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The use of contrast therapy recovery within the New Zealand elite sports setting.

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Contents

EDITORIAL

Rugby and Rodeo

You may wonder what these two activities have in common. The idea for this editorial arose out of a discussion I had with Winne Meeuwisse shortly after the opening ceremony of the Winter Olympics in Vancouver.

Winne works in Calgary, home of the famed Stampede. He therefore sees a lot of rodeo riders. It seems like these riders have a similar mindset to plenty of our football players; that is, they are relatively stoical laconic types. They tend to downplay their problems, which can make history taking a real challenge for the clinician. For example, a rodeo rider saying, "I fell off and hurt my shoulder" is rather analogous to a rugby player saying "he went through me in the back line and I hurt my shoulder". This may be the only explanation given for what turns out to be a glenohumeral dislocation.

Full history taking may seem like dragging teeth but one should attempt it. With such patients there is a tendency to move more rapidly from the general to the specific, e.g. "did you feel a dead arm after the incident". Usually by asking a few key questions the true severity of the condition can be ascertained; given that the history supplies about 80% of our diagnostic information, time spent on this aspect is seldom time wasted.

In this context, the clinician will be more dependent on examination findings. Again, you should have a practised routine and if signs are equivocal then do not be afraid to repeat a specific test later in the course of the examination.

After what may well be a relatively limited history taking and focused examination, you should be in a position to formulate a working diagnosis. You should also be aware of other diagnostic possibilities which may need exclusion.

In my opinion, the role of investigations is often overemphasised in today's healthcare environment. In general, one should only order an investigation if the result will alter patient management. For most sporting injuries we are generally talking radiology; start with plain x-rays and use ultrasound only if there is a treatable pathology likely to be identified by that modality. High-technology imaging, (CT, MRI and bone scanning) should be reserved for those few cases where a diagnosis remains elusive despite standard modalities, or later down the track if the patient's clinical course has not followed expectations.

From my 15 years in primary care, two things I learned that have remained are to be comfortable making a working diagnosis even without extensive investigations, and to use time as a diagnostic aid where appropriate.

In summary, dealing with the laconic patient can have its challenges but the rewards are many, as these patients are usually the most grateful for any intervention which enables them to return to their sporting endeavours.

Dr Chris Milne
EDITOR

BEST OF BRITISH

January

The January issue of the British Journal of Sports Medicine concentrated on kids in sport. The warm up article by Dennis Caine asks the question, are kids having a rough time of it in sports? He notes that sport, recreational and exercise related injuries were the most common cause of paediatric injuries and that some of these may have long term consequences on the musculoskeletal system. Articles later in the same issue tackle specific paediatric sports medicine issues.

The editorial by Steven Stovitz outlined the pyramid of sports medicine and child health. This is built on a foundation of promotion of physical activity, energy balance, non-violence in sports and injury prevention. In the middle row he mentions advocacy plus a voice of reason pushing for more free play opportunities. Also, emotional and physical wellbeing are highlighted together with injury treatment. The pinnacle is the attainment of optimal child health.

There is a useful article on heat injury in young sportspeople. Children are known to be at higher risk for developing heat injury than adults. The article recommends gradual acclimatisation of all athletes to hot conditions and reduction in activity during hot or humid conditions. There is a further recommendation to use light coloured clothing that absorbs heat less and careful monitoring of athletes for signs of heat injury, plus having resources available to immediately and rapidly cool any affected athletes. Lastly, there is a plea for better education of athletes, caregivers and coaches about heat injury in young athletes.

Nicola Maffulli and colleagues examined the long term health outcomes of young sports injuries. It is estimated that 8% of Australian adolescents drop out of recreational sporting activities each year because of injury recurrence. Growth plate injuries are associated with growth disturbance in about 15% of cases. Most of these appear to involve American football. MRI scan studies of athletes with back pain have shown some correlation with disc degeneration, but this is not borne out by all studies. About 50% of young athletes who undergo meniscal surgery will have later development of knee osteoarthritis. These figures are in accord with the data in adults. ACL reconstruction in children is a complex issue. Studies have indicated that children managed non-operatively frequently develop poor function compared with those undergoing reconstruction. There are still potential issues with growth plate disturbance and detailed discussion by the surgeon, athlete and their caregivers is advised.

Weight training among young athletes is another controversial area. Faigenbaum and Myer evaluate this issue and conclude that resistance (weight) training can be a worthwhile and beneficial activity for children and adolescents. They conclude that most injuries relating to youth weight training are as a result of inadequate professional supervision, with associated poor exercise techniques and inappropriate training loads. They therefore advocate supervision by appropriately qualified professionals and, in this context, have not observed any increased risk of musculoskeletal injury resulting from age appropriate weight training, weight lifting and plyometrics. This is when compared with other recreational activities in which children and adolescents regularly participate.

In my experience, in New Zealand a large percentage of the children who I have seen who have been participating in resistance training programmes have been influenced by people with a weight training background. I remain unconvinced that it is necessary for athletes to undergo significant weight training prior to attaining skeletal maturity and believe that the same gains can be accrued by waiting until such maturity has occurred.

The January issue concludes with part 5 of the reviews of nutritional supplements on an A to Z basis. This issue covers sodium bicarbonate and sodium citrate, where there is undoubted evidence of efficacy at an optimal dose of 0.3g/kg bodyweight. Both substances function as buffers, reducing the acidosis associated with high level exercise. The main limitation to their use is GI upset, and individual tolerances vary so users need to test their own response to buffer ingestion. Beta alanine and carnosine both function as intracellular buffers. The authors quote two studies indicating the ability to undertake strenuous bicycle exercise increases with carnosine supplementation and a further study indicated that beta alanine supplementation limits the fall in blood pH during high intensity exercise without affecting blood lactate or bicarbonate concentration. Therefore, it is not surprising that these substances have become used by international level athletes. Further studies are necessary to clarify their true roles.

February

The February issue included a systematic review of home based strength and balance programmes in people aged over 80 to prevent falls. Nine studies were evaluated and three of these showed cost saving in these older adults. The best value for money came from the Otago Exercise Programme which involved a specific set of muscle strengthening and balance retraining exercises prescribed at home by three trained nurses supervised by a physiotherapist. There were five home visits and monthly phone calls. A 30% reduction in falls was observed.

Later in the same issue Bell, Cusi and colleagues in Sydney examined the use of prolotherapy in the sacroiliac joint. They studied a group of 25 patients with SI joint pain, diagnosed by validated clinical tests, who had not had satisfactory improvement following a previous exercise programme. They were given an injection of 0.8ml of a solution containing 50% glucose, Bupivacaine 1% and radioactive contrast material. Their subjects were reviewed at three months, 12 months and two years, and both clinical and functional questionnaire scores using the Quebec Back Pain Disability Score and Roland Multiform Questionnaire showed significant improvement. This is a small intervention trial and the authors suggested further research in this area. The data is consistent with other interventional trials where the more specific the diagnosis is in the low back, the more likely a targeted injection is to achieve a desirable outcome.

Later in the same issue, George Murrell and colleagues evaluated shoulder pain in elite swimmers and concluded that most of this arose from the supraspinatus tendon. They found features of tendinopathy and this seemed most strongly correlated by the volume of swimming training. They found that shoulder laxity per se had only a minimal association with shoulder impingement in elite swimmers. They therefore proposed that the intensity and duration of load to tendon fibre results in tendinopathy, impingement and therefore shoulder pain. This is somewhat different from the prevailing hypothesis that glenohumeral joint instability is the major cause of shoulder pain in swimmers. This study included 80 young elite swimmers aged between 13 and 25 years, of whom 73 had reported shoulder pain.

It has long been observed that rural Africans have low rates of coronary heart disease despite a diet high in saturated fat, and genetic protection has been postulated as the reason for this. Mbalilaki and colleagues performed a cross-sectional study of 985 Tanzanian men and women; 130 were rural Masai, 371 rural Bantu and 484 urban Bantu with a mean age of 46 years. The most significant finding for the rural Masai, who were eating a high fat-low carbohydrate diet, was their extremely high energy expenditure and low bodyweight. The Masai would expend some 2565 kilocalories per day over vasal requirements on average, compared with 1500 kilocalories per day in the rural Bantu and 891 kilocalories per day for the urban Bantu. This high energy expenditure resulted in reduced body mass index among the Masai. In other words, they were so active that they burnt off any excess calories, whether these were in the form of fat or carbohydrate.

Respiratory symptoms are common in endurance athletes. A group from the Australian Institute of Sport evaluated the use of Difflam throat spray in a group of 45 well-trained half marathon runners in an effort to evaluate its efficacy. This study was prompted by the observation that not all bouts of upper respiratory symptoms in athletes have an infectious cause. Therefore, alternative treatments may well be helpful. They found symptom severity scores were approximately 29% lower in those subjects undergoing Difflam treatment, but post-exercise responses in plasma inflammatory markers showed no significant variation. There was a subtle rise in salivary myeloperoxidase and salivary interleukin 6 in the Difflam group; the significance of this remains to be determined. The authors conclude that anti-inflammatory based interventions may be useful in alleviating the severity of post-race upper respiratory symptoms in athlete populations.

Exostoses in the external auditory canal are common in those athletes who exercise in or on water. A Welsh group studied 92 kayakers and compared their findings with 65 control volunteers. They found that 69.5% of the kayaker ears and 1.7% of the ears in the control group were found to have exostoses in the external auditory canal. Severity of these exostoses was significantly associated with the duration and frequency of kayaking. Once kayakers had been active in their sport for more than 10 years, over 90% of them had such exostoses. It is thought that the exostoses arise from hyperaemia after cold water exposure of the external auditory canal. This, in turn, stimulates osteoblastic activity which results in narrowing of the canal. The authors found some evidence that earplugs may prevent the formation and recurrence of exostoses, but advised further study in the area.

March

The IOC-sponsored special edition of BJSM in March focused on rugby injuries. Several articles within this issue will be of interest to New Zealand readers.

The first of these assessed the injury risks associated with tackling in rugby union. Simon Kemp and colleagues studied 645 players from 13 English premiership clubs through two professional seasons. They found that high speed going into the tackle in association with high impact forces and contact with a player's head or neck were significant risk factors for both the ball carrier and the tackler. Midfield backs were more prone to tackling injuries than other players. Video analysis showed that only 17% of players who had sustained an injury relating to a tackle above the line of the shoulder had that tackle penalised by the referee. The authors made mention of New Zealand's Rugby Smart injury prevention programme plus also the Shark Smart injury prevention programme from South Africa.

Shoulder padding is being worn increasingly by today's players but there is relatively little evidence for its benefit. Harris and colleagues from Middlesborough in the UK analysed the impact attenuation properties of four commercially available shoulder pads in the laboratory. They found that all pads reduced peak impact force and the best performing pad was the thickest one, which is hardly surprising. However, the pads were less effective at higher loads and the authors expressed disappointment in the overall performance of pads, stating that they appeared to bottom out under higher impact loads. My interpretation of this would be that they may well induce a false sense of security for players.

Cervical spine injuries are amongst the most catastrophic in rugby. A French-based study, with Peter Milburn and Ken Quarry as New Zealand-based co-authors, examined static and dynamic MRI protocols in the assessment of cervical spine abnormalities in asymptomatic adult professional rugby union players. The most frequent anatomical abnormality was degenerative disc disease and, not surprisingly, this was seen in players aged over 21 years. Those players with a high medulla to canal ratio were at highest risk. Interestingly, most medullary canal ratios that were initially assessed as intermediate on static MRI were subsequently assessed as abnormal with dynamic MR imaging. However, the big unknown is predicting which players with any MR abnormalities would go on to sustain permanent functional impairment. In the absence of such predictors, clinical evaluation remains the mainstay of athlete screening.

The issue also contained an article regarding ethical dilemmas and the sports team doctor. This arose out of the controversy following the use of a fake blood capsule by a Harlequins rugby player during a match versus Leinster in 2009. The doctor was involved as she is alleged to have cut the inside of the player's mouth in order to fabricate a laceration. The ethical issues are examined in depth and the most important guideline is "do not abdicate your responsibility to the individual player".

