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Considerations and best practices for elite football officials return to play after COVID-19 confinement

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ABSTRACT
The recent COVID-19 pandemic resulted in a total lockdown of the major football leagues, aiming to prevent the threat of an uncontrolled spread of infections, and forcing the players and match officials to home-based physical training. Differently from players, no health and physical fitness maintenance guidelines were published for match officials. Before the return to structured conditioning and officiating, match officials must perform a medical assessment, as well as systematic COVID-19 testing and detailed pulmonary function evaluation. The hygienic-sanitary prevention strategies for virus transmission must be strictly followed. In the remaining part of the present season, alterations of the game rules, namely halves of 30-40 min and no allowance for lost time, aiming to reduce the match officials’ physiological load may result as a safer option. Nonetheless, match officials’ cognitive and physical demands, will probably be exacerbated by the increased number of substitutions per game, proposed to reduce players’ match load. The proposed match scenario further stresses the importance of well-developed aerobic and anaerobic fitness in elite level match officials. Therefore, the aim of this paper was to guide a safe and successful return to play for match officials.

INTRODUCTION
The recent COVID-19 pandemic forced the major world football leagues into a total lockdown in the attempt to avert the threat of an uncontrolled spread of infections. The COVID-19 dramatic death toll emerging in Europe and subsequently, in other continents, and the associated uncertainty, discouraged the return to play in some nations (Nussbaumer-Streit et al., 2020). However, the huge economic impact on both clubs and the media of top European league championships promoted consideration over the possibility of a return to play under medically controlled procedures (M. Mohr et al., 2020; Parnell et al., 2020).

The suspension of matches and weekly club training sessions due to COVID-19 pandemic encouraged the publication of guidelines to protect players’ health and assure physical fitness was maintained during the confinement.
In this context, the often wiser advice was home-based physical training (Hammami et al., 2020). Match relevant physical abilities (i.e. aerobic and anaerobic endurance and strength/power) were addressed, proposing generic exercises/drills to the confined players (Corsini et al., 2020; M. Mohr, Thomassen, et al., 2015). Sub-maximal endurance (80% of the individual maximal heart rate) and body-weight circuit training were the methodological proposals to maintain aerobic and anaerobic endurance and strength. Yoga and stretching exercises were proposed to keep, or partially improve, players’ flexibility and to promote psychological relaxation (Corsini et al., 2020; Hammami et al., 2020). The difference in exercise prescriptions between players and the general population resided mainly in the volume and intensity of the guidance (Corsini et al., 2020; Hammami et al., 2020), with online technology enabling remote fitness classes to gather club players in group training sessions while confined at home (Hammami et al., 2020).

However, despite these training innovations for players to cope with the new training scenario, no guidelines were published to enforce match officials’ home-training and possible return to play during the pandemic (Webb, 2020). Yet, football matches cannot kick-off without them.

Therefore, in what follows we will briefly provide some recommendations for the preparation of return to play of elite football officials. Because of the consequences on health of SARS-COV-2 infection, the return to training and officiating should be based on a conscientious scrutiny of individual and public health. Ideally, a return to regular training and officiating should only occur when the probability of being infected during a sport activity is close to zero. The risk of contracting infections remains unpredictable, thus extreme caution in the return to play is warranted (M. Mohr et al., 2020; Nussbauer-Streit et al., 2020). Specific reference to elite level match officials is justified since the stringent medical and physiological testing proposed by sport medicine national organisations is sustainable for this competitive level (Hughes et al., 2020; Mooney et al., 2020; Webb, 2020).

**The match officials’ team**

In the main competitive championships and during each match, the rules of the game are applied, and players’ behaviour is regulated by the field referee, two assistant referees, the fourth official and the Video Assistant Referee (VAR) operators (two match officials and a system operator). These officials’ characteristics and demands differ from those of the players. Match officials are usually 10–20 years older than players (Castagna et al., 2007; Weston et al., 2012). Furthermore, unlike players, they do not experience club routines, including daily mass training, and frequently live in their home cities. Match officials’ status implies individual travel and the use of public transport, increasing their chances to be in contact with SARS-COV-2, thus endangering their communities when returning home (Webb, 2020).

Elite level field referees are either professional or semi-professional in the major football leagues in which they officiate. Assistant referees possess a semi-professional amateur level, which means that alongside with their officiating duties they have a parallel job that also contributes to their income (Webb, 2020) and that conditions their officiating preparation.

