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THE USE OF RECOVERY MODALITIES BY ELITE SOUTH AFRICAN TEAM ATHLETES

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ABSTRACT

Athletes competing at the highest level, should optimally balance training and competition stress with adequate recovery. However, athletes are not always aware of the available recovery options. This study investigated the recovery modalities currently used by elite South African sports persons. Research questions focused on types and frequency of recovery strategies used by players from four different sport codes (hockey, netball, rugby and soccer), as well as from different levels of participation. A total of 890 elite South African team sport players (507 males; 383 females) completed a questionnaire, specifically designed for the study. Results showed that recovery modalities are used to varying degrees by players from the four different sport codes, as well as from different levels of participation. The post-match recovery modality used the most by hockey, netball and soccer players was an active cool-down. Rugby players used a strategy for rehydration the most. The frequency of using an active cool-down and rehydration was not affected by level of participation. There seems to be an increased need for player and coach education regarding recovery modalities.

Key words: Recovery modalities; Elite team athletes; Hockey; Netball; Rugby; Soccer.

INTRODUCTION

It is often stated that optimal performance is only achievable if athletes balance training and competition stress with adequate time for recovery (Coutts & Sirotic, 2004; Fuller & Paccagnella, 2004; Kellmann, 2009). Lambert and Borresen (2006) suggested that inadequate recovery is a training error preventing athletes from producing peak performances. Athletes do not only have to deal with physical strain, but also have to cope with psychological, emotional, social, and behavioural stressors. Training programs and competition schedules are so demanding that "natural" means of recovery alone can no longer provide adequate outcomes (Rushall & Pyke, 1990). The athlete should implement a variety of recovery modalities as part of an effective regeneration strategy. According to Peterson (2005: 64), "the concept of effective, regular, and varied recovery activities has become part of the language of today's smart, professional athlete".

Athletic performance is a result of a synergistic interaction of a complex of physical, emotional, mental, and social factors that interact with an external environment. Benjamin and Lamp (1996) discussed the whole-athlete model, while Kenttä and Hassmén (2002: 58) described the athlete as a "psychosociophysiological entity." It is emphasised that athletes bring the totality of their lives to their sports participation. It is thus implied that effective recovery strategies involve active processes with the aim of re-establishing psychological,

physiological, emotional, social, and behavioural components that will allow the athlete to tax these resources again (Kellmann & Kallus, 2001; Botterill & Wilson, 2002; Noakes, 2003).

Large amounts of money are spent in elite sport. Attempts are made to improve performance through the development of shoes, clothes, and equipment. Advanced technology is implemented to conduct biomechanical and match analyses. Innovative training systems and techniques are also implemented with state of the art equipment. However, the question can be asked: are athletes investing enough time and money on modalities to enhance the recovery process?

The aim of the study was to assess which recovery strategies are currently used by elite South African team players during the competitive phase of the year. For the purpose of this study, the various recovery strategies available to the athletes were grouped into four sections, namely *natural strategies* (e.g., active recovery, nutrition, sleep), *physical strategies* (e.g., cryotherapy, thermotherapy, contrast-temperature therapy, massage), *psychological strategies* (e.g., imagery, progressive muscle relaxation, music, prayer), as well as *complementary/alternative medicine strategies* (CAM) (e.g., reflexology, acupuncture, herbal therapy). This classification was based on literature referring to the psychological, physiological, emotional, and social components which should be addressed in the recovery process (Calder, 2000; Kellmann & Kallus, 2001; Botterill & Wilson, 2002; Kenttä & Hassmén, 2002; Noakes, 2003; Barnett, 2006).

The research was guided mainly by the following questions: Which recovery modalities do elite team players mostly use during the competitive season? Are there differences between the four sport codes (field hockey, netball, rugby union, soccer) regarding the recovery modalities applied? Are there differences in the use of recovery modalities between different levels of performance?

The study was approved by the Ethics Committee of Stellenbosch University (registration number 38/2007).

METHODOLOGY

Participants

A total of 890 South African team athletes (mean age 22.3 years, SD = 3.4) from field hockey, netball, soccer and rugby union, who played in the highest division or section of their major competitions at national and international level, participated in the study. These are all field-based team sports, classified as complex sports, "where there is a high variability of motor actions under conditions of advancing fatigue and varying intensity of work" (Siff & Verkhoshansky, 1993: 362).