The routine March issue of BJSM included an article on oral administration of the probiotic Lactobacillus fermentum VRI-003 and mucosal immunity in endurance athletes. Twenty healthy elite male distance runners were studied at the Australian Institute of Sport. A double blind placebo-controlled cross over trial was conducted over a four month period of winter training. The active ingredient was a freeze-dried powder and gelatine capsules, with placebo capsules for the other group. Subjects reported 30 days of respiratory symptoms during probiotic treatment compared with 72 days during placebo treatment. Also illness severity was lower. There were no significant differences in the mean change in salivary IgA and IgA1 levels, or in interleukin 4 or 12 levels between treatments, however the probiotic treatment doubled the gamma interferon levels compared with placebo. These are impressive results and may offer some avenue of future prophylaxis for those athletes who are prone to recurrent illness, especially over the winter period. It would be worthwhile to see if the results are replicated in other studies before rushing out to embark on this intervention.

Also in the March issue was a study by the Lincoln University group on health and fitness parameters in New Zealand children aged 10 to 14 years. Comparisons were made between a group study in 1991 and a comparator group in 2003. Over that 12 year period the average weight of boys increased by 4.5kg and girls by 3.9kg. The 550 metre run performance declined by 1.5% per year for boys and 1.7% per year for girls. Most worryingly, children in the poorest performing and fattest percentiles showed substantially worse results in 2003 than in 1991. Results obtained in this study confirm the worrying trend seen in other countries. The major worry is health problems that these children will face later in life and the associated healthcare costs that society and these individuals will have to bear. The study provides compelling evidence for trying to get our least active children to be more active.

Whole body vibration exercise has become popular in recent years. Is there any evidence that it may reverse age-related loss of muscle mass and strength? Is seems there could be, based on a UK study of 20 individuals with an average age of 70 years. They used a randomised cross over trial design with five minutes of vibration exercise characterised by static squat with a frequency of 30Hz. There was an acute increase in the circulating levels of IgF1 and cortisol but no change in growth hormone and testosterone. It remains to be seen whether these hormonal changes are sufficient to slow the rate of functional decline in older people.

The regular review of dietary supplements in the March issue considered the role of caffeine. This was on the list of banned substances from 1980 to 2003, when it was removed because it was found that the best ergogenic effects come from small to moderate doses of caffeine (2-3mg/kg). These doses are well within the normal daily caffeine intake of the general population. Traditionally, caffeine was believed to enhance endurance performance by increased utilisation of fat as an exercise fuel and relative sparing of glycogen. However, this glycogen sparing effect is now known to be short-lived and inconsistent. Furthermore, caffeine drinkers were warned about the diuretic effect but small to moderate doses of caffeine have only minor effects on urine losses and the authors conclude that the diuretic risk had been previously overemphasised. All in all, a very good update about this controversial substance.

As Sports Medicine New Zealand is no longer maintaining a collective subscription to BJSM, these summaries have been expanded to provide our members with greater detail on the current contents of the Journal.

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ORIGINAL RESEARCH

The use of contrast therapy recovery within the New Zealand elite sports setting

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ABSTRACT

Background; **Contrast therapy is a recovery modality that is widely used by many athletes despite the lack of scientific evidence for its use.**

Aim; **The purpose of this paper is to firstly survey and analyse the current utilisation of contrast therapy within the elite sports of New Zealand (NZ) and secondly, to compare the findings with current scientific research.**

Method; **A questionnaire was developed to survey elite NZ sports teams on their use of contrast therapy. The majority of respondents (79%) utilised contrast therapy as a recovery modality.**

Results; **The results indicated that contrast therapy is used immediately post exercise, utilising bins (cold cycle) and showers/spas (hot cycle). The temperatures of each cycle ranged from 4-15°C (cold) and 23-40°C(hot) with 1:1-3 minutes (cold : hot) ratio over 3 repetitions.**

Conclusions; **This study demonstrates that contrast therapy is widely used amongst the elite athletes of NZ. There appears to be little consensus in regard to contrast therapy and this is also reflected in the literature which does not currently report optimal contrast therapy parameters.**

INTRODUCTION

Contrast therapy consists of immersion in hot/warm and cold water baths in an alternating sequence. The strategy was initially used for injury management but has being utilised for post-exercise recovery in more recent times.[1] There are a number of anecdotal reports from athletes and coaches that suggest that contrast therapy has a positive effect on both recovery post exercise and on subsequent performance in sport.[1] Contrast therapy may therefore be an athlete's preferred choice of post exercise recovery compared to other recovery modalities.

An earlier paper[9] reported the findings of a systemic review of the literature that investigated the physiological and functional effects of contrast therapy in the experimental setting. The review concluded that although a number of physiological changes were reported (including changes in blood flow, decreased creatine kinase levels, increased range of motion, decreased muscle soreness and faster recovery of power) the quality of the studies included in the review were of limited methodological quality. Therefore this paper reports the findings of a survey that investigated current utilisation of contrast therapy within elite sports of New Zealand (NZ). The purpose of the research was to determine if contrast therapy was being widely used and if so, to establish what the normal practice in terms of protocols was amongst this cohort. This paper also compares how current practice relates to the research evaluated in the earlier paper[9] with the intent of helping to provide a guide to the clinical application of contrast therapy.

METHODS

Questionnaire

A questionnaire was developed by the researchers to collect data concerning a number of sports recovery strategies including: active recovery (light jogging, cycling), water immersions (ice baths, spa, contrast therapy), pool recovery, massage, stretching and nutrition. The data was collected over the period. Key themes addressed in the questionnaire included the type of equipment, application protocols, rationale and the personnel involved with the prescription and the implementation of the recovery strategy. This paper reports the findings specific to the use of contrast therapy.

Questionnaires were coded to correspond to a particular sporting code/team to provide the tracking of responses and subsequent follow up of the non-respondents. Participants were asked to respond to questions for each of the recovery strategies they used. The questioning consisted of a mixture of open and closed ended questions. The closed ended questions required the participant to answer yes/no questions or tick boxes from a list of available choices. Open ended questions were used in relation to the rationale for the use of a particular recovery strategy. Questionnaires were returned (either by a pre-paid envelope, email or fax). On receipt of the completed questionnaire, information was entered into a Microsoft Access data base and Excel spreadsheet.

Participants

Identification of elite national and international sporting teams within NZ that potentially used recovery strategies was undertaken. The nature, purpose, and procedures of the study were conveyed to the participant via telephone and a covering letter attached to the questionnaire. Informed consent was gained in accordance with the AUT University Ethics Committee guidelines.

Statistical Analysis

Analytical reports and tables were generated from Microsoft access and also from SPSS. For this paper, analysis and data presented is specific to the 'water immersion' section of the questionnaire, in particular the contrast therapy section.

RESULTS

Response Rate

A total of 39 out of 41 completed and returned the questionnaire providing a response rate of 95%. Fifteen teams were in NZ domestic (Interprovincial) competitions and 16 teams were international teams or NZ based professional teams playing in overseas competitions. Of the 39 responses, 31 (79%) indicated that they utilised contrast therapy as a recovery strategy. The numbers of responses from the various teams and sports are presented in Table 1 and the individual protocols of each team are presented in Table 2.

Method of Delivery

A range of equipment is used in application of contrast therapy including large bins, showers, plunge pools, spa baths and pools, bath tubs and swimming pools. Large bins were the most commonly used equipment for the cold component, while showers or spas were the most common for the hot component. There was significant variation in the time of application following activity/ competition. This ranged from immediately up to 30 minutes post event. This information is incomplete however as 14 of the respondents (45%) did not answer this question.

Temperature

Eleven teams (35% of respondents) gave details about the temperature of the hot or cold water they used. The temperature of the cold water ranged from 4 to 15°C and between 23 and 40°C for the hot component. The addition of ice to cold water was the usual method of achieving the desired temperature. Three teams did not state how the water was chilled. Twenty one teams (67% of respondents) used showers as the warm/hot component of their contrast therapy. One team used a bin full of hot water and 7 teams used a spa pool.

Application Time

The time spent in the cold varied from 20 seconds to 120 seconds each cycle. The most common was 30 seconds and used by 19 teams (61% of respondents). The time spent in the hot component varied from 30 to 180 seconds. The most common was 60 seconds and used by 15 teams (48% of respondents).

Cycle Ratio / Repetitions

The ratio of the cycle between cold and hot ranged from 1:1 to 1:4. The most commonly used ratios were 1:2 (13 teams/ 41% of respondents) and 1:1 (10 teams/ 32% of respondents). However, one team appeared to spend more time in the cold cycle than hot with a ratio of 2:1. Three teams indicated multiple options in the

TABLE 1: The sports and number of teams the questionnaires were sent to with the response rate and number of teams that utilise contrast therapy.

Sporting Code	Number of Teams	Number Returned	Contrast Therapy	National Teams	Professional/ International Teams
Basketball	3	2	2		2
Cricket	2	2	2		2
Hockey	2	2	2		2
Netball	9	9	9	8	1
Rowing	1	1	1		1
Rugby	14	13	8	6	2
Rugby League	2	2	2		2
Soccer	3	3	3	1	2
Squash	1	1	1		1
Tennis	1	1	1		1
Triathlon	1	1	0		
Softball	1	1	0		
Swimming	1	1	0		
TOTAL	**41**	**39**	**31**	**15**	**16**

ratio of the hot and cold cycle depending on the intensity of the workout.

The number of contrast therapy cycles ranged between 1-5 repetitions. The most common was 3 repetitions (20 teams / 64% or respondents). Total time spent performing contrast therapy ranged from 2.5- 20 minutes.

DISCUSSION

This study has demonstrated that the majority of teams (79%) and elite sporting codes in NZ use contrast therapy. However, there appears to be little consensus with respect to a number of parameters relevant to this form of therapy. Similarly, there are significant differences in the method of application of contrast therapy 'in the field' compared to that used by those who have investigated the physiological and functional effects of this form of therapy. One of the treatment parameters that could be considered likely to have a significant effect on the effects of contrast therapy is the temperature of the water used, however, only 11 teams (35%) of the survey respondents provided detail about the temperature of the water they used.

The temperatures for the cold cycle varied between 4 to 15˚C from the survey which appear similar to the 8-15˚ used in the research environment.[9] Interestingly, the majority of the studies recently reviewed by Hing et al (2008) used temperatures over 10˚C indicating that the temperature of the cold cycle appears to be at the higher end of the range.

In addition, it is clear that temperatures are not monitored or strictly controlled as they are in the research environment. With the repeated cycles between cold and hot water, it is likely that with subsequent use of the ice bath there would be a progressive increase in the temperature of the water. The size of the bins used and the relative amounts of water and ice added are also likely to affect the water temperature.

With respect to the hot cycles, whilst the shower was the most common method of application, it is largely up to the individual to determine how hot they had the water. This is reflected in the responses to the survey where the majority of respondents either stated that they could not give a temperature or left this question blank. Ten teams (32%) used thermostatically controlled plunge or spa pools and could therefore give definitive values (38-40˚C). The hot water temperatures used by these teams were very similar to those used in the research based studies apart from one study that used hot packs heated in water at 75˚C.[9]

It is common for the surveyed athletes to spend less than 1 minute immersed for each cold cycle. This reflects the timing of 1 minute employed in all but one of the research studies[12] identified in our recent literature review.[9] There is more variation in the duration of the hot cycle, with surveyed athletes spending between 1-3 minutes and the subjects in the research studies spending between 3 and 10 minutes.

The total duration of application of contrast therapy also varied between the athletes represented by the survey and the

TABLE 2: Contrast therapy protocols for each sports code and individual team.

