later)	27	Different from the group	20
Different times of the group (afternoon vs. morning)	10	Depends on the context	53
Depends on the day/content of the session	32	No day off	2

**Table 21. How often are the different practitioners involved in the RTP process?**

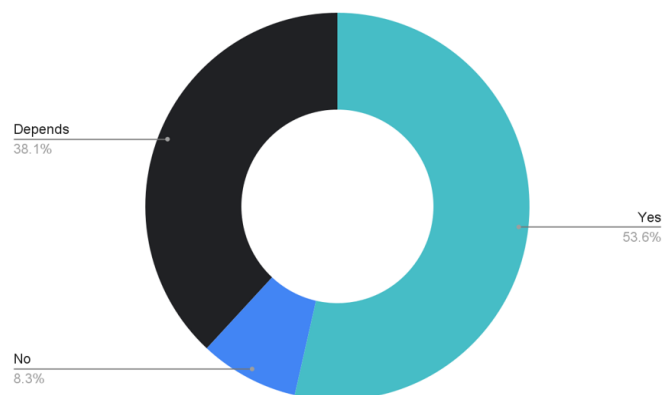
	Coaching staff integrated into the RTP process (e.g., on-field rehab for drills)	Injured players involved in non-pitch based tactical sessions (e.g., team meetings, etc., to keep them engaged)	Injured player assigned additional development work (physical/tactical/mental)	Player's historical injury status considered when designing the RTP process - is special consideration given to additional development work around previous injury sites
Never	19	8	13	1
Sometimes	49	39	37	17
Often	25	39	39	29
Always	6	14	11	54

**Table 22. How often do players get rehabbed outside of your club, in relation to injury severity.**

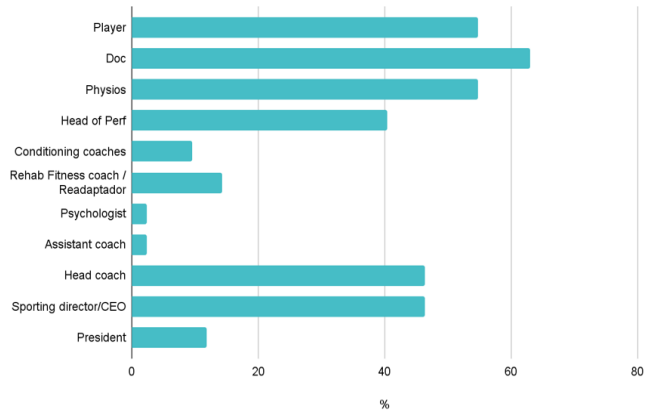
	Low-severity injury (<14 days)	Moderate-severity injury (>14 - <28 days)	Severe injury (>28 days)?
Never	71	60	23
Sometimes	23	33	61
Often	5	5	12
Always	1	2	5

Practitioners in clubs need however to develop the ability to cope with these circumstances which often present in the elite sport environment (especially with senior players). Also, rather than seeing this as noise, if things are well handled, this can even improve the overall understanding of the case and, in turn, the RTP intervention. In fact, in medicine, things are always complex, and humble and open-minded practitioners understand that having other opinions/interventions can often have positive outcomes (4). As an example of this, responders acknowledged that it may be good practice to engage external experts to support and/or manage complex/poorly diagnosed/non-descript chronic time loss injuries (Figure 13) - at least when there was a feeling that they (as a MDT) didn't have the skills and expertise to manage complex/poorly diagnosed/nondescript/chronic time loss injuries (Figure 14). This attitude is in line with the recent work of Gheihman et al. (10) and their tips for thriving in the face of clinical uncertainty.