Subjects volunteered to participate in the study. Players were excluded from the study if they were unable to read English, because the questionnaire was in English. Players were also excluded if they were younger than 18 years. Subjects provided written informed consent for participation in the study. Players were informed that their responses would be anonymous.

Questionnaire and data collection

Data were collected by means of a questionnaire specifically designed for the study. There were no questionnaires available which could be used in the study. The first draft of the questionnaire items was tested informally on two sport science colleagues at a tertiary institution, two former elite players not participating in the study, and two subject-matter experts. After revision of the instrument, a pilot test was done, involving a group of 67 team players who volunteered to participate in the pilot study.

The introductory part of the questionnaire consisted of the demographics of the players, as well as their level of participation. The subsequent sections of the questionnaire dealt with questions on the players' use of various recovery modalities. Questions on the use of each recovery modality were fitted onto one page and divided into three sections. To add an element of consistency throughout the questionnaire, the three sections and response choices for each recovery modality was the same.

The first part of a section began with a contingency question format (Babbie, 2004), where subjects were asked whether they used the recovery strategy mentioned in that section. Only those whose response was *Yes*, were asked to continue with the questions in that section. This helped the respondent to complete the questionnaire by eliminating irrelevant questions. Players had to indicate *when* they use a specific recovery modality (*after training*, *between training sessions*, *after matches, on non-training days*), and the *frequency* of using the recovery modality in the abovementioned situations (*never*, *sometimes*, *regularly*, *always*).

In the second part of the section on a specific recovery modality, check listing was used where players could choose their applicable choices to show what techniques they apply and why they use the recovery modality. In the section on an active cooldown, for example, players had to indicate what they used by marking any one or more of the following activities: slow jogging, stretching, low-intensity activities in a cold swimming pool, low-intensity activities in a heated swimming pool, low-intensity cycling. To include all possible responses, an open category labelled *Other* (*please specify*) was added.

Procedure

A number of survey methods for data collection were considered. These included mail surveys, telephone or face-to-face interviews, internet surveys, group-administered questionnaires, or combinations of methods. According to Groves *et al*. (2004), a combination of methods for collecting data maximises response rates. The logic of mixed modes is to exploit the advantages of modes while neutralising the disadvantages, and optimise resources to improve cooperation. After consideration of various factors, it was decided to use multiple modes of data collection, namely, personal-visit group-administered questionnaires, mailed surveys, and combinations and variations of the two. Permission to conduct the study was obtained from the relevant authorities.

Data analysis

The StatSoft *STATISTICA* data analysis package (Version 8) was used for data analysis. For descriptive purposes means with standard deviations were reported for ordinal measurements

and frequency histograms for categorical data. For comparison of ordinal data between different groupings of respondents, a one-way ANOVA was used with Bonferonni post-hoc testing. Statistical significance was set at $p<0.05$.

RESULTS

The response rate of the completed questionnaires for the total group was 74%. Response rates for the four sport codes were as follows: hockey 74%; netball 81%; rugby 80%; and soccer 61%.

The total group of players (890) consisted of 507 (57%) males and 383 (43%) females. Of the total group, 668 (75%) of the players were from national and provincial teams, and 222 (25%) from club teams.

Rugby players were significantly older ($p<0.05$) than players from hockey, netball and soccer, while soccer players were significantly younger ($p<0.05$) than players from the other sport codes. A statistically significant difference ($p<0.05$) was found between the ages of the players who competed in national teams (23.0±3.58 years), and players from clubs (22.1±2.73 years) and provincial (22.07±3.55 years) teams, with players from national teams being significantly older. Rugby players and national-level players spent on average between nine and ten hours per week training, which is significantly more than players from the other sport codes or levels of participation. Table 1 includes the number of players from each sport in terms of Mean age in years and Standard Deviation (SD).