SPORT	TEAM	TEMPERATURE/APPLICATION COLD	HOT	CYCLE RATIO (Cold:Hot) (secs)	REPETITIONS	WHEN
Basketball	Team 1 option A	ice	Shower	30 : 60	3	straight after
	Team 1 option B	ice	nil	300 in cold	1	straight after
	Team 2	4-10 °C	shower/spa	60: 180	not stated	not stated
Cricket	Team 1	ice	shower	30 : 60	3	10 - 30 mins post match
	Team 2	10 - 15 °C	shower	30 : 30	3	not stated
Hockey	Team 1	ice	shower	not stated	3	15 - 20 mins post match
	Team 2	ice	shower	30 : 60	3	not stated
Netball	Team 1	ice	shower	30 : 60	not stated	not stated
	Team 2	ice	shower	30 : 60	3	straight after
	Team 3	not stated	shower	20 : 40 OR 30 : 60	5	not stated
	Team 4	ice	shower	30 : 60 OR 30 : 120	3	not stated
	Team 5	10 °C	shower	30 : 30	3	straight after
	Team 6	ice	shower	30 : 60	3	straight after
	Team 7	ice	shower	not stated	2 OR 3	straight after
	Team 8	ice	shower	30 : 60	3	straight after
	Team 9	10 - 12 °C	shower	60 : 180	not stated	straight after
Rowing	Team 1	ice	hot water bin	30 : 30	3	straight after
Rugby	Team 1	10 °C	23 °C	30 : 30fOR 60 : 180	5	straight after
	Team 2	8 °C	40 °C spa	45 : 45	4	not stated
	Team 3	not stated	39 - 40 °C spa	60 : 60	3	not stated
	Team 4	ice	shower	60 : 120	2	straight after
	Team 5	ice	38° C spa	30 : 120	1	straight after
	Team 6	not stated	39 - 40 °C spa	60 : 60	3	not stated
	Team 7	8 °C	40 °C spa	45 : 45	4	straight after
	Team 8	ice	38° C spa	30 : 120	1	straight after
Rugby League	Team 1	ice	thermostat controlled spa	30 : 60	3	straight after
	Team 2	ice	thermostat controlled spa	30 : 60	3	not stated
Soccer	Team 1	3 - 4 bags ice	shower	30 : 30	4 OR 5	straight after
	Team 2	ice	shower	not stated	3	not stated
	Team 3	ice	shower	45 : 45	3	not stated
Squash	Team 1	ice	shower	120 : 60	3	not stated
Tennis	Team 1 option A	ice	nil	600 in cold	1	straight after
	Team 1 option B	ice	shower	30 : 60	3	not stated

subjects in the research based experiments. The athletes from the survey averaged a total of 5-10 minutes, while the experimental subjects averaged 20 minutes.[9] In terms of the elite sporting environment, it may not be very practical to spend a long time performing contrast therapy as athletes may have obligations to attend team debriefs, after match functions, media interviews and the like.

As discussed previously, bins filled with cold water and ice and a hot shower are the most common method of application of cold and hot respectively in the sporting situation. This is quite different to the use of whirlpools which were the method most commonly employed in the research identified in the literature review.[3,4,5,8,10,11] Practical considerations most likely dictate the type of equipment used by the sports teams. Bins and showers are cost effective and accessible, especially while travelling however the majority of the rugby teams surveyed have plunge pools/ baths at their home stadiums specifically for the delivery of contrast therapy.

CONCLUSION

This study demonstrates that although contrast therapy is widely used as a post exercise recovery strategy by elite sports teams in NZ there appears to be little consensus in regard to the method of application in terms of equipment, timing or water temperature. The survey found that the parameters of contrast therapy ranged from 4-15˚C for the cold cycle, 23-40˚C for the hot cycle ratio of 1 minute cold to 1-3 minutes hot, repeated 3 times and is usually performed straight after the match.

There are also differences between the methods used by researchers investigating the physiological and performance related effects of contrast therapy and those applying this therapy in the actual sporting arena. Whilst the research has demonstrated a number of physiological effects that might support the theory that contrast therapy can aid in recovery after sport, it was concluded that the quality of the studies included in our recent review were of limited methodological quality.[9] Also, out of the twelve studies included in that review only five investigated contrast therapy in an athletic population.[2,4,6,7,13] With the limited quality of these studies and the inability to be able generalise the findings of most of the studies to the athletic population, it is difficult to be able to provide evidence that supports the use of contrast therapy.

There is anecdotal evidence for contrast therapy's use with limited scientific evidence that justifies its use however, a number of studies of limited methodological quality have demonstrated physiological and functional effects that suggest that the therapy may have promise. Further research is warranted although it is equally clear that the researchers in this field need to be better informed in regard to the methodology employed by the end users of contrast therapy. Good quality research that investigates the effects of contrast therapy using techniques of application that can be replicated in the sports setting is required. This research needs to provide detail regarding the optimal contrast therapy parameters taking into account the restrictions that may face the teams involved.

Similarly, those responsible for administering contrast therapy should keep abreast of the research into its effects and do their best to employ techniques that reflect those that have been shown to produce physiological or functional changes.

Ethics Statement

Full ethics approval was gained from the AUT University Ethics Committee for this study. Informed consent was gained in accordance with the AUT University Ethics Committee guidelines.

Ethical Approval: Ethical approval Application Number 05/147 Recovery strategies in sport.

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Conflict of Interest Statement

There is no potential conflict of interest existing with respect to the authors of this piece of work.

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Changes to straight-line sprinting foot positions during a rugby union based agility task

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ABSTRACT

Aim: **To determine the changes to straight-line sprinting foot positions during a rugby union based agility task.**

Study Design: **3D kinematic analyses examined maximal effort straight-line sprinting (20 m) and agility performances. The agility course involved an initial change of direction followed by a subsequent straightening in the running line, with participants required to complete six successful side-stepping trials, through both right and left running lines.**

Setting: **Testing was conducted on a dry, grassed rugby playing surface.**

Subjects: **8 highly trained rugby union players.**

Outcome Measures: **Anteroposterior and mediolateral foot displacement relative to the centre of mass and as a percentage of leg length. Running speed (anteroposterior) and lateral movement speed (mediolateral) measured as the velocity of the centre of mass in these directions.**

Results: **Agility technique was based on different foot positions (% leg length) than straight-line sprinting. The lateral (41.35 ±5.85 %, p< .001) and anterior (46.24 ±11.19 %, p < .001) foot positions during the change of direction step was greater than straight-line sprinting (8.06 ±3.17 % and 14.90 ±8.90 %, respectively). This meant that the initial side-step was characterised by the deceleration of running speed and the development of lateral movement. Following this, agility manoeuvres were characterised by a redirection of residual lateral movement to promote forward progression. The foot positions reflected this desire to accelerate, with the anterior foot position at the straighten (-0.91 ±15.43 %, p < .001) and re-acceleration (11.84 ±11.22 %, p < .001) steps less than straight-line sprinting (14.90 ± 8.90 %).**

Conclusions: **The characteristics of agility are unique to straight-line sprinting. Running programs in rugby union should focus on effective foot positions when rapidly changing directions.**

Keywords: **locomotion, stability, movement control, biomechanics, sprinting**

INTRODUCTION

The ability to evade defenders using change of direction (agility) manoeuvres is a fundamental determinant of effective attacking strategies in rugby union.[8,25,26] Despite this, there is a severe lack of comprehensive scientific research that has described the key determinants of such agility performance.[6,10,12] Importantly, running technique during agility manoeuvres in rugby union remains relatively undefined throughout the published literature. Consequently, confusion exists regarding the specific technical attributes of agility during attacking ball carries in rugby union. A fact particularly evident when considering the training programs in rugby union, where running technique is trained commonly using models of performance derived from straight-line sprinting (e.g. training athletes to display upright body postures that would be counter-productive during contact with defensive opponents).[19,20] Clearly, the multidirectional nature of rugby means that such models may not be appropriate.

Previous research has demonstrated that straight-line sprinting speed has limited transfer with the speed of agility performance.[11,13,28] This could be because the running mechanics associated with agility require significant alterations to straight-line sprinting gait.[29] For example, track sprinters demonstrate purposeful increases to stride length and concurrent decreases in stride rate.[1] In contrast, excessively long strides (characterised by considerable flight periods) reduces the effectiveness of agility performance during attacking ball carries in rugby union (attacking ball carriers have no stable base of support to resist defenders when in flight).[3,19,20] Beyond this, there is a limited understanding regarding the changes to straight-line sprinting technique during agility manoeuvres in rugby union.

The complexity of agility during attacking manoeuvres in rugby union indicates that it is important to divide the skill into the respective performance phases (agility gait cycle). It would no doubt be a mistake to describe the agility gait cycle (multidirectional motion) using straight-line sprinting models of performance (unidirectional motion in the sagittal plane).[18,22] A comprehensive model of agility needs to consider the events before, during and after direction change.[25] Accordingly, it is proposed that the agility gait cycle display five distinct phases, consisting of the pre-change of direction, change of direction, transition, straighten and re-acceleration phases (Figure 1).

The open skilled nature of field sports such as rugby union means that agility movement patterns are expressed in a number of ways.[25] A side-step and straighten agility manoeuvre (complete agility cycle) would be observed when an attacking ball carrier executes an initial side-step to outmanoeuvre an opponent and then straightens the running direction to advance the ball beyond the defensive line (Figure 1). In contrast, a slightly different pattern of movement would be observed when an attacking ball carrier displays an initial lateral running line and then side-steps to challenge the defence (Figure 2). It should be noted that biomechanical analyses of agility performance have been limited to a direction change and continuation through the adjusted running line.[5,15,16,23] Additional analysis of the agility cycle (e.g. side-step then straighten) would no doubt provide a vital understanding of agility running technique during various attacking strategies in rugby union and other similar sports (e.g. rugby league). Accordingly, this study explores the characteristics of a complete agility cycle based on evasive attacking ball carries in rugby and compared this to conventional straight-line sprinting technique.

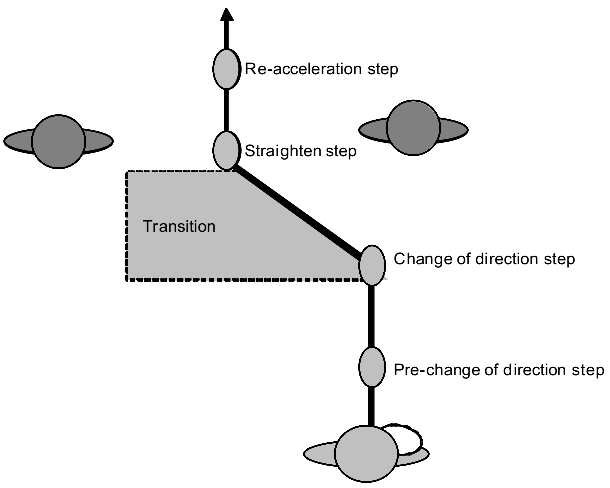


FIGURE 1: Transverse plane representation of the complete agility cycle.

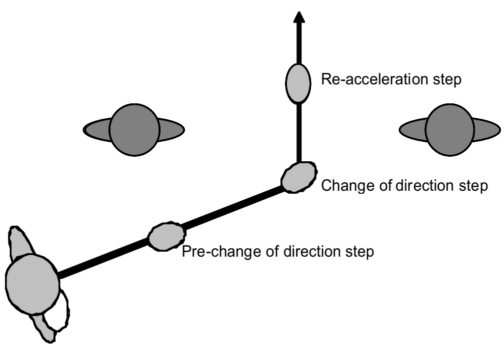


FIGURE 2: Transverse plane representation of a modified agility cycle.

METHODS

Participants

Eight male rugby union players volunteered to participate in this study (age 23 ± 4 yr, height 183 4 cm, mass 98 11 kg). The participants were from high level rugby union teams, such as those competing in international provincial competitions. All testing procedures were approved by the University Human Research Ethics Committee, and informed consent was obtained before testing.

Study Design

Three dimensional kinematic analyses examined maximal effort straight-line sprinting and agility performances (full recovery between each straight-line running and agility trial). Participants completed three 20 m straight-line sprints. Agility course design was based on the characteristics of attacking ball carries in rugby union.[14,21,25] Participants ran at maximal effort through an agility course with an initial change of direction followed by a subsequent straightening in the running line (Figure 3). Measures of agility were recorded for six successful side-stepping trials, through both right and left running lines. Testing was conducted on a dry, grassed playing surface. Participants were required to carry a rugby ball and wear rugby footwear as well as any other necessary protective equipment, as regulated by the International Rugby Board. Participants received descriptions and demonstrations of the assessment tasks (straight-line running and agility conditions) and completed non-measurable performances as part of their standardised warm-up.