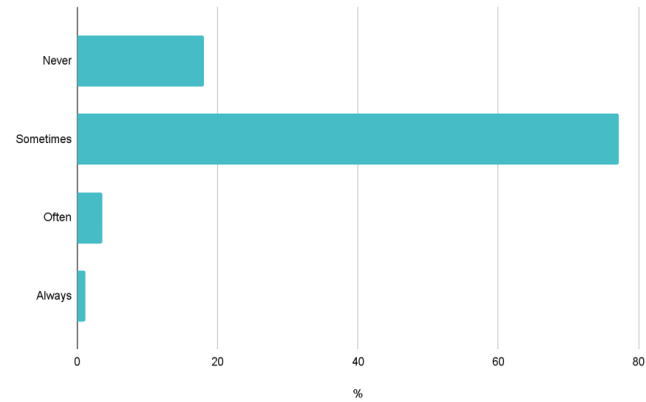
During the time the player is away, the general and ideal practice is to ask external practitioners to provide regular updates on the work done and the player's progression. Players often participate in this feedback process too (Figure 15). It is however worth noting that 30% of responders admitted that while they try to get as much information as possible from the external staff, the reality is that the level of information is rarely complete. For this latter reason (i.e., limited handover of information), the large majority of practitioners (50%) need to test the player when the player comes back (Figure 16).



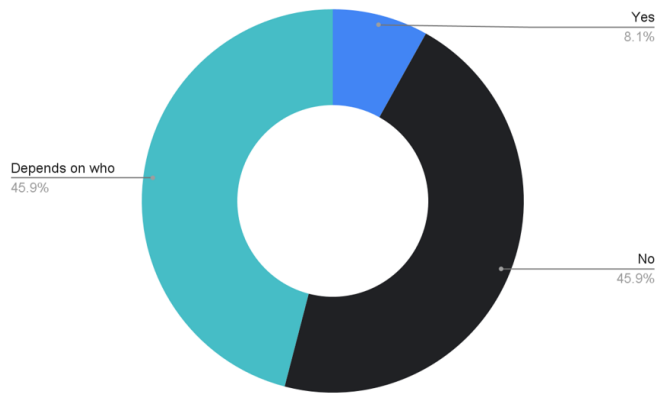
**Fig. 10. Whether practitioners are trying to replicate the dynamic/programming of the team workload with the individual player during rehabilitation.**



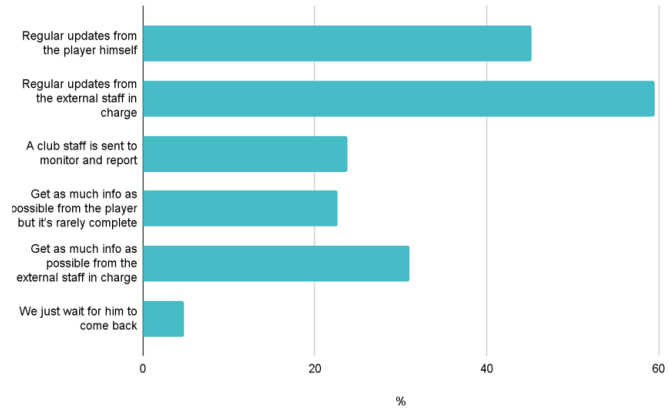
**Fig. 11.** Practitioners involved in the decision to let the player go, if players get rehabbed outside of your club (multiple choice).



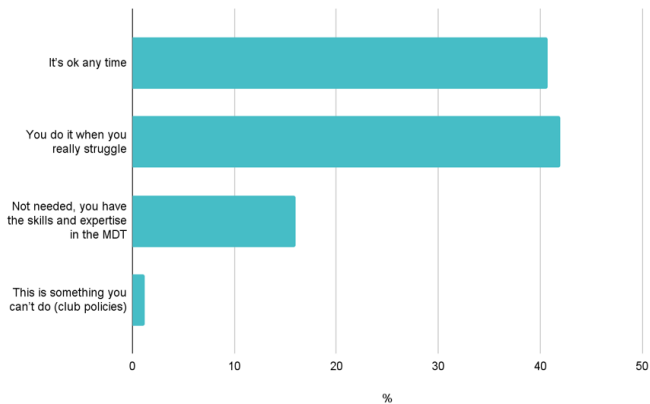
**Fig. 14.** How often do practitioners feel that they (as a MDT) don't have the skills and expertise to manage complex/poorly diagnosed/nondescript chronic time loss injuries and whether it is acceptable to engage external experts to support.