**Match demands**

Elite field referees must keep up with the game whatever the match tempo to gain optimal positioning to control and, if necessary, regulate match conduction (Castagna et al., 2007; Weston et al., 2012). Match external load materialises in 10–12 km total distance covered, with 10–15% performed at high-intensity (Castagna et al., 2007; Weston et al., 2012). The intermittent high-intensity nature of the game elicits average heart rates of 80–90% of the individual maximal with a
corresponding 70–80% of their maximal aerobic power being taxed (Castagna et al., 2007). Assistant Referees cover 5–8 km during a match, with 1 km being covered at high-intensity and with sideways running (Krustrup et al., 2002). Match internal load corresponds to 75% of maximal heart rate and 65% of maximal aerobic power (Krustrup et al., 2002). Blood lactate concentrations during first division matches range from 1.7–14.0 and 1.1–13.7 mmol for field and assistant referees, respectively (Krustrup et al., 2002; Krustrup & Bangsbo, 2001).

**Fitness training methodology**

High internal match loads, resulting from the large association between field referees and team players’ match high-intensity activity, supports a progressive conditioning approach considering the worst match scenarios (Castagna et al., 2007). To control for an unwarranted immune system suppression and to limit non-contact injuries, careful progression should be proposed for strenuous exercise drills (Dixit, 2020; Hull et al., 2020).

Since decision making is a key indicator of match officials’ performance, fitness training should aim to limit possible negative effects of fatigue on match officials’ judgments (Weston et al., 2012). Individual development of aerobic and anaerobic endurance, considering the ideal worst match scenario (i.e. most challenging passages of play), may result in a viable strategy to prepare match officials to cope with competitive psychological and physiological demands. Strength/power and flexibility training are currently proposed for match officials to improve sprint ability and limit injury occurrence (Bizzini et al., 2011, 2014).

High-intensity training has been suggested to foster match economy and limit possible detrimental effects of fatigue (i.e. physical and cognitive) on match decision making (Castagna et al., 2007; Weston et al., 2012). Strenuous exercise either in the form of continuous long duration and short-term high and very high-intensity drills may result in transient immune system weakening (Hull et al., 2020; M. Mohr et al., 2020). However, in elite athletes sudden increments of the proposed training load may increase vulnerability to illness and disease (Corsini et al., 2020; M. Mohr et al., 2020).

**Return to refereeing and training load control**

Training volume during the return to play phase should be controlled and regulated by monitoring match officials’ internal load (Hughes et al., 2020; M. Mohr et al., 2020). Session-RPE (Rate of Perceived Exertion) and muscular and cardiorespiratory RPE (i.e. differential RPE) may result in a viable strategy to personalise training prescription in the attempt to avoid non-functional over-reaching (Castagna et al., 2007; M. Mohr et al., 2020; Weston et al., 2012). Weekly increments in training load not exceeding 10–20% would be advisable. In this regard, the popular and no evidence-based “no-pain-no-gain” training mantra should be discarded (M. Mohr et al., 2020). This should be undertaken with the aim to advert pernicious states of non-functional overreaching leading to immune system worsening and muscle-tendinous injuries. Progression of the weekly training load should be provided considering a default 24–48-hour post training session residual fatigue to avoid immune system suppression (Silva et al., 2018). Maximal tests should be discouraged in this stage of the competitive season to avoid excessive physiological stress. Heart rate and RPE monitoring during a standardised part of the daily training session may result in a viable strategy to individually fine tune daily training prescription aiming to promote optimal adaptations (M. Mohr et al., 2020; Nassis et al., 2020). Submaximal testing (6’ or 1800 m in the Yo-Yo intermittent recovery level 1 test) may help in training personalisation, if periodically performed across the training micro-cycles as structured warm-ups, as well as in physical fitness clearance to officiate (Castagna et al., 2007; Weston et al., 2012). With the aim to
promote optimal training adaptations, match official daily status and associated internal load should be preferentially considered (Lombard et al., 2020). A flexible training approach involving adjustments of the prescribed intensity, volume and training aim according to the match officials’ daily readiness to train, is strongly advised (Soligard et al., 2016).