Performances were filmed by 4 PAL digital video cameras (Panasonic Nv-GS180GN, Matsushita Electric Industrial Co., Ltd., Japan) operating at 50 Hz and the shutter speed at 1/2000th s (Figure 3). Twenty anatomical landmarks forming a full body model (Figure 4) were next digitised using the Ariel Performance Analysis System (Ariel Dynamics, Inc., USA), with 3D transformation using standard Direct Linear Transfer (DLT) procedures (25 stationary control points digitised on a calibration frame (2 m wide, 2 m high and 6 m long)) and smoothed with a 5 Hz digital filter. The choice of cut-off frequency was based on a residual analysis[27] and a visual inspection of the coordinate and displacement data consistent with Wakai and Linthorne.[24] Digitising was completed by a single analyst and the raw position of randomly selected landmarks and joint displacements were used to assess reliability. Coefficient of variation (CV) and typical error of measurement (TEM) demonstrated high reliability for joint landmarks in the anteroposterior (CV = 3.12 %, TEM = 1 cm); mediolateral (CV = 0.42 %, TEM = 1 cm) and vertical (CV = 0.87 %, TEM = 1 cm) planes, in accordance with Menz et al.[17]

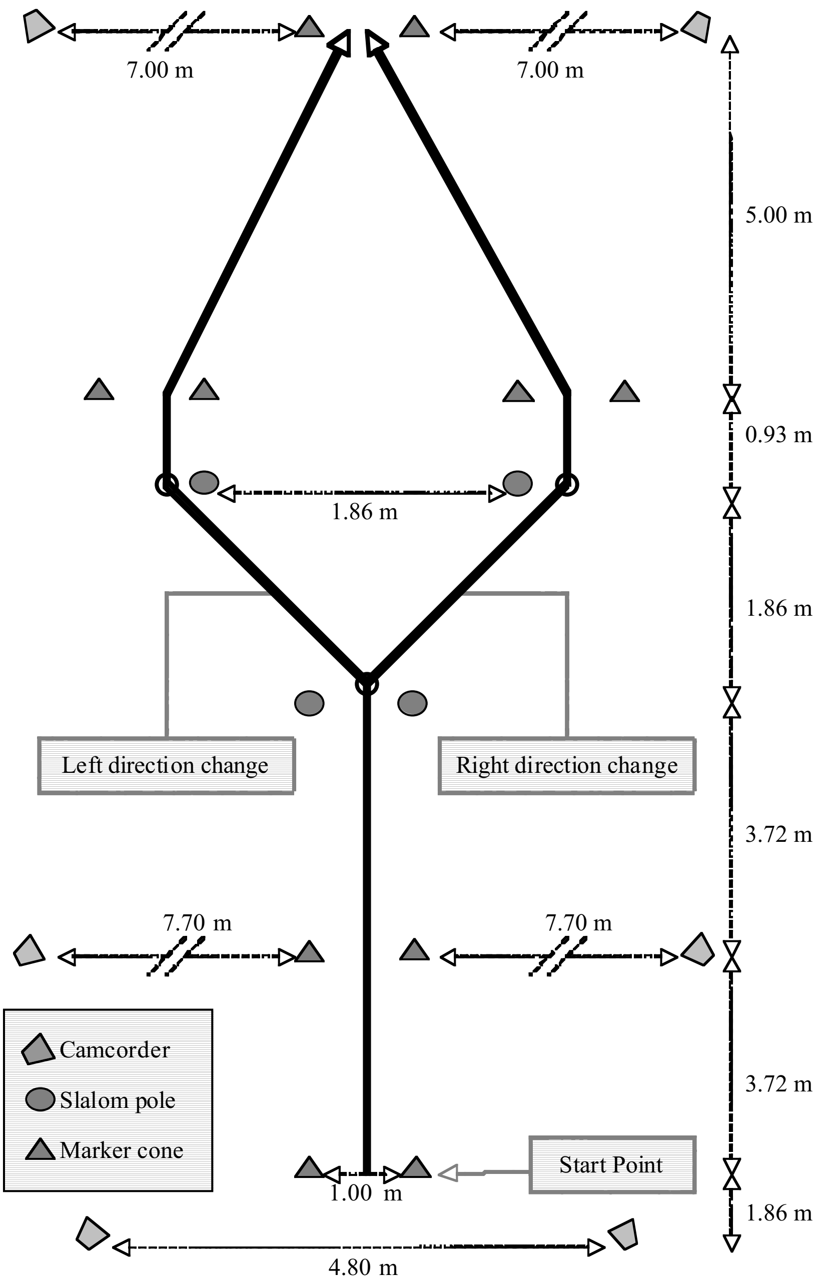
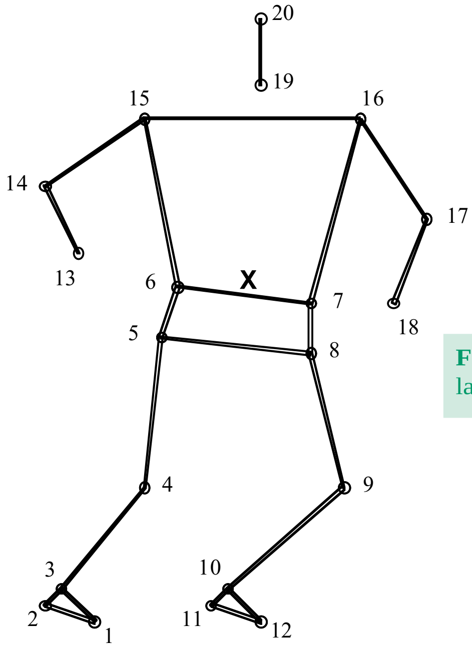


FIGURE 3: Diagram of the agility course design.

Statistical Analysis

The SPSS software package (Version 17.0 for Windows, SPSS, Inc., USA) was used to present descriptive statistics ($\bar{x}$ ±SD) and compare performances using *t*-test (*t* (df) = 000, p = .000) and Chi-squared (^{2}) measures of relationship (^{2} (df) = 000, p = .000). A significance level of p < .05 was used for all analyses. Independent variables included; performance condition (straight-line sprinting and agility), speed of agility performance (fast, moderate and slow) and the number of transition steps (0, 1 and 2). It should be noted that the speed of performance was categorised



1 Right toes
2 Right posterior calcaneal point
3 Right lateral malleolus of the fibula
4 Right femoral lateral epicondyle
5 Right femoral greater tronchanter
6 Right iliac crest
7 Left iliac crest
8 Left femoral greater tronchanter
9 Left femoral lateral epicondyle
10 Left lateral malleolus of the fibula
11 Left posterior calcaneal point
12 Left toes
13 Right distal lateral radius
14 Right humoral lateral epicondyle
15 Right acromion process
16 Left acromion process
17 Left humoral lateral epicondyle
18 Left distal lateral radius
19 Anterior mandible
20 Anterior frontal bone
X Centre of Mass (CM)

FIGURE 4: Representation of the full body model achieved by linking anatomical landmarks.

based on fast (0.5 SD below the mean performance time), moderate (between 0.5 SD above and below the mean performance time) and slow (0.5 SD above the mean performance time) for agility and straight-line sprinting. Dependant variables included speed (running and lateral movement) and foot positions (anteroposterior and mediolateral). Running speed and lateral movement speed were determined using kinematic measures of the velocity of the centre of mass (CM). Changes to running speed and lateral movement speed between foot-strike and toe-off were then calculated for each agility phase as well as averaged over multiple stance phases of straight-line sprinting. Displacement of the foot in the anteroposterior and mediolateral planes at foot-strike and toe-off was measured relative to the CM and as a percentage of leg length (Figure 5).

RESULTS

Pre-change of Direction Phase

Comparison of the spatiotemporal characteristics between straight-line sprinting and agility tasks showed that running speed decreased during the pre-change direction phase (-0.64 ±0.43 $m.s^{-1}$) compared to an increase during stance of straight-line sprinting (0.27 ±0.17 $m.s^{-1}$, t (67.91) = 12.759, p < .001). The anterior foot displacement at foot-strike was then greater at the pre-change direction step (41.68 ±14.78 %) compared to straight-line sprinting (14.90 ±8.90 %, t (67.405) = -9.556, p < .001) (Figure 6).

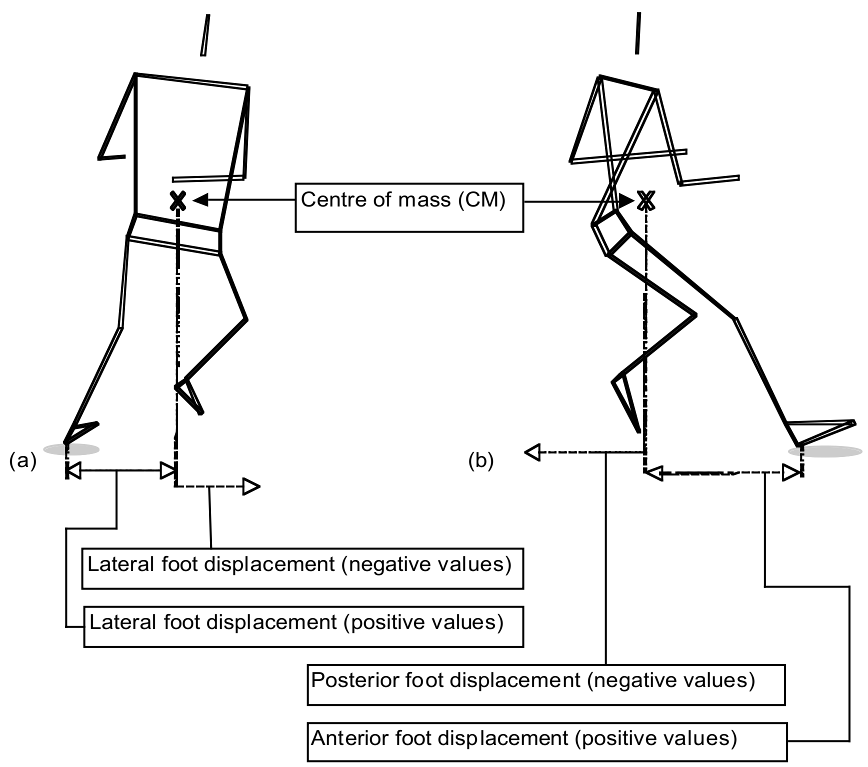


FIGURE 5: Representation of a foot displacement values (a) frontal plane view of lateral foot displacement (b) sagittal plane view of anteroposterior foot displacement.

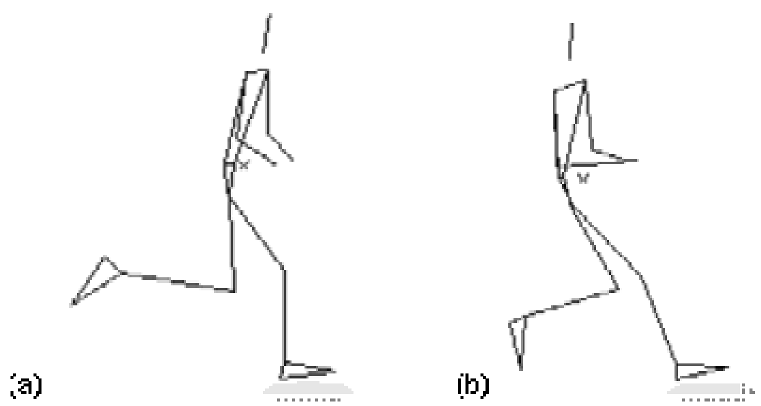


FIGURE 6: Sagittal plane representation of the anterior foot displacement at foot-strike (a) straight-line sprinting (b) pre-change direction step.

