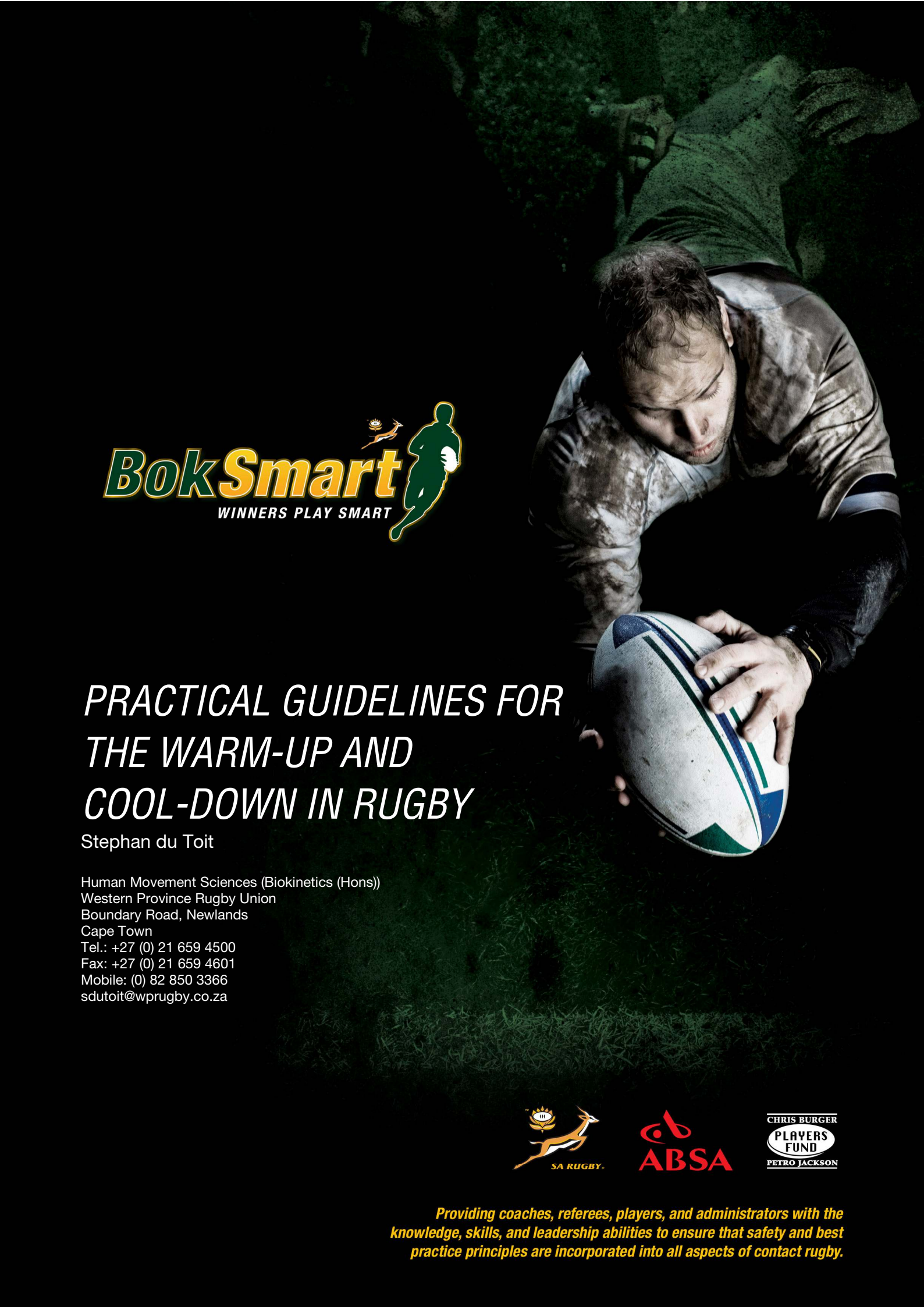

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PRACTICAL GUIDELINES FOR THE WARM-UP AND COOL-DOWN IN RUGBY

Stephan du Toit

Human Movement Sciences (Biokinetics (Hons))
Western Province Rugby Union
Boundary Road, Newlands
Cape Town
Tel.: +27 (0) 21 659 4500
Fax: +27 (0) 21 659 4601
Mobile: (0) 82 850 3366
sdutoit@wprugby.co.za

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Providing coaches, referees, players, and administrators with the knowledge, skills, and leadership abilities to ensure that safety and best practice principles are incorporated into all aspects of contact rugby.