The urgency to finish the 2020–2021 competitive season will result in a congested match calendar (i.e. three matches per week). Playing every 48–72 h may result in a higher injury risk, and a reduced chance for fully functional recovery, causing greater immune system alterations in match officials. The reported association between aerobic fitness (VO2max) and the magnitude of the immune system response suggests the functional interest of aerobic training in this critical moment (Malm et al., 2004). During the first week, home-training specific care should be devoted to low-to-moderate aerobic training with a progressive introduction of short-duration (2–3 s) anaerobic training (sprint, agility, strength/power). Training drills should be introduced with extreme care using a minimalist approach to avoid injuries and maladaptation, with the aim of preparing officials to match high-intensity and very high-intensity demands. Depending on the quantity and quality of physical training performed during home confinement, 4–6 weeks is estimated to be required to regain the sufficient fitness to cope with game demands.

In the COVID-19 pandemic and its inherent detraining consequences, referees and assistant referees are exposed to a considerable musculoskeletal risk at the restart of their “normal” training and match routines (Bizzini et al., 2011). Chronological age and years of exposure to training and competitions may constitute additional variables, exposing referees to increased injury risk.

Medical considerations

The risk for exercise-related sudden cardiac death due to an underlying coronary heart disease (CHD) is increased in referees given their average age (Weston et al., 2012). Therefore, a standardised pre-competition medical assessment (PCMA), comprising of a general physical, orthopedic, and detailed cardiac examination (with rest and exercise electrocardiogram), has become a crucial part in match officials’ health protection (Bizzini et al., 2012; Keller et al., 2013). The PCMA must therefore be performed on referees before restarting a structured physical preparation towards match appointments in the agreed COVID-19 return to play phase (Hughes et al., 2020; Mooney et al., 2020). Additionally, within this pandemic situation, the medical staff must ensure that COVID-19 testing is systematically performed on the officiating team, and possibly add detailed pulmonary function tests. However, currently no consensus of a specific medical screening in athletes after the COVID-19 pandemic period is available (Hughes et al., 2020; Mooney et al., 2020). The hygienic-sanitary prevention strategies for COVID-19 transmission must be strictly followed, and each “suspected” case must be accordingly medically managed. In general, after the COVID-19 pandemic, regular health checks will be of even greater importance for referees and assistant referees after restarting their “normal” training and match routines.

Injury risk

Two of the main characteristics of the athlete “referees” are their higher average age and an, often undisclosed, history of injuries and overuse musculoskeletal problems (Bizzini et al., 2011; Mario Bizzini et al., 2014). Considering the length of their career, referees and assistant referees often suffer from musculoskeletal complaints (overuse) in the low back and lower extremity (quadriceps, hamstring, adductors, calf muscles, and Achilles/patellar tendons). It has been estimated nearly 60% to 90% of officials have had at least one complaint in their career (Bizzini et al., 2011; Mario Bizzini
et al., 2014). Concerning acute injuries, the non-contact injury incidence (up to 20 injuries per 1000 match hours) is similar to that of players. The most common types of non-contact injuries in referees are muscle strains (hamstring, calf) and ankle sprains (Bizzini et al., 2011; Mario Bizzini et al., 2014). A recent systematic review and meta-analysis found that older age and a history of hamstring strain injury are the strongest risk factors for hamstring injury in athletes (Green et al., 2020). Consequently, referees performing at high-level may even be at a higher risk than players. Therefore, after the COVID-19 pandemic and its inherent detraining consequences (M. Mohr et al., 2020), referees and assistant referees are exposed to a considerable musculoskeletal risk at the restart of their “normal” training and match routines (Mohr et al., 2020). The implementation of warm-up routines considering strength, flexibility and movement efficiency exercises, may result in a useful strategy to limit training and match injuries (Mario Bizzini et al., 2014). In this regard, the use of the FIFA 11+ injury prevention warm-up version for referees and assistant referees may result in an ecological and population-specific option (Mario Bizzini et al., 2014).

**Planning the return to play of match officials**

Government’s restrictive strategies to contain the spread of SARS-COV-2 resulted in the momentary or final suspension of some European leagues (e.g. France, Belgium and Holland). Other top European Leagues accepted the associated risk of returning to play, planning the completion of the remaining matches to conclude the competitive season. The temporal proximity of the 2020–2021 competitive season meant the consideration of a congested match calendar (i.e. three matches per week), if the return to play was to be granted.

