

THE OFFICIATING TEAM

MODERN CARE OF FOOTBALL REFEREES

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A football match cannot kick off without the referee and their assistants to regulate the behaviour of the players and enforce the rules of the game. The last official FIFA survey ('Big Count 2006') revealed that there were approximately 900,000 registered referees and assistant referees worldwide, across all levels of football. Of these, about 90% are male and 10% female. There are also about 3400 registered international referees wearing the FIFA badge.

Modern refereeing faces several challenges, and the speed and intensity of elite-level matches is one of them. In the Italian Serie A, referees (2017/2018 season) covered more total distance than players and an equal distance at high intensity (unpublished data), confirming patterns tracked in the English Premier League¹. Top class referees need to be physically and mentally fit to cope with game demands. Elite referees exercise at 80 to 90% of their maximal heart rate while making match-outcome-relevant decisions. Despite the high demands imposed on referees in

top leagues there are very few full-time professional referees. This means most referees must maintain separate paid employment. In contrast to players, match officials perform at the elite level well into their forties, suggesting specific^{2,3} strategies to sustain physical performance are needed.

PHYSICAL FITNESS

An elite referee must keep up with the game to be in the best position to control and, if necessary, regulate, match proceedings. Match officials should train to be as economical as possible during the game, to limit the possible effects of fatigue on decision-making. High-intensity aerobic training has been suggested to prepare elite referees to cope with match demands. Training intensity equal to or above 90% maximum heart rate should be regarded as a reference for aerobic fitness development. Training drills that mimic actual match movements are of interest, provided that appropriate physiological load (heart rate $\geq 90\%$ max heart rate) is achieved¹. In elite

refereeing, training may also involve open match simulations with players. This combines physical and technical-tactical skill development (functional training) for referees. Contemporary football tends to favour a frequent attack-counter-attack style of play. This aggressive style means that referees need to be able to perform long sprints to keep up with play. Repeated sprint training with variable recovery time, where the referee runs as far as possible for 30 to 40 seconds at 90 to 95% maximum speed, may be a viable training strategy (long sprint ability)⁴. Combinations of high-intensity aerobic training, repeated sprint ability and long sprint ability in weekly training programmes may best target game-specific fitness⁴. Match officials are, on average, 10 to 15 years older than the players they are officiating, and age constitutes an additional challenge to fitness development in elite referees. This suggests emphasis should be placed on strength development/maintenance training⁴. Progressive strength training should incorporate basic, specific

and functional exercises. Functional strength exercises should exclusively consider drills that mimic very high-intensity (5 to 10 seconds) match activities⁵.

MEDICAL ASSESSMENT

Cardiac screening is a relevant aspect for the medical care of referees^{6,7}. Besides a resting ECG, an exercise ECG is often recommended. The leading cause of sudden cardiac arrest in those over the age of 35 years is coronary artery disease. An exercise test should be done in all athletes with an increased cardiovascular risk profile and/or in individuals older than 35 years. If abnormal findings are detected, additional examinations should be performed (e.g. cardiac magnetic resonance) and evaluated by experienced sports cardiologists. Internal medicine and orthopaedic screening, and prompt physiotherapy intervention should be afforded to elite officials across their career to promote health and performance. Advice about proper diet and recovery strategies should also be offered, to avoid health and performance impairment across the competitive season. Although difficult to implement in officials not refereeing as full-time professionals, the aim is to provide personalised and preventive medicine to all referees.

INJURY PREVENTION

Given the limited number of field referees officiating in the top professional leagues (20 to 25 per league), and their congested fixture list at national and international level, injury prevention is acutely relevant. Because of the training and match demands, and often non-professional status (which implies less time for preparation and recovery), referees may have an increased risk of injury (both acute and overuse problems). Although there is limited literature available, the injury profile of referees and assistant referees has been described in detail⁸. At elite level, 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 – similar to players – ankle sprains. Referees do not typically sustain contact injuries.



Figure 1: Italian Serie A referees training session (Coverciano, Italy, October 2013). Photos courtesy of C. von Grebel and M. Bizzini.

Match officiating involves a considerable amount of direction changes (500 per match), backwards running and running at medium to high speeds. Assistant referees are exposed to a considerable amount of lateral shuffling (~30% of total distance) and running at different speeds. These activities put muscles (low back and lower extremity), tendons (Achilles tendon) and joints (knee, ankle) under heavy eccentric and rotational loads. As a consequence, and considering the length of their career, referees and assistant referees often suffer from musculoskeletal complaints (overuse) in these areas. Despite the lack of precise data, it has been estimated that between 60 and 90% of officials have had at least one complaint in their career⁹.