INTRODUCTION

The warm-up in rugby is an important component of the sport, and has evolved from a traditional jog around the field to more specific activities ensuring that physical and mental / psychological benefits are achieved. The warm-up can assist in injury prevention and is seen as an integral part of the coaching session or match [8, 10, 26, 35, 37]. It can set the tone and attitude for the coaching session or match that will follow [17]. The functional dynamic warm-up has been defined as "a comprehensive approach to training or rehabilitation that addresses ALL performance components (i.e. strength, power, balance, vision, coordination, reaction, agility, acceleration and deceleration) necessary to achieve success in any target activity" [35, 37]. In this instance, the target activity is the game of rugby, with many different movement patterns, activities and skills (all the performance components mentioned above) as the building blocks. A functional dynamic warm-up in this instance means that active rugby movements (e.g. kicking, stepping, catching, jumping, passing, tackling, etc.) are replicated in the coaching session or match warm-up at the exact speed as they would be completed in the subsequent match or coaching session, in order to achieve the greatest physical benefit [6, 9].

WARM-UP OBJECTIVES

The objectives of the warm-up are three-fold: 1) it assists in injury prevention [5, 9, 10, 33] due to the physiological benefits achieved, as discussed in PHYSIOLOGY BEHIND THE WARM-UP; 2) it creates a favourable physiological environment for physical preparation [27] and; 3) the warm-up assists in the mental preparation of the player [10, 26, 37].

All of the above should eventually assist in an improved sporting performance (6, 39).

PHYSIOLOGY BEHIND THE WARM-UP

During the competition phase (match) of a sports event, and particularly when it comes to rugby, the contracting muscles need input from the central nervous system to coordinate and control body movements [10].

The body temperature increases as a result of an increased energy expenditure resulting from accelerated metabolism and heat generated from the contracting muscles ([6, 10, 26, 37]. This also accounts for the elevated heart rate. In some instances, the stimulation of skin heat receptors tends to increase heart rate [10]. This explains the erroneous belief that manual application of heat emulates the effect of an increased heart rate, which would usually only be attained through physical exertion [5].

During the warm-up metabolic rate increases and various physiological changes occur which prepare the player for high intensity activity. After the warm up these processes gradually revert back to their resting

levels, if the exercise stimulus is removed completely [24, 26]. Therefore the timing of the warm-up must be planned so that the start of the match occurs coinciding with the accelerated metabolism and physiological changes induced by the warm-up, and not after everything has reverted back to their resting levels.

Another consideration is that ATP, a source of energy used for muscular activity, is replaced by phosphocreatine metabolism. It takes about 8 minutes to restore 97% of the pool of phosphocreatine. Thus, if the player starts the match within this time frame, he will have impaired muscle function. These factors suggest that there is a fine line between a warm-up that is too intense, and one that is too low in intensity. Furthermore the timing between the end of the warm-up and the match can influence the player's state of readiness for high intensity activity.

PHYSIOLOGICAL BENEFITS OF THE WARM-UP

The goal of a well-planned warm-up is to increase the physical and physiological readiness of the athlete, decrease the risk of injury incidence, and increase injury resilience [5, 6, 9, 10, 27, 33]. During the physiological preparation, the cardiorespiratory and musculoskeletal systems are stimulated for the subsequent demand of exercise [10, 37]. Apart from the physiological preparation, the player also has to prepare mentally for the subsequent match or training session [10, 26, 37].