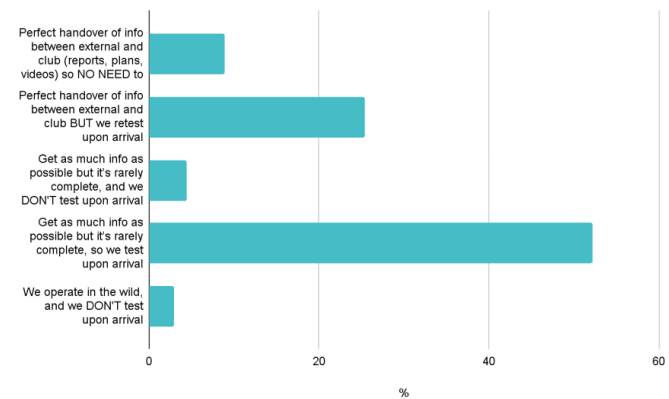
**Fig. 12.** When players get rehabbed outside of the club, is this made public?



**Fig. 15.** Usual practices during the time the player is away when players get rehabbed outside of your club (multiple choice).



**Fig. 13.** Is it good practice to engage external experts to support and/or manage complex/poorly diagnosed/nondescript chronic time loss injuries.



**Fig. 16.** Usual practices when a player comes back after having done his rehab outside of the club.



## Limitations

In the current survey, we treated RTP as the overall rehabilitation process leading to the generic idea of returning to “play”. While more specific classifications have been used and involve different periods to return to run, train, play and even perform (6), it was probably not needed to go more into detail in the context of the present survey since we looked at questions at a higher level (i.e., diagnostics, progression criteria, logistics and reintegration).

Survey-based research has an inherent limitation because of its low response rates, which may limit its effectiveness from an external perspective. The survey was completed by only 85 practitioners. In light of this, caution should be exercised when interpreting or generalising these results, since it is unclear whether they reflect the perceptions or practices of the non-responding teams. Future research should examine how these findings relate to other levels of competition (professional vs. amateur), gender, age (senior-level vs. academy-level) and cultures. It is also common knowledge that philosophies often change with a new Head of department - Performance/Medical/Physio, so the responses collected should not be set in stone and could be different if the survey had been completed at another time, even by the same practitioner.

## Conclusions

The value of our present surveys is that practitioners were asked to answer questions regarding what they have experienced and not necessarily what they think would be optimal. This allowed us to provide real-life insights into how RTP is organised in their (elite) clubs - going further than solely-focused scientific work around the progression criteria themselves for example. The different sections of the manuscript illustrate how the three main elements that are 1) the player (e.g., status, history, beliefs, culture), 2) his injury type and severity, and 3) the context (e.g., calendar, coach pressure) constantly interact altogether, making each case unique. This explains why the entire RTP process needs to be as flexible as possible (from the different progression phases to the group reintegration to train and compete) and benefits from continuous monitoring of both the contents and the outcomes.

Overall, from the diverse responses collected, the RTP process appears as the most collaborative phase in which players may be involved throughout the season. While it’s obviously heavily doctor/physio-led (from the diagnostic to setting the progression phases), other professionals take part actively (strength & conditioning coaches working in duos and sometimes assistant coaches helping the latter on pitch-specific sessions) or more passively (e.g., Head coach and Sporting director when making the decision to let go a player to get rehabbed outside of the club).