Following the trend towards injury prevention in the last 10 years, preventive

exercises and programmes (based on referees' injury profile and on the available research in players) have also been developed for referees and assistant referees. In a project prior to the 2010 FIFA World Cup, a basic prevention programme was implemented as part of the FIFA referee selection process. The incidence of referee match injuries during the 2010 tournament was lower than that documented 4 years prior in Germany (6.9 vs. 20.8 match injuries per 1000 match hours), whereas the prevalence of complaints (approximately 30%) did not change¹. Based on referees' specific injury profile and on the successful 11+ programme, experiences at FIFA tournaments and World Cups, and in co-operation with several experts, an adapted injury prevention programme ('11+ Referee') was developed, pilot tested and

subsequently implemented into the FIFA referee selection process. The data from the 2014 World Cup (before and during the tournament, a total of 6 weeks) revealed only one training injury (experienced during a jogging acclimatisation session on the first training day for the tournament!), whereas a slightly lower prevalence of complaints (compared to previous editions) was recorded (Bizzini, unpublished data).

Therefore, the implementation of prevention programmes within the training routine may help referees to reduce non-contact (acute) injuries and minimise musculoskeletal complaints throughout their career. It is recommended that to further help prevent injuries, referees' training loads must be carefully monitored, especially given the high volume of matches and physical training sessions performed each season¹.

FUTURE DIRECTIONS

Football match demands have increased – driven by superior player fitness, sophisticated tactics from master coaches and player-magicians – and this is a challenge for match officials from both fitness and decision-making perspectives. Technology is a valuable friend for elite referees, so long as the natural flow of the game is not interrupted. Technology also needs to be accurate and used by well-trained referees. The rise of technology presents new opportunities for the training and development of referees. Communication between referees was the first technology-based tool made available, followed the goal line technology system. Video-assisted referee (VAR) systems are now used in some national leagues (e.g. Italy, Germany and Portugal). Sport scientists model the game to understand the complex cause and effect relationships of match events, and to try to predict decision-making patterns. Virtual reality instruments for physical-technical training in elite skill development might represent a way to train for the unpredictability of football match play.

Referees require specific physical abilities to ensure they are in the best position to make a decision throughout the entire match. Aerobic fitness has always been the central fitness requirement for elite referees. Maximal oxygen uptake values equal to or



Figure 2: Echocardiography examination (Schulthess Clinic, Zürich, Switzerland, September 2012). Photos courtesy of C. von Grebel and M. Bizzini.

higher than 60 ml/kg/min with a speed at maximal aerobic power in the range of 18 to 20 km/h, should be considered a benchmark for top referees. The ability to repeat short (4 to 6 seconds) and long (6 to 30 seconds) sprint bouts is also necessary to cope with teams' rapid offensive and defensive transition tactics.

Experience is a key peculiarity of elite refereeing performance that theoretically contrasts with the biological impairment of physical performance across the years. However, current research may provide effective training strategies to efficiently counteract the inevitable decline in physical performance that happens with age. High-intensity aerobic and anaerobic training protocols are likely to be a winning

strategy. One challenge is that national governing bodies rarely recognise the elite performance level of referees through professional contracts. This means that most referees have reduced time to devote to training. Training schedules that mirror the schedules of players (i.e. either physical or technical sessions once or twice daily) throughout the competitive season should be a future goal for elite referees.

There is still debate about the best training interventions for football referees. Just as the player does, the referee needs basic, specific and functional training with progressive implementation of 'match-like' drills. One way to achieve this is with match simulation (involving players), where the aim is that referees concurrently develop specific



Figure 3: FIFA World Cup 2010 referees performing injury prevention exercises (Pretoria, South Africa, June 2010). Photos courtesy of C. von Grebel and M. Bizzini.



Figure 4: VO_2 max and ECG evaluations during a progressive speed treadmill test (Schulthess Clinic, Zürich, Switzerland, September 2012). Photo courtesy of C. von Grebel and M. Bizzini.

physical fitness and technical-tactical skills. Although promising in terms of supposed effectiveness, functional training in football refereeing lacks a solid scientific background and the systematic use of specific match scenarios may encourage stereotyped motor patterns, limiting transferability of the skills to the competitive match situation. To counteract the risk for stereotyped motor patterns due to insufficient variability in simulated matches, it may be helpful to use virtual reality technology, which can be manipulated to simulate a wide range of match scenarios.

CONCLUSIONS

The modern elite referee needs to be afforded full-time professional status and have access to the very best in technology. Organising training microcycles in refereeing academies with an emphasis on physical and technical-tactical sessions, overseen by professional fitness trainers and technical managers, will develop the best referees. Elite referees are often the target of intense scrutiny regarding match

decisions. Sometimes this can progress to verbal and, occasionally, physical abuse. Therefore, strategies to manage stress, mental health and communication may support elite referee performance.

Individualised strategies aimed at promoting physical and mental performance are needed. These strategies include preventive medicine and effective training load management⁹. Age should not be a barrier to elite refereeing, as accumulated experience is a vital element of successful performance.

References available at
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