Physiological benefits include the following:

i. An increased core temperature as a result of the muscles producing heat from an increased physical workload [9, 15, 16, 33, 39]. In order to reach this internal rise in temperature, a period of between 4-15 minutes of active movements as explained in phase 1 of TYPES AND PHASES OF THE WARM-UP is needed [35]. A slight sweat should be visible on the forehead of the player as a sign that body temperature has increased [28].

ii. An increase in body temperature to 39 ºC will assist in improving flexibility by up to 20% [10, 17, 29, 30, 33] because warm muscles can contract and relax at a faster rate (improved speed and efficiency of contraction and relaxation), are more elastic and therefore at a lower risk of injury [5, 9, 10, 33].

iii. The warm-up also improves the neural firing rate (the speed at which messages can be relayed, via the spine, from the muscles to the brain and back again), an optimal state for muscles to move quickly and efficiently [17].

iv. More oxygen is delivered to the muscles as a result of increased blood temperature, and the ability of haemoglobin to release more oxygen at higher temperatures [10, 33, 35].

v. The warm-up is a good time to "pre-play" the competition phase or match [10, 33]. A warm-up prior to a gymnasium programme or a warm-up prior to a coaching session or match assists players to focus on what they have to do during the training or competition period, and therefore they gain a psychological benefit [5, 10, 20].

Forty-four men (22 to 52 years) were put under physical stress on a treadmill set at 14 km.h-1 and at an incline of 30º for a 10-second period prior to warming-up. Sixty-eight percent had an abnormal ECG reading. However, when the same activity was done after a warm-up (two-minute easy jog on the treadmill), there were no abnormalities. This explains why a period of ischemia (reduced blood flow) may occur in the heart when the coronary blood flow is expected to increase instantaneously after a sudden increase in heart rate. Adequate warm-up routines are therefore also necessary in preventing ischemia and thus protecting the heart from malfunctioning [10].

TYPES AND PHASES OF THE WARM-UP

In planning a warm-up, the time-frame, equipment, age and fitness levels of the participants and the environment need to be considered [16, 17].

The warm-up can either be split into a continuous dynamic protocol, or a discontinuous dynamic protocol [6]. The biggest difference between the two protocols is the rest component, which is absent during the continuous protocol.

Phase 1 – General Aerobic (Low intensity); Combined with Dynamic stretching

The first phase is a general warm-up [19, 26, 37, 39]. This involves a period of 5-10 minutes of low-intensity aerobic activities (cycling or jogging) with the objective of increasing body temperature, heart rate and muscle readiness [6, 37]. It is a phase during which the body is prepared for both aerobic and anaerobic work [6].

It is important to monitor the ambient temperature, which will affect the body temperature increase. If needed, the intensity of this stage should be increased if the ambient temperature is too low and vice versa [6].

Phase 2 – General Skill (Medium Intensity)

The integration of basic rugby skills and active flexibility provides a neuromuscular and musculoskeletal preparedness for the competition period (coaching session or match) [6].

Phase 3 – Specific Skill (High Intensity)

The reason the third phase is called a specific warm-up is because exercises are performed in a specific pattern, at lower intensities than in the match or practice session but in a specific movement pattern [37]. Kinetic chains can be included in the warm-up to focus on 3-5 specific movement patterns that should be completed during the coaching session or match [23, 35]. A kinetic chain is the coordination between different muscles from the ankle joint to the knee, hip, back, shoulders and head to ensure the perfect bodily movement is achieved. If any of these joints are not functioning properly, it would affect all the joints above or below this level of the chain, and thus affect the whole kinetic chain.

Phase 4 – Functional Skill – Position specific OR Technical specificity (Positional split)

This phase will focus on the individual's balance and co-ordination, and will also assist in increasing body temperature [37]. During this phase, the most specific skills and functional rugby patterns will be completed incorporating all the performance components as described in the INTRODUCTION. By simulating specific movement patterns, injuries can be eliminated and the individual can be prepared for activities such as stepping, accelerating, tackling and winning the collision, which in rugby require high levels of physicality [39].