TABLE 1. **NUMBER AND AGE OF PLAYERS WITHIN EACH SPORT CODE**

Group	N (% of total group)	Mean age (years)±SD
Hockey	213 (24%)	21.78±3.29
Netball	215 (24%)	22.00±4.00
Rugby	317 (36%)	23.19±3.03*
Soccer	145 (16%)	21.33±2.23*
Total sample of players	890 (100%)	22.26±3.37

(*$p<0.05$)

Natural strategies

Active cool-down. Players indicated that they use an active cool-down to varying degrees. The soccer players used an active cool-down after training and matches significantly more ($p<0.05$) than players from the other sport codes. Rugby players used an active cool-down after training and matches significantly less ($p<0.05$) than hockey, netball and soccer players. Rugby players used an active cool-down after matches less than after training sessions and not as regularly as players from the other sport codes. Players from hockey, netball and soccer used an active cool-down after matches more than after training sessions.

The national- and provincial-level players used an active cool-down more after matches than after training ($p<0.05$). They also used an active cool-down after matches regularly, and significantly ($p<0.05$) more than the club-level players. The national-level players used an active cool-down after training significantly ($p<0.05$) more than the provincial-level players.

Stretching and *slow jogging* were most often used during an active cool-down. Players could add to the list under the option *Other*. Four players mentioned that they use *walking* or *walking down* as part of their active cool-down, while one player mentioned *rowing* and another sportsperson mentioned *self-massage*.

Refuelling and rehydration. In terms of a strategy for rehydration, 44% of the players from the total group indicated that they *never* had a strategy for rehydration after training sessions, 15% of the players *sometimes* had a strategy, 22% *regularly* had a strategy, and 19% stated that they *always* had a rehydration strategy. With regard to having a strategy for rehydration after matches, 41% of the players reported that they *never* had a strategy. With reference to a strategy for refuelling after training sessions, 48% of the players *never* had a strategy, 14% *sometimes* had a strategy, 20% *regularly* had a strategy, and 18% of the players *always* had a strategy after training. When it comes to a strategy for refuelling after matches, results showed the following: 49% of the players *never* had a strategy, 15% *sometimes*, 19% *regularly*, and 17% *always*.

Results showed that players from all four sport codes did not have a strategy for rehydration on a regular basis. A statistically significant difference ($p<0.05$) was found between soccer and rugby players in terms of having a strategy for rehydration after training sessions, with soccer players having less of a strategy than rugby players. With reference to a strategy for refuelling after matches, a statistically significant difference ($p<0.05$) was found between soccer players and players from netball and rugby teams, with netball and rugby players having more of a strategy for refuelling after matches than soccer players.

With regard to a strategy for rehydration, the results showed that players from all levels of participation had more of a strategy for fluid intake after matches than after training sessions, although not regularly. Statistically significant differences ($p<0.05$) existed between players from the various levels of participation with provincial- and national-level players having more of a strategy for rehydration after matches than club-level players.

No significant differences were found between players from the different sport codes in terms of having a consistent refuelling strategy after training and after matches. A statistically significant difference ($p<0.05$) existed between national- and club-level players in terms of a strategy for refuelling after training, with national-level players having more of a strategy than club-level players.

Sleep. A regular sleep routine was indicated by 67% of the players. Most (75%) of the players reported that they slept between six and eight hours per night. Changes in sleep patterns occurred over weekends where 11% indicated that they slept less than six hours, 60% slept between six and eight hours, and 29% slept more than eight hours per night.

In terms of falling asleep at night, 59% of the players stated that they *never* had problems falling asleep. Players (60%) indicated that they experienced problems waking in the morning to varying degrees. With regard to taking a nap during the day, 32% of the players *never* took a nap, 47% *sometime*s took a nap, 17% *regularly* took a nap, and 4% *always* took a nap. Players reported that *noise* and *light* in the sleep environment were the two factors that affected the quality of their sleep the most.

Physical strategies

Cryotherapy (external cold). Players indicated that they used cryotherapy to varying degrees after training and after matches. Rugby players used cryotherapy more ($p<0.05$) after training sessions and matches than players from hockey, netball and soccer sport codes. Soccer players used cryotherapy significantly less ($p<0.05$) than hockey, netball and rugby players.

Players from the different levels of participation did not use cryotherapy on a regular basis. Cryotherapy was used more often after matches than after training sessions by players from all levels of participation. National-level players used cryotherapy statistically significantly ($p<0.05$) more than club-level players after training sessions and matches. Provincial-level players used cryotherapy statistically significantly ($p<0.05$) more after matches than club-level players.