The main view around RTP is that despite some strong (scientific) anchors in terms of diagnostics (i.e., quasi-systematic use of scans) and progression criteria (very often based on the literature and then historical tests used as reference points), practitioners’ work is really about their capacity to adapt to the overall context - responses of the players and how things actually progress counts way more than delays announced initially and how long the player has been unavailable. For that latter reason, delays are better communicated in terms of ranges of dates, and daily/weekly communication updates with the head coach and CEO are required to maintain trust when things don’t progress as fast as they were expected to.

Throughout the entire process, practitioners need to show enough confidence to drive their decision when things are at stake, especially when calendar, player status and coach pres-

sure interfere. More precisely, we have shown for the first time that sending players on the pitch without having ticked all the boxes is a very common practice, especially for low-severity injuries (70% of the time all criteria are not met). Whether playing or competing while not having validated all the (expected) criteria effectively put players at higher risk of injury/re-injury within two weeks/re-injury within 2-3 months, and whether (re)-injury rates are actually higher in these specific cases is unknown - this is definitely an area of future research. Another question that would deserve more attention in the future is why practitioners actually manage players returning from injury in terms of volume (minutes) and not intensity or specific repetitions of actions (e.g., high-speed running, changes of directions), where the load through the joint kinetic chain is likely a greater risk factor.

The ability to work under high pressure and maintain trust is often challenged at another level when external-to-the-club professionals are involved, whether it is to provide an (alternative) diagnostic or directly treat and train the players. In these specific situations, common sense should be the main driver, and the interest of the player put in first - which is often easier said than done in such a competitive and ego-centred environment.

Our findings have highlighted the variety of ways elite sports practitioners manage their injured athletes. There may be consensus on how best to manage injured athletes theoretically, but in the “real world” we have presented some of the reasoning behind why this may not be put into practice. The pressures encountered may lead to reinjuries, but may also lead to advanced practice and improved return to play times. This is an area for individual practitioners to understand the unique pressures faced and how this impacts their practices and returning players safely to competition.

There is finally another important element that may deserve more examination in future rounds of the survey: the psychological aspect of players’ support and a player’s perception of the care that is provided within a MDT (which may directly impact the trust that players put in the MDT group, and in turn, whether they would look for outside support or not). It would therefore be interesting also to survey professional players about their environments and confidence levels in them. Following these lines, more attention should be paid to how players’ responses are taken into account by staff, and how players take part in the progression and decision-making aspects during the entire RTP phase.

## Summary of the main points

### Diagnostics

- Practitioners admitted to relying most of the time on scans, but only if there was a feeling that the scan was really required.
- Doctors tend to be open to asking for opinions from colleagues outside of clubs and even sharing information with external-to-the-club professionals (e.g., players’ personal physios).
- Delays announced are meant to be honest (>85% of responses) and refined as the RTP progresses (>45%).
- Expected unavailability is given in terms of ranges of dates rather than exact dates since the process often needs to be modulated in relation to the actual progression of each individual player.
- The predicted duration of the RTP can sometimes be influenced by coach pressure, calendar and importance of upcoming games, and player’s status (with the more important and senior the player, the greater the potential impact on predicted delays).

- Advancement in the rehab process is communicated daily (>50%) to weekly (>20%) to the head coach, mainly during physical in-person meetings (60%). Phone calls and text messages are also used sometimes, but not emails or Athlete Management Systems.

### Progression criteria

- Return-to-play goals are defined by doctors and physios (>50% for both) and are generally process- and performance-driven.
- KPIs inform players' progression across the RTP and are perceived as more important than the duration initially set with the performance/coaching staff.
- Function, players' response to daily work, initial diagnostic and perception and confidence of players were rated as the top four most important criteria to be used to organise daily work during the entire RTP process.
- The most important drivers for players' progression are their progress measured against baselines or return to function measures, and not overall time loss and injury duration.
- Practitioners are okay to move to the next phase when some criteria are not met, as long as the load is adapted and they can compensate later on.
- The speed of progression may be often accelerated based on external-to-the MDT factors including, calendars, coaches pressure and player status (i.e., senior and important players, but not junior players).
- During the RTP, decisions were equally made either collectively (whole MDT), within-discipline, and/or by the individual leading the RTP.
- The involvement of a psychologist is very low (<2%) while, on the other hand, "perception and confidence of players" was rated in the top four most important criteria to be used to organise daily work. In fact, physios are generally the ones indirectly in charge of this psycho-emotional monitoring and assess this confidence themselves, simply by asking how players feel, performing some manual muscle and movement/function testing and examining players' responses to specific exercises in the gym/pitch.