Phase 5 – Final Dynamic Stretching / Upper-body Specific Movements

Final competition (coaching session or match) preparations are completed during this phase. It includes speed, agility and quickness (SAQ) drills to stimulate the central nervous system (CNS) at the end of the warm-up, when all the other physiological benefits have been achieved. This phase provides the final dynamic stretching within the SAQ exercises. All movements in this phase must be replicated at the speed at which they will be performed in the match [6, 9]. The final upper-body warm-up in this phase should therefore be completed at the same intensity as a tackle or ruck clean-out would be performed in the coaching session or match [24].

WARM-UP DURATION AND PERFORMANCE EFFECTS

As a guideline, in the rugby context the warm-up should comprise about 25% of the time planned for the training session [23, 30]. For example, a training session expected to last an hour, should have a warm-up session lasting for a maximum of 15 minutes. During the initial 3-5 minutes, the body and muscle temperatures rise rapidly, until they reach a plateau after about 10-20 minutes [6]. Obviously the rate at which temperature increases is dependent on the intensity of the exercise.

The warm-up should be tapered 10-15 minutes prior to the start of the coaching session or match and should be ended 5 minutes before kick-off [10]. The most intense part of the warm-up should not be performed less than 15 minutes before kick-off [16].

Repetition numbers of sprinting during the latter part of the warm-up must be limited to 6-8 repetitions and a work:rest ratio of 1:6 for highly fit players, and 4-6 repetitions and a work:rest ratio of 1:8 or greater for unfit players. The activities should last between 4-10 seconds and should incorporate movements such as sharp turning, and acceleration at maximal speed with maximal power [6].

PROGRESSION WITHIN THE WARM-UP

The planning and progression within the warm-up should include all the components described in phases 1 to 5 in TYPES AND PHASES OF THE WARM-UP. The normal progressions would be from a general movement/activity type, to specific movements/activities, a positional split and finally contact (upper-body warm-up); or a general movement/activity, to specific movements/activities, to contact (upper-body warm-up) and finally a positional split [17].

A basic explanation would be that the progression of movements would be from easy to moderate to difficult; the speed from slow to fast; the flexibility from passive to active to dynamic; and the type of stretching from easy to moderate to complex [6].

Parameters to keep in mind when constructing the warm-up include i) the type of coaching session or match that will follow the warm-up, ii) the sequence of the previous workout within the warm-up, iii) the warm-up menu for the training period, iv) the demands of the sport and v) the needs of the player [17].

Important guidelines to consider during the warm-up are i) specificity, ii) overload and iii) reversibility. Specificity means that the focus should be on the demands of the activity. Overload is the progressive increase in intensity. Reversibility suggests that the advantages of the warm-up are lost after the exercise stops and the player cools down [24].

MATCH VS. PRACTICE

There are some limitations to introducing functional exercises into the warm-up regime. Firstly, the time available for the warm-up may be limiting, while secondly the player may not have the skill to perform all the functional exercises needed to be specific. However, if functional activities are available to the coach, and the player is at an advanced learning stage, it would be advisable to incorporate some functional activities into his warm-up [37].

WARM-UP DRILLS

Due to the different playing positions in rugby, one has to keep track of the different movement patterns that are needed in the warm-up in order to be specific [23, 25]. The use of grids is space-, time- and player effective and an easy way to introduce the sport-specific skills needed for the coaching session or match

[29]. Most grids are not too big, and allow for improved skills in a confined space – this is similar to many rugby-specific situations. Grids are also an effective method to introduce rugby skills and at the same time achieve the physiological benefits [29, 31]. New warm-up drills, which have not been completed during coaching sessions should not be included into a pre-match warm-up [29]. To achieve an atmosphere of energy and enthusiasm, it is important to include more enjoyable dynamic movements and stretches, especially when working with children [20, 27].