Change of Direction Phase

During the change direction phase, it was shown that running speed decreased markedly (-1.18 ±0.41 m.s^{-1}) which is in stark contrast to the acceleration that occurred with straight-line sprinting (0.27 ±0.17 m.s^{-1}, *t* (68.586) = 20.998, p < .001). The trend for anterior foot displacement at foot-strike continued during this agility phase, with greater values recorded at the change of direction step (46.24 ±11.19 %) compared to straight-line sprinting foot-strike (14.90 ±8.90 %, *t* (70) = -11.944, p < .001) (Figure 7). Conversely, posterior foot displacement at toe-off was less during change of direction (-22.92 ±15.52 %) compared to straight-line sprinting (-43.36 ±2.94 %, *t* (53.430) = -8.816, p < .001) (Figure 8). Results then showed that lateral movement increased during the change of direction phase (1.64 ±0.28 m.s^{-1}) compared to straight-line sprinting (-0.43 ±0.29 m.s^{-1}, *t* (70) = -28.835, p < .001). This was no doubt related to the greater lateral foot displacement observed at the change of direction foot-strike (41.35 ±5.85 %) (Figure 7) and toe-off (74.69 ±8.34 %) (Figure 8) when compared to the foot-strike (8.06 ±3.17 %, *t* (56.451) = -31.273, p < .001) and toe-off (-17.69 ±2.82 %, *t* (64.134) = -68.751, p < .001) positions of straight-line sprinting.

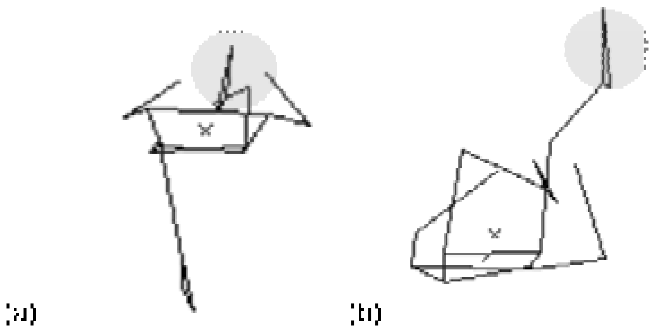


FIGURE 7: Transverse plane representation of the anterior and lateral foot displacement at foot-strike (a) straight-line sprinting (b) change of direction step.

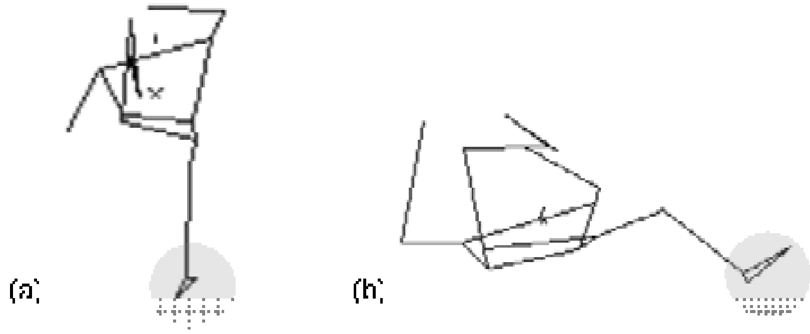


FIGURE 8: Transverse plane representation of the posterior anterior and lateral foot displacement at toe-off (a) straight-line sprinting (b) change of direction step.

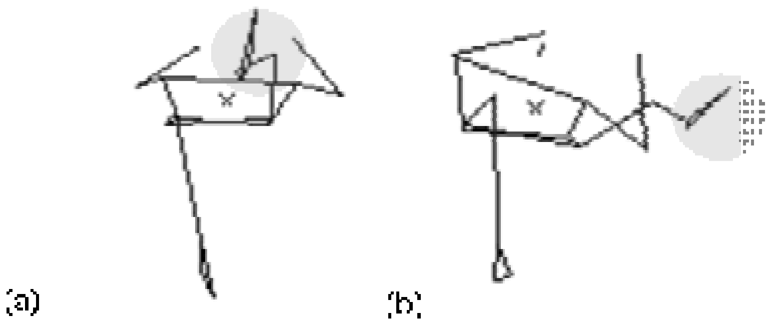


FIGURE 9: Transverse plane representation of the anterior and lateral foot displacement at foot-strike (a) straight-line sprinting (b) straighten step.

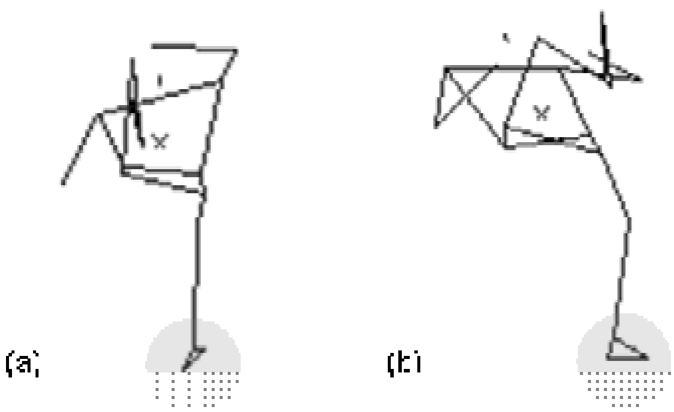


FIGURE 10: Transverse plane representation of the posterior and lateral foot displacement at toe-off (a) straight-line sprinting (b) straighten step.

Transition Phase

Our results then explored the transition step patterns during the agility task. Differing transition step strategies were observed with athletes exhibiting no steps through the transition phase or one transition step or two transition steps. Moreover, analysis examined the transition step strategies between speeds of agility performance. A significant relationship was observed where fast performances favoured no transition steps, whilst moderate performances often demonstrated a single transition step and slow performers were more likely to display two steps through the transition phase (^{2}(4) = 103.403, p < .001).

Straighten Phase

Further comparison of straight-line sprinting to agility tasks showed that greater acceleration to running speed occurred during the straighten phase of agility trials, with increases in running speed of 0.77 ±0.35 m.s^{-1} compared to just 0.27 ±0.17 m.s^{-1} for straight-line sprinting (t (69.996) = -8.208, $p < .001$). It was then shown that the foot was positioned posterior to the CM at foot-strike of the straighten step (-0.91 ±15.43 %) compared to the anterior placement of the foot during straight-line sprinting (14.90 ±8.90 %, t (68.426) = 5.501, $p < .001$) (Figure 9) and that posterior foot displacement at toe-off was greater at the straighten step (-81.02 ±7.35 %) compared to straight-line sprinting (-43.36 ±2.94 %, t (67.773) = 30.896, $p < .001$) (Figure 10). In addition, the straighten phase was characterised by having a large reduction in lateral movement (-1.51 ±0.57 m.s^{-1}) compared to straight-line sprinting (-0.43 ±0.29 m.s^{-1}, t (69.934) = 10.660, $p < .001$). Lateral foot positions then followed similar patterns to the change of direction step, with greater values recorded during the straighten phase (foot-strike = 46.14 ±11.42 % and toe-off = 28.40 ±15.56 %) compared to straight-line sprinting (foot-strike = 8.06 ±3.17 %, t (59.722) = -21.494, $p < .001$) and toe-off (-17.69 ±2.82 %, t (54.926) = -19.887, $p < .001$) (Figures 9 and 10).

Re-acceleration Phase

The spatiotemporal characteristics of the re-acceleration phase were similar to that reported for the straighten phase. Greater acceleration to running speed again occurred during this phase for agility trials, with increases to running speed of 0.50 ±0.49 m.s^{-1} compared to a smaller increase in running speed for straight-line sprinting (0.27 ±0.17 m.s^{-1}, t (64.922) = -2.910, $p < .001$). In addition, this phase was also characterised by smaller anterior foot displacement at foot-strike (11.84 ±11.22 %) compared to straight-line sprinting (14.90 ±8.90 %, t (68.426) = 5.501, $p < .001$) (Figure 11) and greater posterior foot displacement at toe-off (-68.33 ±12.72 %) compared to straight-line sprinting (-43.36 ±2.94 %, t (56.272) = 12.923, $p < .001$) (Figure 12). The previously reported reduction in lateral movement continued through this phase (-0.97 ±0.32 m.s^{-1}), which was greater than the changes to these values for straight-line sprinting (-0.43 ±0.29 m.s^{-1}, t (70) = 6.871, $p < .001$). Further analysis showed that lateral foot displacement at foot-strike of the re-acceleration step (-39.50 ±8.64 %) had crossed the line of the CM and was greater than recorded during straight-line sprinting (8.06 ±3.17 %, t (65.968) = 33.840, $p < .001$) (Figure 11). Finally, lateral foot displacement at toe-off was also greater at the re-acceleration step (-32.00 ±10.52 %) compared to straight-line sprinting (-17.69 ±2.82 %, t (59.012) = 8.811, $p < .001$) (Figure 12).

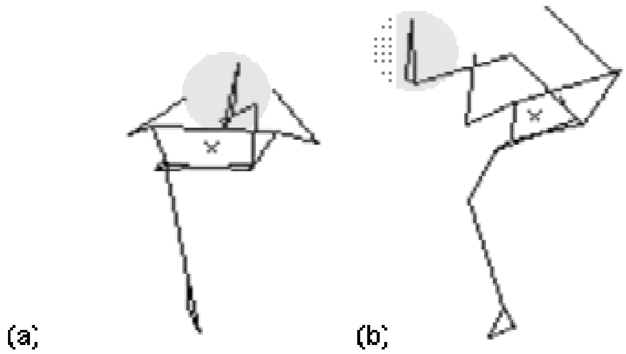


FIGURE 11: Transverse plane representation of the anterior and lateral foot displacement at foot-strike (a) straight-line sprinting (b) re-acceleration step.

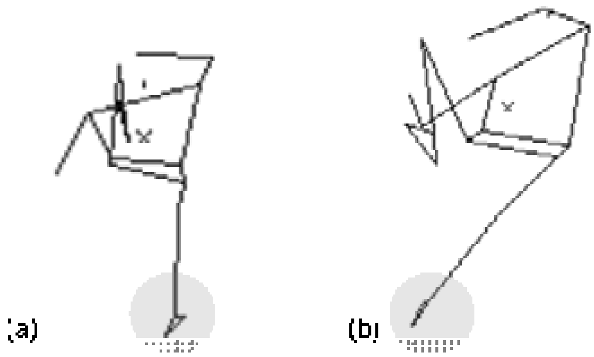


FIGURE 12: Transverse plane representation of the posterior and lateral foot displacement at toe-off (a) straight-line sprinting (b) re-acceleration step.

DISCUSSION

Pre-change of Direction Phase

We demonstrated that the pre-change direction phase is characterised by a reduction to running speed which is no doubt crucial to maintain movement control during the subsequent change of direction.[2] It appears that the main avenue for reducing / controlling running speed is by increasing anterior foot displacement at foot-strike, which has been associated with braking forces that decelerate running speed.[4,9] We propose that a trade-off exists between running speed and controlled agility movements (dynamic stability), where excess running speeds when attempting to evade (change directions) defenders during attacking ball carries may promote instability and as result, greatly diminish the ability to maintain movement control.

Change of Direction Phase

The change of direction phase was characterised by continued reduction to running speed achieved with increases to anterior foot displacement at foot-strike. Similarly, it was shown that an increase to anterior foot positions occurred with greater running speed at change of direction foot-strike. This further emphasises the role that increases to anterior foot positions have in reducing running speed prior to direction change.[7] There is no doubt that the reduction to running speed with purposeful increases to anterior foot displacement at foot-strike represents a fundamental element of the change of direction phase during agility manoeuvres.

We also demonstrated that the change of direction phase provides the critical component eliciting the desired direction change during agility manoeuvres. Consequently, a substantial increase to lateral movement was associated with greater lateral foot positions, where increases to lateral foot displacement during the change of direction phase increased lateral movement. In rugby union, the ability to execute rapid change of directions (lateral movements) represent a fundamental component of evasive (agility manoeuvres) attacking strategies.[21,25] It is recommended that rugby union coaches focus on the foot placement patterns of players in order to improve their rapid lateral movement during attacking ball carries.

Transition Phase

We observed that the transition phase is characterised by the transmission of lateral movement whilst seeking to control forward motion. Importantly, the step patterns exhibited during the transition phase altered the properties of lateral movement and provided differentiation between speeds of agility performance. Clear variations to the transition steps patterns occurred during agility skill execution, such that enhanced speed of performance was achieved with less transition steps and subsequent increases to the percent transition flight. It was concluded that the inverse relationship between the speed of performance and the number of transition steps represents a key determinant to the speed of evasive agility manoeuvres during attacking ball carries in rugby union. Clearly, further research examining running technique during this agility phase is warranted.