Methods of cooling that were used (in order of frequency) included: *Ice packs*, *ice bath*, *cold shower*, and *activities in cold swimming pool*. Some players added the following to the list under the option *Other*: *compression with Rocket skins*, *Arnica ice*, *Ice-man (ice-rub on muscles),* and *Jacuzzi after game*.

Contrast temperature therapy. The majority (68%) of players stated that they *never* used contrast temperature therapy after training and 65% indicated that they *never* used it after matches. *Hot and cold showers* and *a cold pool with a hot shower* were the main methods used to apply contrast temperature therapy. Most players indicated that they started and ended the session with *cold application*, and spent more time exposed to the colder temperature than the warmer temperature. Some players added the following methods to the list under *Other*: *ice and a hot water bucket*, *cold bath and hot jacuzzi*, *hot packs and cold packs*, *ice bag and hot bean bag*.

Massage. From the total group of players who responded to the section on massage as a recovery modality, 372 (43%) mentioned that they used massage to varying degrees. Most of the massage sessions were performed by a therapist and consisted of a *deep massage*. Hockey, netball and soccer players used massage mostly after matches, while rugby players used massage mostly on non-training days. National-level players used massage more ($p<0.05$) than club- and provincial-level players after training sessions and on non-training days. However, massage was not used on a regular basis for recovery purposes.

Psychological strategies

Progressive muscle relaxation was used by 29% of the players. Soccer players used progressive muscle relaxation the most, and significantly more ($p<0.05$) than players from the

other three sport codes. Rugby players performed progressive muscle relaxation the least and significantly less than netball players.

A large portion (67%) of players *never* used breathing exercises as a recovery strategy. Imagery was used by 43% of the players. Netball players used imagery the most and more ($p<0.05$) than rugby and soccer players. National-level players used imagery more ($p<0.05$) than provincial- and club-level players.

Eighty percent of the respondents *never* used meditation and 82% *never* used autogenic training. Prayer, in contrast, was used by 72% of the players for recovery purposes. Netball players used prayer more ($p<0.05$) than hockey, rugby and soccer players. Rugby and soccer players used prayer more ($p<0.05$) than hockey players.

Music was *always* used by 12% of the players after a match. Fourteen percent *regularly* used music, and 13% *sometimes* used music. The remaining 61% of the total group, *never* used music after matches. Players used music for recovery purposes more after matches than after training sessions. Players from hockey, netball and soccer used music more ($p<0.05$) than rugby players after training sessions and after matches. The most popular types of music were *rock* and *gospel* music. A number (77) of players added other types of music than those listed in the questionnaire. *House music* and *R&B* were mentioned by most of the players, followed by *Hiphop*, *Kwaito* and *dance beats*. *Calm music*, *chants and Gregorian music*, *love songs*, *panpipes*, *soul* and *traditional African music* were also mentioned.

Complementary/alternative strategies

Acupuncture was *never* used by 77% of the players who responded to this section. Rugby players used acupuncture significantly more ($p<0.05$) than netball and soccer players. National-level players used acupuncture significantly more ($p<0.05$) than club- and provincial-level players. Reflexology was *never* used by 92% of the respondents.

DISCUSSION

Recovery modalities from the *natural strategies category* were used by many players. Modalities from the natural strategies are seen as specific modalities that do not require any special equipment (Bompa, 2009). It should therefore be relatively easy for players from all levels of participation to address natural strategies for recovery. Pickett and Morris (1975: 49) wrote: "Next to the air we breathe, food and sleep are the two most crucial physical essentials for maintaining a sound and healthful state of living." Davis *et al*. (2002) mentioned nutrition and sleep as part of the basics that athletes have to address with regard to recovery, with Williams (2007) also emphasising nutrition and rest as key components of recovery.

With regard to the natural strategies identified in this study, players could respond to aspects pertaining to sleep, nutrition and an active cool-down. Most (75%) of the players indicated that they sleep between six and eight hours per night. This supports the findings of a number of studies showing that individuals older than 18 years tend to sleep between six and eight hours per night during weeknights (Hicks & Pellegrini, 1991; National Sleep Foundation, 2005). Although Ferrara and De Gennaro (2001) wrote that seven to eight hours should be

enough for most people, Bompa (2009) and Calder (2003) stated that athletes require nine to 10 hours of sleep, of which 80-90% should be during the night. Athletes should be encouraged to take a 20-minute nap (often called a "power nap") during the day (Kenttä & Hassmén, 2002; Postolache & Oren, 2005).