STRETCHING / FLEXIBILITY

What is stretching?

Flexibility is the ability to move a joint or series of joints smoothly and easily throughout a full range of motion [25]. At the start of a warm-up session, the players normally complete an aerobic activity alongside stretching, whether this be static, ballistic or proprioceptive neuromuscular facilitation (PNF) [1, 37, 39]. Although all the methods will improve flexibility, the influence on power output immediately after the activity is different with every stretch performed. This will be discussed in the next section.

Stretching techniques

There are many different stretching techniques that can be included during the warm-up. Static stretching is when an individual holds a stretch for a certain number of seconds (30-60 seconds) and then repeats it 3-4 times [3]. This stretch is applicable to most beginners [6, 37]. Static stretching can also be called passive range of motion due to the lack of muscle contraction in the stretching regime [31].

Ballistic stretching is another stretch that involves dynamic movements through the joint range of motion, and often the purpose with this type of stretch is to mimic the exact movement an athlete will have to go through during a coaching session or match [6, 37]. The basis of ballistic stretching is the speed and range of the movement [1, 16, 24, 29, 37]. Dynamic flexibility is also called active range of motion due to muscle contractions which occur during the movement [31]. One of the biggest advantages of dynamic stretching is that rugby specific exercises can be performed [16, 28].

The PNF stretching technique is a partner-assisted stretching method that involves the stretch reflex and the Golgi Tendon organ responses, with subsequent reciprocal inhibition to stretch a muscle [24, 29, 37, 39]. The PNF stretches make use of alternating muscle contraction and stretches and includes slow-reversal-hold-relax, contract-relax and hold-relax [21, 32].

Recent research has highlighted that passive stretching before exercise may inhibit sports performance by reducing power output [12, 15]. The reason behind this is that passive stretching causes the musculotendinous unit to become more compliant and therefore reduces force development by

decreasing the musculotendinous stiffness [12, 39]. This leads to acute neural inhibition and a decrease in neural drive to the muscles, thus resulting in a decrease in power output [12].

In a recent research study it was found that players who completed passive stretching before a 20-metre sprint recorded slower times compared to players who completed an active dynamic stretching method, which was incorporated into their warm-up. It was also found that players (55% of the testing group) who completed static stretching before their vertical jump effort showed a significant decrease in performance [18]. This is confirmed by a recent research study that showed a significant decrease of between 5-30% in strength and power output after static stretching was completed. Even as little as two minutes of static stretching can impair power output [12, 39].

An interesting point to note is that PNF stretching has an even greater negative effect on vertical jump performance than static stretching [15, 27, 39]. It is therefore important to avoid both static and PNF stretching before a match, where power and strength requirements are of crucial importance.

Static stretching during the warm-up has not been proven to reduce injuries; however, in a study involving a large number of American soldiers it was found that the intervention group that completed static stretching after exercise experienced 50% fewer injuries than the control group [2, 20]. Although static stretching before physical activity is not recommended, it does have a better effect than no stretching at all [11].

Swanson reports that a set routine during the training week ensures that his athletes have progressed through all the different stretching methods in order to gain different benefits. These include active static flexibility on Mondays, passive static stretching on Tuesdays, a recovery day or a completion of PNF stretches on Wednesdays, rope stretching incorporating passive static stretching on Thursdays, while on Friday the athlete can choose any of the stretches done during the week [35].

Benefits of stretching

Benefits of stretching are to i) ensure that a full or optimal range of motion is achieved, 2) ensure that the risks of musculotendinous injuries are minimised, iii) contribute towards an improved physical performance, iv) promote body awareness and cause excitement of the muscles, v) supply an optimal environment to learn new skills and movement patterns, vi) aid in relaxation and vii) reduce muscle tension [4, 8, 25, 29].

Recommendations for stretching are i) stretch slowly and smoothly, ii) avoid bouncing and jerking movements, iii) avoid pain and uncomfortable movements, iv) do not hold your breath and v) repeat the stretch on both sides [7].