Straighten Phase

The straighten phase was characterised be a redirection of lateral movement to promote forward motion. Accordingly, increases to running speed in conjunction with a reduction to lateral movement were observed during the straighten phase. An increase to lateral foot positions no doubt assisted this redirection of lateral movement, which coupled with a concurrent decrease to anterior foot positions promoted the acceleration of running speed.[9] Interestingly, the foot was positioned posterior to the CM at foot-strike of this phase, a characteristic of acceleration based running techniques[4,9] In rugby union, rapid acceleration of forward motion during the straighten phase would no doubt enhance the ability to exploit breaks in the defensive line created from the initial evasive direction change. The ability to evade defenders and advance the ball beyond the advantage line is a crucial component of running ability in rugby union.[14,25,26] Therefore, the properties of forward propulsion during the straighten phase represent a key determinant of agility performance in rugby union.[14,25]

Re-acceleration Phase

The re-acceleration phase refers to the concluding events of the agility manoeuvre, where a considerable increase to running speed is a desirable feature of performance. In rugby union, the re-acceleration phase allows the attacking ball carrier to advance the ball beyond the defensive line.[14,21,25] We demonstrated that a reduction to anterior foot placements, that more closely resembled straight-line sprinting patterns, promoted acceleration of running speed during the re-acceleration phase.[4,9]

In contrast, the lateral foot placements observed during the re-acceleration phase were distinctive to straight-line sprinting. The negative lateral foot positions, where the foot crossed the line of CM indicated that a residual amount of lateral movement remained following the straighten phase, and that the foot position likely produced a blocking force to counter this movement. In addition, the presence of residual lateral movement during the re-acceleration phase no doubt represents a destabilising component that would reduce the effectiveness of running ability in rugby union and would therefore not be a characteristic of effective performance.

CONCLUSION

The phases of the agility gait cycle exhibit characteristics that make it a unique skill to that of straight-line sprinting. The initial side-step was characterised by the deceleration of running speed and the development of lateral movement towards the intended direction change. Following direction change, the agility gait cycle was characterised by a redirection of residual lateral movement to promote forward progression. Our findings present an essential understanding of agility running technique throughout multidirectional sports and specifically rugby union. Clearly, training programs that emphasise straight-line sprinting techniques are inappropriate in rugby union because of the multidirectional nature of this sport. It is then recommended that agility development programs, that are more suited to the requirements of rugby union, focus on the effectiveness of foot placement patterns and consider the ability to control movements when rapidly changing directions.

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Review current thinking on the management of retropatellor pain

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INTRODUCTION

Retropatella pain is the most common diagnosis made amongst runners in sports medicine centres.[10] It contributes up to 25% of all knee injuries in sports medical centres and constitutes between 16 and 25% of all injuries in runners.[3,15]

It is more commonly known as patellofemoral pain syndrome (PFPS), runner's knee or movie-goer's knee. Generally other intraarticular and periarticular pathologies such as, plica syndromes, apophysitis, and inflamed bursa are excluded.[1] The diagnosis of PFPS is usually a clinical one as imaging is usually normal. The pain can be difficult to manage, but often improves with a well designed conservative treatment protocol.

PATHOPHYSIOLOGY

The patellofemoral joint is comprised of the patella and femoral trochlear. The function of the patella contained in this joint is to act as a lever and increase the power generated by the extensor mechanism. The patella contacts with the trochlear at 20 degrees with maximal contact at 90 degrees.[11] The stability of the patellofemoral joint is controlled by both static and dynamic stabilisers. Together these help to control the movement of the patella throughout its range of motion and this is referred to as "patella tracking". Forces through the patella which can be transferred onto the joint can range from a third of one's body weight during walking to seven times during squatting.[12] Abnormalities of patella tracking can change the patellofemoral joint contact pressures and lead to pain stimulation. This is thought to be the key to determining possible causes of PFPS and help to identify the focus of treatment.[3]

RISK FACTORS

Several factors may increase the risk in development of PFPS. Overuse, trauma anatomical and dynamic biomechanical forces and their effect on patella tracking appear to be the main contributors.[3]

Static malalignment of the patellofemoral joint such as an increased standing Q angle, pes planus and subtalar pronation have thought to have been contributors in the development of PFPS.[3] However, there is limited evidence of a causal relationship for this.[5,13,22] Kinematic analysis during the stance phase has been performed with runners with PFPS showing higher resultant abduction and external rotation movements and lower resultant extension moments at the knee than those without symptoms of PFPS.[13] Larger studies are needed to confirm this finding.

HISTORY

A patient will typically describe pain behind and around the patella that is difficult to localise. Pain is usually described over the anterior aspect of the knee but often patients will draw a circle around the patella.[3] Symptoms are usually of gradual onset and can be bilateral. Pain is often exacerbated by prolonged sitting and pain on activities that increase pressures over the patellofemoral joint such as running, jumping and squatting.[3] Patients may also complain of instability, however this does not usually represent true patella instability but rather transient inhibition of the quadriceps because of pain or deconditioning.[16]

PFPS is described as an overuse type injury so a recent training or occupational history should also be sought. Other significant contributors can include inappropriately worn footwear, exercises such as squats and lunges and other conditioning exercises.[3]

CLINICAL FINDINGS

The reliability of clinical tests for PFPS is either low or untested and therefore multiple evaluations are needed to help give a diagnosis of PFPS.[8] These are discussed below. They may also be helpful in revealing factors contributing to PFPS and patellofemoral malalignment. Any significant effusion or swelling of anterior structures such as fat pads or bursa are unusual and would suggest an alternative diagnosis.

Q-angle

The Q angle is the angle formed by the line formed by the quadriceps relative to the patella tendon as it intersects in the centre of the patella.[17] Changing the Q-angle can change the location of contact and pressure at the patellofemoral joint resulting in areas experiencing excessive stresses that are not physiologically manageable.[18]

By increasing the Q-angle the patella is more likely to tract laterally as the quadriceps is contracted.[8] This may increase lateral contact pressures and also instability.[5] Decreasing the Q-angle will not change the patella position but will increase the tibiofemoral contact pressures through increasing varus orientation of the knee.[19] Numerous studies have been done to determine whether the Q-angle is correlated with PFPS with conflicting results.[5] Grossly larger Q angles such as those greater than 20 degrees may be a significant risk factor.[20]

Mediolateral Glide

This test is performed with the knee flexed at 20 degrees. The midpoint of the patella is measured (usually by tape measure) and should be equidistant (+/- 5mm) between the two femoral epicondyles. Data appears to be inconclusive in the relevance of this test. Correlation appears to be poor with both comparison MRI measurements at the 20 degree angle and clinical symptoms of PFPS.[5]

Patella Tilting

Excessive patellar tilting laterally can restrict medial motion and increase the stress between the lateral facet of the patella and the lateral trochlea. It is considered pathological when the tilt is greater than 20 degrees in knee extension when measured by CT.[5] It has been reported in one study that a positive patella tilt was significant for PFPS compared to controls with 92% specificity and 43% sensitivity.[14]

Patella Compression Test

This test is performed by compression of the patella in the trochlear groove while moving the patella up and down, with pain indicating a positive test. It has been noted that patients with PFPS have a high probability of a positive result in the affected knee, but also in the unaffected knee[21] and so the reliability for this test is uncertain.

Dynamic Patellar Tracking

This can be assessed by having the patient perform a single leg squat and stand. Imbalance between the medial and lateral patella forces such as vastus medialis obliquus (VMO) dysfunction and tight lateral structures can be manifested by an abrupt deviation of the patella as it engages the trochlea in early flexion. This is known as the “J sign”.[3]

Neuro-Motor Dysfunction has also been measured using EMG studies. One study has demonstrated a significantly faster combined VMO and vastus lateralus (VL) response as well as a delayed response of the VMO compared to the VL compared to controls in PFPS.[22] However although the later finding would support the theory of maltracking of the patella contributing to symptoms to PFPS it was small and not significant.

Foot Abnormalities

Static measurements of genu varum, genu valgum, pes cavus and pes planus have not been found to contribute to PFPS.[5,13,22]

MANAGEMENT

Numerous strategies can help to alleviate and better manage the pain associated with PFPS, usually best in combination.

Education

Education about the pathophysiology to the patient is important for both patient understanding and may help with compliance to any rehabilitation program. Positive effects on the muscular system with modification and training takes time and so patients need patience and plenty of encouragement.[1,2]

Relative Rest and Modification

Reduction of exacerbating factors and loading to the patellofemoral joint is the first step to reduce pain. If certain exercises such as lunges or squat are contributing, these should be stopped. Runners should reduce their mileage to a level that does not provoke pain during the exercise and over the 24 hours post exercise.

Symptoms usually abate with these modifying measures however further treatment as described below is often needed to prevent recurrence.[1,2]

Physical Therapy

There is conflicting data regarding the effectiveness of physical treatments in PFPS.

Some authors have suggested that part of the reason for this is that PFPS has failed to be and needs to be categorised into subgroups that describe an underlying cause for PFPS such as tightness or muscular weakness.[6] Physical therapy then needs to be focused on these underlying factors. For example, in women with weak hip external rotator muscles a focused strengthening programme can improve patella tracking in patients with PFPS.[9] Tight structures should be mobilised and the kinetic chain balanced. Specific factors to work on in a training programme are: strength, flexibility, proprioception, endurance, functional training and a gradual progression of the exercise load.[26] This can be done with manipulative therapy such as stretching combined with proprioceptive and strengthening exercises. The efficacy of this can be assessed by watching patella tracking with single leg squats with heavier or higher frequency loads.

The general recommended treatment for PFPS is with an exercise programme as described above, however one of the main difficulties is with compliance. One study by Yates who followed up 64 patients with PFPS over 15 months revealed 42 non compliant, 17 partially compliant and only 5 compliant with the prescribed rehabilitation programme.[27] Despite this, numerous studies have shown good results. In a long term study of 48 patients given advice about PFPS and isometric exercise over a mean period of 11 years, results were found to be good to excellent in 85% of patients.[28] This agrees with findings from other studies.[1]

There is inconclusive evidence to support the superiority of specific physiotherapy interventions[1,4] however eccentric quadriceps strengthening programmes appear to result in a better treatment response than other forms of strengthening when comparing functional impairment measures.[4]

Analgesia

NSAIDs and paracetamol are often prescribed for patients with PFPS, however there is little evidence supporting their effectiveness.[23] They may be useful for patients with symptoms during their daily activities at the initiation of treatment when other measures such as ice are ineffective.[3]

Taping

Patella taping has been suggested as a measure in improving patella tracking and quadriceps function. However randomised clinical trials have failed to show consistent benefit when added over physical therapy. It has also not been shown to improve symptomatic relief in the long term.[3]

Foot Orthosis

As mentioned above static measurements have failed to show a relationship between lower extremity malalignment and PFPS. However in a patient with significant foot pronation corrective footwear can be a reasonable option.[3] In patients with rearfoot varus there is some evidence from a non blinded study that corrective footwear may be useful in reducing pain in PFPS activities after a period of 8 weeks.[24]

Progressive Resistance Brace

High volume quadriceps strengthening has been monitored using a progressive resistance brace which showed significant improvement in pain, radiological patellar alignment and function.[25] Although benefit was observed, this was not compared with any equivalent treatment arm and also given the expense of the device further comparative study is needed.

Surgery

Surgical consultation may be considered for patients whose symptoms persist despite a thorough rehabilitation program for at least 1 month and whom other causes of anterior knee pain has been excluded.[3] Most studies for surgical treatment are uncontrolled case studies and therefore have not been fully evaluated.

Options include release of the lateral retinaculum and proximal realignment for those with tight lateral structures.[9] Distal realignment with anteromedialisation of the tibial tubercle may benefit those with lateral compression and associate articular cartilage injury.

CONCLUSION

The pathophysiology of PFPS is not fully understood but there are probably multiple factors contributing to pain in the anterior knee. The underlying principle is thought to be excessive or abnormal forces over the patellofemoral joint as the knee is flexed.

Generally improvement is expected over a long period with modification of activities. Physical therapy is the mainstay of treatment but this needs to be individualised to the patient and focused on the underlying factors that may be contributing to patella maltracking. Patients need to be strongly encouraged to be compliant with any rehabilitation programme. Other forms of treatments have not been fully evaluated, however may be useful in certain circumstances.