### Reintegration with the group/competition

- Physios and doctors were by far the practitioners most involved in the validation of the return of the player to training.
- When it comes to validating return to play (competition) with the team, the head of performance, the player and the head coach were also heavily involved.
- Sending players on the pitch without having ticked all the boxes is a very common practice, especially for low-severity injuries (70% of the time all criteria are not met).
- Once back with the team and training, players were reported to train in an "adapted" manner (i.e., reduced overall load, restrictions to perform some forms of exercise) for a few days to a maximum of a week following low-severity injuries (<14 days). When injuries were moderate to severe (>14- <28 days), group training was adapted for at least a week, and following severe injuries, a minimum of two weeks (Table 15).
- Players were reported to be sometimes selected in the group for a match without having met all the most important RTP criteria - the shorter the unavailability, the greater this latter occurrence [reaching near-to-normal baseline (ROM, mobility, maximal strength) and speed exposures appeared to be the most important criterion not to miss though].

- Match minutes played in their first official match post-injury was often 30 and sometimes 60 minutes following all injury severity, and almost never (60%-75%) 90 minutes after severe injuries. Central defenders tended however to play more often 60 minutes (and even 90 minutes) than the other positions, especially following low-severity and moderately-severe injuries.
- The involvement of the technical staff in the last phase of the process (i.e., modified training load when back with the group and adjusting playing minutes) likely explains why those criterias are less frequently met than those more under control of the MDT (i.e., reaching near-to-normal baseline values and maximal speed exposures) - the head coach often allowing themselves the right to decide whether the player may be ready to train and compete or not.

### Organisation of the RTP process

- Head physios and physios were reported to have the greatest impact on the decision-making overall - both at the start (make the plan) and during (adjust, monitor) the RTP plan.
- The majority of cases involved a sequential but collaborative handover of the player between medical and performance practitioners (38%), with physios in charge of the treatment and first steps of gym and pitch work, and then the conditioning coaches together with the physios were in charge of the rest of the gym and pitch work.
- One referent physio is reported to be in charge of the entire process (86%) - whether he/she does the entire follow up himself (42%) or rotates with colleagues (44%) is likely context-dependent (number of staff available, specific player).
- The time when players are called up to receive treatment and train depends on the day and session content (33%), but it may be more frequent to have them at a similar time (30%) or shifted by one hour or so (28%) rather than at completely different times than the main squad.
- The coaching staff is sometimes involved in some rehab drills, and injured players can also often be involved in non-pitch-based tactical sessions (e.g., team meetings, etc., to keep them engaged).
- The RTP phase gives players opportunities to do things they would not always have time to do when fit and while training with the group (e.g., additional development work around previous injury sites, physical/tactical/mental depending on players' needs and profiles).
- It was acknowledged that it may be good practice to engage external experts to support and/or manage complex/poorly diagnosed/non-descript chronic time loss injuries
- The decision to let the player receive treatment and get rehabbed outside of the club involves the head coach and the sporting director/CEO (>40%), following the doctor and the physios (>60%) - and depending on who the player is, this is made public or not.
- During the time the player is away, external practitioners are asked to provide regular updates on the work done and the player's progression (players often participate in this feedback process too).
- 30% of responders admitted that while they try to get as much information as possible from the external staff, the reality is that the level of information is rarely complete. For this latter reason (i.e., limited handover of information), the large majority of practitioners (50%) need to test the player when the player comes back.