COOL-DOWN

The cool-down should occur immediately after activity as part of the recovery process, and while the athletes still have an elevated body temperature. The most common stretches to complete after exercise would be static stretching [8, 23].

Two components of the cool-down are:

1. Static muscle stretching, which should be completed gently [8, 20, 23].
2. Cardiovascular activity to facilitate the re-distribution of blood from active muscles [23].

The cool-down can include slow jogging and/or fast walking, which can involve the muscles for at least 2-5 minutes. If tools are available, it is advisable to gradually lower the exercise intensity after the workout to levels of <60% of maximum heart rate to relieve effects of delayed onset muscle soreness [30, 36, 38].

The cool-down assists with i) the maintenance of joint mobility, ii) the reduction in circulating blood lactate, iii) preventing blood pooling. [20, 22].

The cool-down period is also a period where refuelling can occur to replenish energy (20).

AUTHOR'S BIOGRAPHY

Stephan du Toit is a Strength and Conditioning Trainer with the Western Province Rugby Union in Cape Town, South Africa.

REFERENCES

1. ALLERHEILIGEN, W. Stretching and warm-up: Essentials of strength training and conditioning, CHAPAIGN ed. Ill, HUMAN KINETICS, 1994.
2. Applied Sports Knowledge. Available at: http://www.ask.net.au/downloads/Update_on_Recovery_Techniques.pdf. Accessed March 27, 2006.
3. BANDY, W., IRION, J. The effect of time on static stretch in the flexibility of the hamstring muscles. J Orthop Sports Phys Ther. 74:845. 1994.
4. BLANKE, D. Flexibility. In MELLION, M. Ed.: Sports Medicine secrets. Philadelphia, HANLEY & BELFUS, 1994.

5. BROWN, L.E. Warm-up or no warm-up. Strength and Conditioning Journal. 23(9):23. 2001.

6. CONE, J.R. Warming up for intermittent endurance sports. Strength and Conditioning Journal. 29(6):70-77. 2007.

7. COOK, B.B., STEWART, G.W. Strength Basics: Your guide to Resistance Training for Health and Optimal Performance. Human Kinetics, 1996. Pp. 54.

8. CORBIN, C.B., LINDSEY, R. Concepts of physical fitness with laboratories. WM C BROWN, ed. USA, 2001. pp. 35 – 37.

9. DEVORE, P.A., HAGERMAN, P. Pre-game soccer warm-up. Strength and Conditioning Journal, 28(1):14-18. 2006.

10. ELAM, R. Warm-up and athletic performance: A physiological analysis. Strength and Conditioning Journal. 8(2):31-33. 1986.

11. EMILIANO, C.E., MARGONATO, V., CASASCO, M., VEICSTEINA, A. Effects of stretching on maximal anaerobic power: The roles of active and passive warm-ups. Journal of Strength and Conditioning Warm-ups. 22(3):794-800. 2008.

12. FLETCHER, I.M., JONES, B. Stretch protocols on 20 meter sprint performance in trained rugby union players. Journal of Strength and Conditioning Research. 18(4): 885-888. 2004.

13. FULLER, CW., LABORDE, F., LEATHER, RJ., MOLLOY, MG. International Rugby Board Rugby World Cup 2007 injury surveillance study. doi:10.1136/bjsm.047035. 2008.

14. GABBETT, TJ. Influence of fatigue on tackling technique in Rugby league players. Journal of Strength and Conditioning Research. 22(2):625-635. 2008.

15. GAMBLE, P. Physical Preparation for Elite level Rugby Union Football. Strength and Conditioning Journal. 26(4):10-23. 2004.

16. GODWIN, M. The warm-up. Available at: http://www.communityrugby.com/CommunityRugby/index.cfm/fuseaction/Home.Download_Counter/downloadId/1208/filename/5%20eliteperf%20warm%20up.pdf. Accessed 15 May, 2008.