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The relationship between personality and performance in endurance sport

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There have been numerous studies that have attempted to elucidate the relationship between expert performance in sport and the personality traits of athletes. The popularity of this research topic was perhaps at its zenith in the early 1980s with the work of Morgan being particularly influential (Morgan, 1980). Early studies tended to focus on the difference between athletes and non athletes with findings suggesting differences on such dimensions as motivation, social confidence, aggressiveness (Cooper, 1969), conscientiousness and self control (Garland and Barry, 1990). However many of these studies were based upon team contact sports which may account for these particular differences. Furthermore, these early studies aimed at exploring personality and sporting performance suffer from a lack of theoretical basis of personality and have been referred to as a "Blunderbuss" approach: if we throw enough personality questionnaires at athletes something is bound to hit the mark (Shaw, Gorley & Corban, 2003). Even the work by Morgan cited earlier, and which is often seen as a seminal work in the area, suffers from a fatal flaw. Morgan developed what he termed the Ice Berg Profile of successful athletes. This profile was obtained by measuring the mood *state* of athletes using the six dimensional Profile of Mood States (POMs). Clearly mood states are not equivalent to personality traits, something often overlooked by sport psychologists and sport scientists.

Given the inconsistent findings of early research and some of the issues around personality and its measurement, research in the area seemed to come to a halt by the end of the 1980s and little of any real substance has appeared in the literature in the subsequent 10 to 15 years.

Perhaps one of the major issues around the measurement of personality was the lack of a clear theoretical model of personality. Specifically, it had been suggested that one of the reasons for the equivocal results relating performance in a variety of areas (job, academic and sporting performance) was the lack of a consistent use of methodologies and theoretical approaches to the study of personality and performance (De Raad & Schouwenburg, Hogan & Roberts, 2001;Guion & Gottier, 1965;, 1996; Piedmeont, Hill Blanco, 1999). Eysenk, Nias and Cox (1982) suggested that the application of a factorial model of personality may provide a more fruitful avenue for exploring the relationship between personality and performance. These authors demonstrated how the application of a theoretically consistent well established, broad spectrum dimension approach to personality could be applied to high level ability athletes in specific sports to identify the relationship between personality and performance. Eysenk et al (1982) supported the use of a three factor model of personality, although more recent views of broad factorial models of personality have proposed a five factor model. Specifically, an individual's personality can be described within the context of five broad domains of behavior:

Openness (inventive/curious vs cautious/conservative)
Conscientiousness (efficient/organised vs easy-going/careless)
Extroversion (outgoing/energetic vs shy/withdrawn)
Agreeableness (friendly/compassionate vs competitive/outspoken), and
Neuroticism (sensitive/nervous vs secure/confident).

Moreover, this "Big Five" approach to personality theory has shown to provide a broader description of personality than Eysenk's original three factor model (Costa and McCrae, 1995).

In terms of the application of the "Big 5" within a sporting context the study conducted by Piedemont, Hill and Blanco (1999) employed the five factor model of personality to attempt to predict sporting performance in collegiate female soccer players. This more recent study was able to put some of the earlier inconsistent findings in the context of the "Big 5" model and obtain some agreement with their own findings. Specifically, in combination with earlier studies, including Eysenk et al. (1982), it would appear from the Piedmont et al's (1999) study successful athletes tend to be more focused and goal driven and score low on Neuroticism (high self control, self esteem and emotional control). In summary these authors concluded that high achievers in sport, just like in other behavioural domains, are emotionally stable, capable, have a heightened sense of competence and a drive to succeed. This appears to be the only existing application of the Five Factor Model (FFM) of personality applied to the investigation of the relationship between personality and sport performance. However, examination of the literature drawing on other performance domains such as academic and occupational performance would tend to support the sport findings. In particular, this research suggesting that those who perform well academically and in occupational settings score highly on the Conscientiousness domain and low on Neuroticism domain (Hurtz & Donovan, 2000; Judge & Ilies, 2002; Poropat, 2009; Sackett, Gruys, Ellingson 2006). However, on closer examination of these findings it is not the scores on the domains themselves that are predictive but rather some of the facets that sit "below" these domains. What seems to be consistent across these studies is that the facets of Achievement Striving and Self discipline are better predictors than their global domain of Conscientiousness. The only other FFM domain that seems to be consistently related to performance is that of Neuroticism. Further examination of the findings would appear to suggest that there is a general negative relationship between the facets of impulsivity and anxiety. In support of this view in sport are the recent findings by Stoeber et al. (2008) that suggests successful elite endurance athletes require high levels of perfectionism and achievement striving and low levels of what can be likened to behaviours associated with the FFM of neuroticism.

Thus there appears to be some evidence that some facets of the big 5 personality factor model are predictive of performance at least in collegiate athletes. Additionally, this seems to be consistent with findings in other performance areas outside of sport. The danger of course is that people with a lack of understanding of personality theory and its psychometric assessment assume that we should, from the results above, be able to "profile" athletes to predict those that will be successful. Much of this misguided ideology comes from the Human Resource practice of the use of personality tests to screen potential employees. In these situations the tests used are not exposed to rigorous peer review and are "sold" to clients as a robust process. In practice of course these psychometric tests are not as reliable or valid as one would like, and are treated with caution by those professionals that do posses the necessary knowledge and expertise in their use. Even if we do take the results of Peidemont et al. (1999) and others applying the FFM to profile successful athletes we must consider that the population assessed were not true elite athletes and in Peidemont et al's study were collegiate athletes participating in a closed skill team sport (ie, soccer). Even the results provided by Stroebe et al (2008) do not specifically utilise the FFM of personality and in addition their definition of elite was based on hours of training rather than level of performance. Thus it is possible that different results would be obtained by an examination of true elite athletes (those that have competed in elite World Championships and Olympic Games) participating in endurance based sports.

One further interesting development has been the recent emergence from the positive psychology literature that optimism (or hope) plays an important role in how successful one is. For example, Seligman (1998) suggested from a study using inter collegiate swimmers that those high in optimism were more successful compared to those scoring high on pessimism. Other prominent sport researchers have also suggested that dispositional hope and high levels of optimism may be predictive of successful performance (Gould, Dieffenbach & Moffett, 2002). This positive psychology approach has received some popular support in the modern sporting world – particularly in NZ. It also appears that high levels of optimism also predicts successful performance in other areas such as the work place (Peterson and Byron, 2008).

To this end and with the cooperation of Rowing NZ and Bike NZ members of NZ national teams since the Athens Olympics were asked to complete an online personality assessment measuring the facets of Achievement Striving, Self Discipline, Hope (Optimism), Impulsivity and Anxiety. These facets were chosen due to their consistent relationship with performance in sport and other performance domains as noted in the above. Specifically, successful athletes score high on the first three facets and lower on the latter maladaptive two. Those individuals who had won medals at a World Championship (not a World Cup) or an Olympic Games (n = 21) were compared to those who had not (n = 28). Surprisingly, on average successful athletes scored significantly lower on the adaptive personality traits of achievement striving, self determination and optimism, although they did score significantly lower on the neurotic facet of anxiety. However, of more interest, when examined individually the successful athletes varied markedly in terms of their personality profile. Indeed an examination of the variability of the scores on the personality facets showed that "champions" were quite different from each other and more so than the non-champions particularly with respect to the more adaptive personality traits (see Figure 1). For those of us who work with elite successful athletes this is of no surprise: these athletes are extremely different in terms of their personality. Anecdotally one just has to think of the differences in personality of John McEnroe and Bjorn Borg; two very successful tennis players of the same era and yet with clearly different personalities. Moreover the results suggest there is very little point in looking for athletes that have a particular personality type to predict who will be successful at the elite level. Rather these results suggest that successful athletes come in different shapes and sizes (psychologically and physically) and that coaches, administrators and support service providers should perhaps pay more attention to the different individual needs of these athletes.

"The author acknowledges the input of Professor Michael O'Driscoll Department of Psychology, University of Waikato".

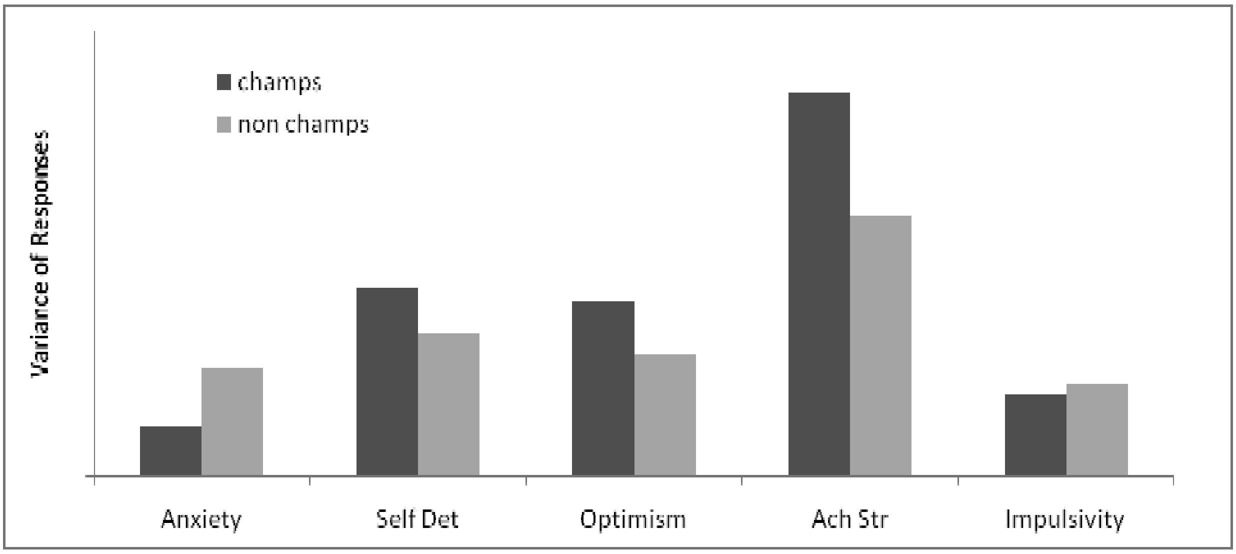

FIGURE 1: Comparison of the variability of scores on the personality facets measured between champion athletes and non-champion athletes.

Note

Obviously this is a very abridged report of the aforementioned study. For more information you should contact Rod Corban (rodc@nzasni.org.nz)

De Quervain's Tenosynovitis

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INTRODUCTION

De Quervain's tenosynovitis is a stenosing tenosynovitis of the first dorsal compartment of the wrist at the radial styloid.[5] It is caused by impaired gliding of the tendons of the abductor pollicis longus (APL) and extensor pollicis brevis (EPB) muscles, caused by thickening of the extensor retinaculum.[6] Although the term tenosynovitis is commonly used, histopathological studies indicate that the pathophysiology involves degenerative changes[2] and the absence of inflammation. Few treatments have been shown to lead to favourable outcome. However corticosteroid injection has been proven to be effective, with surgery reserved for those patients who fail to respond conservatively. This case study outlines a patient successfully treated for De Quervain's tenosynovitis.

CASE STUDY

A 34 year old woman was referred for physiotherapy with right thumb and wrist pain, of insidious onset. Her pain had began two weeks earlier and had been progressively increasing. She was having discomfort playing badminton, lifting her children and with any lifting or gripping activities of daily living. The pain was not enough to stop her doing any of these activities, however, she was worried that the pain was going to stop her lifting her children. She had seen her General Practitioner (GP) who prescribed her non-steroidal anti-inflammatories and referred her for physiotherapy. She was a mother of two, and a regular badminton player.

She described an intermittent sharp pain along the radial aspect of her right (dominant) wrist during activity. She complained of no pain at rest, and no night pain. She had no pins and needles or numbness.

She was otherwise fit and healthy, with no previous complaints affecting the thumb, hand, wrist, shoulder or neck.

Her examination findings showed her to be swollen over the distal radius near the radial styloid. She was tender on palpation over radial styloid process and the tendons of APL and EPB muscles. There was no loss of range of motion of the thumb, wrist, forearm or elbow joints. She had pain with resisted abduction of thumb. There was no crepitus present with movement. Finklestein's test was positive (pain reproduced at end of range ulnar deviation/thumb flexion). Her neck examination was unremarkable.