Some (41%) players indicated that they experience problems falling asleep at night. Carney and Waters (2006) mentioned "worry" as a major contributor to pre-sleep cognitive arousal, while a strange setting (Lee, 1997), noise, light, extreme temperatures (Kawada & Suzuki, 1995; Öhrström & Skånberg, 2004; Axt & Axt-Gadermann, 2005), caffeine and nicotine (Zarcone, 1989; Van Dongen *et al.*, 2001; Sierra *et al*., 2002) can all negatively affect the onset of sleep. Players could be educated with regard to these factors as well as on various methods to help them to relax at bedtime. Players mentioned that noise and light in the sleep environment were the two factors that affected the quality of their sleep the most. Hanton *et al.* (2005) reported that disturbed sleep patterns were mentioned as a major environmental stressor by elite sport performers. It is important for management staff to consider aspects in the environment, which could affect sleep quality when players are at training camps, tournaments or on tour. The importance of making appropriate accommodation arrangements should therefore not be underestimated.

A number of players reported that they experience problems waking in the morning, which could indicate sleep deprivation. The fact that some players mentioned that they increase the amount of hours they sleep over weekends might be an indication that they addressed their lack of sleep over weekends. It should be noted that most of the players who participated in the study were not from full-time professional teams. Various factors under these circumstances, such as academic and work demands, and family commitments, make it difficult for athletes to sleep as well as they would like.

In hockey, netball, rugby and soccer, play involves intermittent high-intensity exercise, which reduces muscle glycogen stores (Williams, 2007). Reilly and Ekblom (2005) stated that, by the time a soccer game ends, those players who had played for the entire game are likely to have almost depleted their active-muscle and liver glycogen stores. The restoration of glycogen stores after exercise should be a priority for players. Maughan *et al.* (1997) wrote that, if players begin an event with muscle glycogen stores that are low as a result of inadequate glycogen repletion, performance will be impaired. Team sport players are advised to refuel effectively between matches, undertaken every four to seven days during the competitive season, as well as the conditioning sessions undertaken between matches. It has been shown that repetition of high-intensity exercise on successive days is difficult, but better restoration of muscle carbohydrate stores can enhance recovery (Burke *et al*., 2006). The time to recover between successive competitions or training sessions is often short (less than eight hours), and rapid glycogen synthesis becomes even more crucial under these circumstances (Jeukendrup & Gleeson, 2004; Burke *et al.*, 2006), as in tournament situations.

The results showed that players from all the groups did not apply these strategies on a regular basis. However, national-level players applied these strategies more often. National-level players might experience a greater need for rehydrating and refuelling due to the intensity of competition at that level. They might also have members of management that regard these aspects as important, and the players might generally be well looked after.

Athletes are often advised to gradually recover from high-intensity exercise through a cool-down period (Hawley & Burke, 1998; Harris & Elbourn, 2002). It is suggested that an active cool-down could consist of stretching as well as up to 20 minutes of low-intensity aerobic exercise, with the intensity of the aerobic exercise no higher than 50% of the athlete's maximum heart rate (Bompa, 2009). An active cool-down is the recovery modality that ass used the most by hockey and soccer players, second most by netball players and third most by rugby players. Rugby players also used an active cool-down more after training than after matches, while the other players used an active cool-down more after matches than after training. It might be that, due to the fact that rugby is a contact sport, players felt more fatigued and sore after a match than after a training session. They might therefore not regard an active cool-down as important or suitable to their specific post-match situation and needs.

The players in this study did use cryotherapy for recovery purposes, but it was not used regularly. Rugby players used cryotherapy more compared to other players. Rugby players may, due to the fact that rugby is a professional sport, have better access to facilities where they can use cryotherapy after training and after matches, which might not be the case with the other sport codes. Rugby is also a contact sport and rugby players might have looked for modalities which they believed could address the effects of contact on the body. National-level players used recovery more than club-level players after training sessions. Provincial and national-level players also used cryotherapy more after matches than club-level players. Players at higher levels of participation often have better access to specialised facilities and might be more exposed to trainers focusing on aspects of recovery. As results showed that players did not use cryotherapy on a regular basis, it might reflect that these cryotherapy methods were only applied in specific instances, like at a training camp or at a tournament.