17. HEDRICK, A. Learning from each other: Warming up. Strength and Conditioning Journal. 28(1):43-45. 2006.

18. HOLT, B.W., LAMBOURNE, K. The impact of different warm-up protocols on vertical jump performance in male collegiate athletes. Journal of Strength and Conditioning Research. 22(1):226-9. 2008.

19. International Rugby Board (IRB). IRB Rugby Ready. Available at: http://www.irbrugbyready.com/irbrr/en/warmUp.jsp. Accessed May 15, 2008.

20. International Rugby Board (IRB). IRB Rugby Ready. Available at: http://www.irbrugbyready.com/irbrr/en/coolDown.jsp. Accessed May 15, 2008.

21. KNOTT, M. VOSS, P. Proprioceptive Neuromuscular Facilitation. HARPER & ROW, ed. 3, New York. 1985.

22. LAW, R.Y., HERBERT, R.D. Warm-up reduces delayed onset muscle soreness but cool-down does not: a randomised controlled trial. Australian Journal of Physiotherapy. 53(2):91-5. 200

23. LUGER, D., POOK, D. Complete Conditioning for Rugby. Human Kinetics, 2004. pp. 3-4.

24. MCFARLANE, B. Warm-up pattern design. Strength and Conditioning Journal. 9(4):22-30. 1

25. MCKENZIE, A., HODGE, K., SLEIVE, G. Smart Training for Rugby. New Zealand, Auckland. 2000, pp. 42.

26. MICHELI, L.J. The Sports Medicine Bible. HARPER PERINIAL. 1995. pp. 10.

27. National Strength and Conditioning Association (NSCA). Fitness Frontlines. Available at: http://www.nsca-lift.org/perform/Issues/0605.pdf. Accessed May 19, 2008.

28. New South Wales Rugby Union. Available at: http://www.nswrugby.com.au/00_Uploads/NSWRU_Website/documents/coaching/NSWRU_Coaching_Resources-[Dynamic_Active_Stretching].pdf. Accessed 15 May, 2008.

29. New South Wales Rugby Union. Warm-up & Cool-down. Available at: http://www.nswrugby.com.au/00_Uploads/NSWRU_Website/documents/coaching/NSWRU_Coaching_Resources-[Warm-up_Notes].pdf. Accessed 15 May, 2008.

30. NORRIS, C.M. The complete guide to stretching. A & C BLACK. London, 1999. pp. 36-37.

31. PEARSON, A. SAQ Rugby. A & C BLACK. London, 2001. pp. 1.

32. PRENTICE, W. Proprioceptive Neuromuscular Facilitation Techniques. In PRENTICE, W.: Rehabilitation techniques in sports medicine. Dubuque, Iowa, McGraw-Hill, 1999.

33. RODENBURG, JB, STEENBEEK, D., SCHIERECK, P. BÄR, PR. Warm-up, stretching and massage diminish harmful effects of eccentric exercise. International Journal of Sports Medicine. 15(7):414-9. 1994.

34. SCHIK, D.M., MOLLOY, M.G., WILLEY, J.P. Injuries during the 2006 Women's Rugby World Cup. doi:10.1136/bjsm.046672. 2008.

35. SWANSON, J.R. A functional approach to warm-up and flexibility. Strength and Conditioning Journal. 28(5):30-36. 2006.

36. TAKAHASHI, T., OKADA, A., HAYANO, J., TAMURA, T. Influence of cool-down exercise on autonomic control of heart rate during recovery from dynamic exercise. Front Med Biol Eng. 11(4):249-59. 2002

37. THOMAS, M. The functional Warm-up. Strength and Conditioning Journal. 22(2):51 – 53. 20

38. WESSEL, J., WAN, A. Effect of stretching on intensity of delayed onset of muscle soreness. I Sports Med. 112:83. 1994.

39. YOUNG, W.B., BEHM, D.G. Should Static stretching be used during a warm-up for strength and power activities? Strength and Conditioning Journal. 24(6):33-37. 2002.