## Acknowledgements

We would like to thank all participants for their time, transparency, and willingness to share insights with us during this study. Their efforts and thoughtful feedback have been invaluable in helping us to better understand the topic. We are deeply grateful for their participation and hope that their experiences prove useful to elite football practitioners in return to play practices.

**Twitter:** Martin Buchheit (@mart1buch), Ryan King (@Blended\_Team), Adam Stokes (@stokesay16), Benjamin Lemaire (@blmphysiosports), Adam Grainger (@atgrainger), Diarmaid Brennan (@diarmaidbrennan), Darcy Norman (@DarcyNorman), Anne Mäkinen (@Anne\_\_Makinen), Andy Shelton (@sheltssportssc<sup>2</sup>), Greg Sammons (@gsammons2), Michael Bridges (@michaelbr1dges), D. McHugh (@DerekMcHugh3), Benoit Delaval (@BenDelaval), Karim Hader (@Karad70)

## References

1. Ardern CL, Glasgow P, Schneiders A, Witvrouw E, Clarsen B, Wangensteen A, et al. 2016 Consensus statement on return to sport from the First World Congress in Sports Physical Therapy. Bern. *Br J Sport Med.* 2016;50:853–864. doi: 10.1136/bjsports-2016-096278.
2. Bengtsson H, Ekstrand J, Waldén M, Hägglund M. Few training sessions between return to play and first match appearance are associated with an increased propensity for injury: a prospective cohort study of male professional football players during 16 consecutive seasons. *Br J Sports Med.* 2020 Apr;54(7):427–432. doi: 10.1136/bjsports-2019-100655. Epub 2019 Aug 29.
3. Buchheit M, Eirale C, Simpson BM, Lacombe M. Injury rate and prevention in elite football: let us first search within our own hearts. *Br J Sports Med.* 2019 Nov;53(21):1327–1328. doi: 10.1136/bjsports-2018-099267. Epub 2018 Jun 2
4. Buchheit M. & G.M. Perry; EGOals. Exercising your EGO in high-performance environments. Amazon Printing, October 4, 2021.
5. Butler S, Running fast: The cause, the cure and a vaccine, in BJSM Blog, <https://blogs.bmj.com/bjasm/2019/03/19/running-fast-the-cause-the-cure-and-a-vaccine/>, Editor. 2019.
6. Dunlop G, Ardern CL, Andersen TE, Lewin C, Dupont G, Ashworth B, O'Driscoll G, Rolls A, Brown S, McCall A. Return-to-Play Practices Following Hamstring Injury: A Worldwide Survey of 131 Premier League Football Teams. *Sports Med.* 2020 Apr;50(4):829–840. doi: 10.1007/s40279-019-01199-2.
7. Edouard P, Mendiguchia J, Guex K, et al. Sprinting: A potential vaccine for hamstring injury? *Sport Performance & Science Reports*, 2019;January(48):v1.
8. Ekstrand J, Bengtsson H, Waldén M, Davison M, Khan KM, Hägglund M. Hamstring injury rates have increased during recent seasons and now constitute 24% of all injuries in men's professional football: the UEFA Elite Club Injury Study from 2001/02 to 2021/22. *Br J Sports Med.* 2022 Dec 6;bjsports-2021-105407. doi: 10.1136/bjsports-2021-105407.
9. Eliakim E, Morgulev E, Lidor R, Meckel Y. Estimation of injury costs: financial damage of English Premier League teams' underachievement due to injuries. *BMJ Open Sport Exerc Med.* 2020 May 20;6(1):e000675. doi: 10.1136/bmjsem-2019-000675. eCollection 2020.
10. Gheihman G, Johnson M, Simpkin AL. Twelve tips for thriving in the face of clinical uncertainty. *Med Teach.* 2020 May; 42(5):493–499. Doi: 10.1080/0142159X.2019.1579308. Epub 2019 Mar 26.