Although not used regularly, players from all four sport codes and levels of participation indicated that massage was used. Hockey, netball and soccer players mentioned that massage was used after matches, while rugby players indicated that massage was used more on non-training days. Some researchers suggested that a massage should not be applied after training or after a match, because post-exercise massage could cause further trauma where training has caused tissue damage (Barnett, 2006). Holey and Cook (2003) wrote that there are opinions that an intense, vigorous massage might stress the body like a training session and that activity should therefore be reduced slightly over the following 24 to 48 hours.

Players from hockey, netball, rugby, and players from different levels of participation indicated that they used imagery in some instances. Netball players used imagery the most. Whitehead and Basson (2005) reported from their study on the use of imagery by athletes that players from team contact-sports (rugby) used imagery more than players from non-contact sports. This trend was not found in the current study. National-level players used imagery more than club- and provincial-level players.

Prayer activity seems to be present throughout various levels of sport participation (Todd & Brown, 2003). The therapeutic potential of spirituality is acknowledged increasingly. Spirituality is attracting attention as a moderator of stress, with Ridnour and Hammermeister (2008) indicating that spiritual well-being may be a construct that is useful in developing an enhanced coping-aptitude necessary for excellence in sport. The use of prayer in coping with the uncertainties in sport is prevalent among athletes and more so for athletes playing elite

sport. Jones (2003) mentioned that many people reported using prayer as a stress-management technique. This is supported by the study by Plaatjie (2006) where soccer players indicated that they used prayer as a post-match coping strategy. In this study, some players mentioned that prayer helped them with emotional recovery. Of all the recovery modalities players could respond to, prayer was used the most by netball and rugby players, followed by an active cool-down for netball players and fluid replacement for rugby players. Prayer was used second most by hockey and soccer players, following an active cool-down. No differences were found in the use of prayer between different levels of participation.

Players used music for recovery purposes more after matches than after training sessions. Players from hockey, netball and soccer used music more often than rugby players after training sessions and after matches. The most popular types of music that were listened to, were *rock* and *gospel*. Music preferences are diverse and for music to have a positive effect, it needs to be a pleasant and meaningful experience for the listener. The athlete's preferences must therefore be taken into account when music is used for recovery and regeneration purposes. Athletes should be encouraged to create a bank of music they like which generate a range of moods and atmospheres, to produce a stimulating or calming effect (Calder, 2000).

Cohen *et al.* (2005) and Johnson and Blanchard (2006) mentioned the substantial increase internationally in the popularity of alternative medicine for a variety of illnesses and symptoms as well as for preventative health practices and general self-care. MacLennan *et al*. (2006) identified an increase in CAM use in Australia, while Johnson and Blanchard (2006) found that 58% of the undergraduates in their survey used at least one type of CAM during the previous 12 months. White (1998) stated that many athletes use CAM when conventional medicine, according to them, fails to relieve their musculoskeletal symptoms. In this study, athletes indicated that they seldom used complementary and alternative therapies for recovery purposes.

This study revealed some similarities in the recovery modalities that hockey, netball, rugby and soccer players used in the recovery process. There might be an impression that players used the recovery modalities extensively, but results showed that this was not the case. The only recovery modality that was applied on a regular basis was an active cool-down after training and matches by hockey, netball and soccer players. All the other modalities were not applied regularly.

There might be various reasons why the players in this study were not applying recovery modalities regularly. In this study, on average the highest number of hours per week spent training indicated by rugby and national-level players were between nine and ten hours. It might be that most of the players from the other groups did not have more than one training session per day and that they therefore did not regard recovery as important.

Alternatively, players might not be serious about recovery and did not regard it as a high priority. It might also be that players did not have the knowledge to know what to do if they wanted to use a specific modality. Kellmann (2009) mentioned that, although coaches recognise that recovery is crucial, they often have limited knowledge of what recovery modalities are available. The lack of application of recovery modalities could also be monetary related, as money has to be paid for specific services (e.g., massage) and players

might not want to pay for services related to their recovery. Simjanovic *et al.* (2009) mentioned time and cost as key considerations in their study of factors influencing the use of different recovery modalities.

This study provided insight into the current use of recovery modalities by elite team athletes. The results suggest that there is scope for further athlete and coach education with regard to the use of recovery modalities for team players.

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