Reorganised matches held with a 48–72 h break may result in higher injury risk, reduced probability of functional recovery causing greater immune system alterations. The reported association between aerobic fitness (VO_{2max}) and the magnitude of the immune system response suggests the functional interest of aerobic training in this critical moment (Dixit, 2020; Malm et al., 2004; M. Mohr et al., 2020). Match officials should be preferentially trained in specifically sanitised venues for the entire duration of the remaining part of the season and repeated COVID-19 tests across the final stages of the competitive season should be considered to warrant personal and other people’s (family members, colleagues, players and citizens) health. Social distancing during training sessions and individual training should be enforced. VAR rooms must be sanitised and operators enabled to officiate at social distance and with face masks and plastic gloves, to reduce the likelihood of being infected with SARS-COV-2. Temporary alterations of the rules of the game should be considered for the remaining part of the season to reduce the internal load of match officials. This may be pursued by reducing halves’ duration to 30–40’ per half, and not considering any allowance for lost time. During the first week after specific home-training, care should be devoted to low moderate aerobic training with a progressive introduction of short-term (2–3 s) anaerobic training (sprint, agility, strength/power) (M. Mohr et al., 2020). With the aim to prepare officials for high-intensity matches and very high-intensity demands, training drills should be introduced with extreme care using a minimalist approach to avoid injuries and maladaptation. Despite the aim of this paper to warrant a safe and successful return to play for the important actors of the game, the critical situation suggests that the restart of leagues and championships should only occur when health care conditions can be appropriately implemented. Depending on the amount of physical training performed during home confinement, 4–6 weeks is estimated to be the period of time necessary to gain the sufficient fitness to cope with game demands.
**Match preparation**

The congestion of league and championship matches over 4–6 weeks will heavily challenge match officials’ physical cognitive abilities. Using players’ post-match residual fatigue model, referees are expected to recover physical performance in 48–72 h (Krustrup et al., 2006; M. Mohr, Draganidis, et al., 2015; Silva et al., 2018). In order to protect match officials from unwarranted stress, match appointments should be paced every 14 days to allow full recovery and maintain the ability to sustain match high-intensity across the competitions (Weston et al., 2007; Weston et al., 2011). Tapering, implemented with a significant reduction of the weekly training volume, and intensity conservation, should be considered to warrant optimal match individual performance (Fessi et al., 2016). Post-match recovery strategies such as contrast-baths and cool water immersion may be considered to foster match officials physical restoration (Nedelec et al., 2012). Most of the final part of the national first division championships will be played in summer time with heat stress being an additional challenge to match officials (Nassis et al., 2020). Acclimatisation training sessions using brief aerobic training sessions during day hot-hours may constitute a sustainable practice to prepare match officials for heat stress (M. Mohr & Krstrup, 2013; Nybo et al., 2013; Racinais et al., 2012). Whilst match hydration and carbohydrate rich diets may reveal additional strategies to allow match officials to maintain physical and cognitive performance during the match.

**Conclusions**

The aim of this paper was to guide a safe and successful return to play for match officials. The critical situation still suggests the restart of the season only when health care conditions are assured.

Before structured conditioning and return to play, match officials must perform a pre-competition medical assessment. The medical staff must ensure that COVID-19 testing is systematically performed on match officials, also adding detailed pulmonary function tests. The hygienic-sanitary prevention strategies for COVID-19 transmission must be strictly followed, and each “suspected” case must be accordingly medically managed. After the COVID-19 pandemic, regular health checks will be of even more importance for referees and assistant referees after restarting their “normal” training and match routines. In the remaining part of the season, temporary alterations of the game rules, namely halves of 30–40 min and no allowance for lost time, aiming to reduce the match officials’ physiological load, may be an option. With the aim to favour rotation and reduce players’ match load, more than three substitutions per game were suggested (M. Mohr et al., 2020). This will probably exacerbate match officials’ cognitive and physical demands, particularly in the final stages of the match, where, most likely, the teams will perform the substitutions. The prospected match scenario further stresses the importance of well-developed aerobic and anaerobic fitness in elite level match officials (Castagna et al., 2007; Weston et al., 2012).

**Ethics**

The project received approval by the internal research board committee of the FIGC Technical Department.

**Patients consent for publication**

Not required.

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