11. Hickey JT, Timmins RG, Maniar N, Williams MD, Opar DA. Criteria for Progressing Rehabilitation and Determining Return-to-Play Clearance Following Hamstring Strain Injury: A Systematic Review. *Sports Med.* 2017 Jul;47(7):1375–1387. doi: 10.1007/s40279-016-0667-x.
12. Hoppen MI, Reurink G, de Boode VA, van der Kaaden L, Jagtman L, Glazenburg T, Bruning B, Tol JL. Return to match running performance after a hamstring injury in elite football: a single-centre retrospective cohort study. *BMJ Open Sport Exerc Med.* 2022 Feb 24;8(1):e001240. doi: 10.1136/bmjsem-2021-001240. eCollection 2022.
13. McCall A, Carling C, Davison M, Nedelec M, Le Gall F, Berthoin S, et al. Injury risk factors, screening tests and preventative strategies: a systematic review of the evidence that underpins the perceptions and practices of 44 football (soccer) teams from various premier leagues. *Br J Sports Med.* 2015;49:583–9.
14. McCall A, Ardern C, Delecroix B, Abaidia A, Dunlop G, Dupont G. Adding a quick and simple psychological measure of player readiness into the return to play mix: a single player case study from professional football (soccer). *Sport Performance & Science Reports*, 2017, Nov (8):v1.
15. McCall A, Pruna R, Van der Horst N, Dupont G, Buchheit M, Coutts AJ, Impellizzeri FM, Fanchini M, the EFP-Group. Exercise-Based Strategies to Prevent Muscle Injury in Male Elite Footballers: An Expert-Led Delphi Survey of 21 Practitioners Belonging to 18 Teams from the Big-5 European Leagues. *Sports Med.* 2020; 50(9): 1667–1681. Published online 2020 Jul 16. doi: 10.1007/s40279-020-01315-7
16. Orchard JW, Read JW, Anderson IJ. The use of diagnostic imaging in sports medicine. *Med J Aust.* 2005 Nov 7;183(9):482–6.
17. Taberner M, Allen T, Cohen DD. Progressing rehabilitation after injury: consider the 'control-chaos continuum'. *Br J Sports Med.* 2019 Sep;53(18):1132–1136. doi: 10.1136/bjsports-2018-100157. Epub 2019 Feb 8.
18. van der Horst N, van de Hoef S, Reurink G, Huisstede B, Backx F. Return to Play After Hamstring Injuries: A Qualitative Systematic Review of Definitions and Criteria. *Sports Med.* 2016 Jun;46(6):899–912. doi: 10.1007/s40279-015-0468-7.
19. van der Horst N, Backx F, Goedhart EA, Huisstede BM; HIPS-Delphi Group. Return to play after hamstring injuries in football (soccer): a worldwide Delphi procedure regarding definition, medical criteria and decision-making. *Br J Sports Med.* 2017 Nov;51(22):1583–1591. doi: 10.1136/bjsports-2016-097206. Epub 2017 Mar 30. PMID: 28360143

20. Yung KK, Ardern CL, Serpiello FR, Robertson S. A Framework for Clinicians to Improve the Decision-Making Process in Return to Sport. *Sports Med Open*. 2022 Apr 13;8(1):52. doi: 10.1186/s40798-022-00440-z.

21. Zambaldi M, Beasley I, Rushton A. Return to play criteria after hamstring muscle injury in professional football: a Delphi consensus study. *Br J Sports Med*. 2017 Aug;51(16):1221-1226. doi: 10.1136/bjsports-2016-097131. Epub 2017 Feb 28. PMID: 28246078

**Copyright:** The article published on *Science Performance and Science Reports* are distributed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. The Creative Commons Public Domain Dedication waiver (<http://creativecommons.org/publicdomain/zero/1.0/>) applies to the data made available in this article, unless otherwise stated.