X-rays of her wrist requested by her GP were normal.

Based on the very typical history and examination findings a diagnosis of De Quervain's Tenosynovitis was made. It seemed unlikely to be intersection syndrome or osteoarthritis of the 1st carpometacarpal joint.

After initial assessment, treatment options were discussed with the patient. It was decided that the initial course of action would be provision of a splint to support and rest both the thumb and wrist and referral for a corticosteroid injection to the tendon sheath. The splint was provided and four days later she had the corticosteroid injection. Within 3 days of having the injection she was able to stop using the splint, and 8 days later felt no further pain with lifting or playing badminton.

DISCUSSION

There is good evidence for the efficacy of cortisone injection[1,6] early on in the treatment phase and later surgery for patients with De Quervain's who fail to respond to surgical treatment. Other treatment options include non-steroidal anti-inflammatories, splinting,[4] and eccentric training.

Splinting has also been used as a conservative treatment. Lane et al[4] studied 300 patients with De Quervain's and categorised the symptoms into minimal, mild or severe. The combination of splinting and NSAID's were found to be very effective in mild cases (88% had relief of symptoms) but less effective in moderate (35%) and severe (25%) cases. On the basis of this study, there is potential to encourage the use of splinting in mild cases of De Quervain's, but no evidence to support the use of it in moderate or severe cases.

Corticosteroid injection has been shown to be curative for De Quervain's. Most patients are symptom free after a single injection. The effectiveness is attributed to the anti-inflammatory effects of the cortisone, but the exact mechanism remains unclear.[6] A study by Avci et al[1] of 18 pregnant or lactating women compared steroid injection to splinting with thumb spica. All nine patients in the injection group achieved complete relief of pain, compared to 0 out of 9 in the thumb spica group. However only a small number of participants were used, and were all from one subset of society.

A systematic review by Ritchie & Briner[7] included seven observational studies with 459 wrists. They authors found that 83% of the 226 wrists that received injection alone were cured, 61% of the 101 wrists that received injection and splint immobilisation were cured and only 14% of those treated with splint only were cured.

This literature provides a basis for treatment options. Only the very mildest cases seem to respond well without early corticosteroid injection. It seems reasonable to provide a splint as it gives early and yet functional pain relief, but to abandon it as soon as the corticosteroid injection has been performed and its effects felt.

A small, pilot study researching a combination of sclerosing therapy and eccentric training led to encouraging results in terms of pain reduction and functional improvement.[3] However, there were only three subjects in the study, and as the intervention was both sclerosing therapy and eccentric training, it is impossible to attribute the improvements to one single intervention and further research should be done in this area.

Surgery has been identified as the treatment of choice after conservative treatment has failed. It has been reported to have success rates of 91% in non-controlled studies[6] but is associated with higher costs and the risk of possible surgical complications. In a long-term follow up study,[8] 94 patients with De Quervain's tenosynovitis were surgically treated. Subjects were considered for surgery if they had disease duration of longer than three months and unsuccessful treatment with one or two corticosteroid injections. A successful outcome was defined as absence of triggering and pain, and was achieved in all cases. The authors concluded that due to no complications affecting either tendon, that simple decompression of both tendons and partial resection of the extensor ligament could be recommended for excellent long term results in patients who fail to respond to conservative treatment.

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Intersection Syndrome

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INTRODUCTION

Intersection syndrome is an overuse, inflammatory condition of the distal forearm, located at the intersection of the first and second dorsal extensor tendon compartments, in the dorso-radial aspect. It commonly occurs with the onset of a new sport or work activity that involves repetitive wrist flexion and extension. It is important to distinguish from de Quervain's Tenosynovitis.[4] The pathophysiology remains unclear. It was generally thought to be due to unaccustomed friction between the two tendon compartments, but more recently was demonstrated as tenosynovitis of the second compartment, with adjacent swelling occurring subsequently.[1] We present a case study of a patient with intersection syndrome and review treatment recommendations.

CASE REPORT

A 33 year old male marketing manager and social rower presented with a one week history of pain in his right dorsal forearm and wrist. His pain occurred initially while racing on the water, with strong winds. He felt a twinge initially and then the pain became deep and ached for the last 500 m. Over the next week his pain intensified, became more frequent and his distal forearm became increasingly swollen. He continued to row and in windy or cold conditions he began getting pain into his thumb and felt a "creaking" in his forearm. He had no pain with other activities or while ergometer training. He only began rowing at the beginning of the current season and he had been training four times per week and raced in regattas at the weekends. He had had no recent trauma to the area, or previous wrist injuries. He had no neural symptoms. No medication had been taken prior to the initial consultation.

On examination it was noted there was swelling on the radio-dorsal aspect of the forearm 4 cm proximal to the radial styloid. There was tenderness, minimal warmth and crepitus on palpation over the above area. He was not tender along the line of the thumb abductors at the radial styloid. There was full active and passive movement of wrist joint but with pain and audible crepitus felt in dorsal wrist 4 cm from radial styloid with wrist flexion, extension and ulnar deviation.

Weakness associated with pain was noted with grip and pinch strength of the right hand. There was a negative Finkelstein's Test, negative Tinel sign of radial sensory nerve at exit of deep fascia and normal neck and shoulder examinations.

Further investigation was not necessary as a clear diagnosis of Intersection Syndrome was made based on the clinical history and examination. The differential diagnosis included de Quervain's tenosynovitis, entrapment of dorsal radial sensory nerve and tenosynovitis of the wrist extensors - "Sculler's Thumb".

Treatment was commenced and initially relative rest was indicated for the first week where he only trained on the ergometer. During this time he was instructed on modification of his rowing technique including:

- increasing use of palm and fingers while relaxing grip
- relaxing at end of each stroke
- correcting pull through phase
- controlling oar while feathering and squaring
- fleece grips worn in cold weather

Anti-inflammatories were prescribed by his general practitioner (diclofenac 75 mg bd).

He gradually returned to full training on the water over the subsequent two weeks where the modified/corrected technique was adopted.

He was pain-free and in full training, without the use of anti-inflammatories after three weeks of conservative treatment.

DISCUSSION

There have been limited studies evaluating the effectiveness of treatment options for intersection syndrome. It is however, widely suggested that it responds positively to cessation and modification of provocative activities and anti-inflammatories, within two to three weeks in majority of cases.[4] Rumball et al[10] explains that among rowers this injury is usually due to excessive wrist motion, and is generally traced back to fatigue or poor technique. Inexperienced rowers are more likely to suffer due to their inability to relax at the end of strokes and improper initiation of their pull through. Further they suggest ERG training initially to limit wrist motion and continue training, as it is the 'feathering' action on the water which generally causes excessive movement. It has been found that high winds and improper use of the wrist contributes to tenosynovitis in canoeists.[2] Cold conditions were also shown to increase oar gripping. Nowak et al[6] showed that cold conditions decrease sensory feedback from the hands, increasing grip forces, leading to excessive forearm and wrist movement. The use of 'fleece pogies' are recommended to prevent this in colder weather.[10]

There is strong evidence supporting the inclusion of anti-inflammatories as part of initial treatment for this condition. Pantukosit et al[7] carried out a prospective study with 30 patients with intersection syndrome, with all but 1 patient having dominant forearm pain. Patients were prescribed non steroidal anti-inflammatory medication, and advised to modify their aggravating activity. All patients at follow-up one week later had favourable responses. At 12-18 months post-treatment, 14 were followed-up and there was no symptom recurrence. Caution should however be used with topical anti-inflammatory agents as there is a suggestion the patients do worse with their use.[5]

There has been no research evaluating the effectiveness of splinting for intersection syndrome, but it is widely suggested that splinting is another way of resting the muscles involved if appropriate. A thumb spica splint with 15 degrees of wrist extension, for two weeks is generally prescribed.[7,8]

The majority of patients have an excellent response with conservative treatment but if this fails after two to three weeks, a corticosteroid injection at the site of swelling or the second dorsal compartment has proved successful.[1] Hanlon et al[3] reported a case of a 35 year old landscaper with intersection syndrome. He was initially treated with a thumb spica splint and anti-inflammatories. At two weeks he had minimal improvement. He received a corticosteroid injection adjacent to the area of maximal swelling. After 10 days he was pain-free and showed no recurrence of pain after six months.

It is very rare for good conservative management, as outlined here, to fail. If the patient isn't responding to conservative treatment after six weeks, it may be appropriate to operate, releasing the second dorsal compartment and debriding of the inflamed tissues.[9]

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The Complete Guide to Food for Sports Performance 3rd Edition

Authors: Dr Louise Burke and Greg Cox
Publisher: Allen and Unwin, Sydney 2010
Price: $40.99

I picked this book up at the airport whilst waiting for my children to arrive on a delayed flight. Having previously owned the first edition, I was aware of the strengths of that work and was curious to see how much had changed - in essence, a lot.

The principal author is Dr Louise Burke, who is head of the Sports Nutrition Programme at the Australian Institute of Sport. She is joined for this edition by Greg Cox, who is another member of the sports nutrition team at the same institution. Together they have put together a highly readable and comprehensive guide to nutritional issues facing athletes.

The book is divided into two parts. The first half goes through the principles of sports nutrition in a systematic fashion, and the second half is concerned with the practical application of those principles in a series of about 20 sports; all of the major sports are included.

The authors start with the big picture, including trends away from traditional food prepared from scratch and eating in a family setting with the social attributes that provides, to the all-too-familiar situation of rapidly prepared or reheated meals eaten "on the run". In other words, a move towards just feeding rather than the other attributes of other food consumption.

They cover the big trends following reports of superior sports performance by athletes consuming high carbohydrate diets. The food industry response was to provide large portions of low fat, high carbohydrate processed foods. Not surprisingly, this has led to a rise in obesity throughout the population. Not all athletes have high fuel requirements and a large energy budget and many need to focus on weight control with only low to moderate fuel needs.

The second issue is that of fluid balance. Following the publication of a study years ago showing the adverse effects of dehydration, today's athletes often appear welded to a drink bottle. In competition some obsessional athletes who rigidly follow previous hydration guidelines have died of hyponatremia, hence the current advice to drink according to thirst. Another issue they touch on is that of sugary drinks, which not only contribute to extra energy consumption but also can eat away at dental enamel. They explain that the admonition to drink eight glasses of water per day is folklore rather than being evidence-based.

The first half of the text follows a consistent pattern, with checklists following at the end of each chapter. These are excellent bullet point lists which can be readily applied to most athletes.

There is an excellent section on dietary supplements based on material from the AIS's Sports Supplementation Program. This groups supplements into categories A to D, depending on the evidence for their efficacy and also their potential for harm. Category A, which includes substances with the most benefit and the least risk, includes only three substances: caffeine, bicarbonate and creatine.

The second half of the book examines the dietary challenges for individual sports and the strategies that can be used to overcome them. Once again, there are useful checklists covering such issues as eating well in a cafeteria style dining hall and making weight for specific events.

Overall, I would rate this book very highly. It is a tour de force of the available information regarding sports nutrition and is presented in an easy to read format. The current edition runs to about 500 pages, which is an indication of how much knowledge has been accumulated in the past few decades. The challenge for today's athletes, and those who advise them, is to incorporate this knowledge into their daily routine. This book certainly provides the tools to do that.

Chris Milne
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Hamilton

Open: An Autobiography

Authors: Andre Agassi
Publisher: Harper Collins, London 2009
Price: $35.00

Andre Agassi is one of the great tennis players of the modern era - also one of the most colourful. Therefore, his autobiography was eagerly awaited and it does not disappoint.

The book opens with him on the threshold of retirement at the age of 36 at the US Open in 2006. He required a cortisone injection to help him play and the description of that is something that will interest all clinicians.

His early life was dominated by his father, who corralled him into playing tennis. Born in Iran, his father exhorted him to hit harder and "verk your volley". He hit 2500 balls per day as a youngster, most flung at him by a custom-made ball machine. As he put it "no one ever asked me if I wanted to play tennis, let alone make it my life". He grew up on the outskirts of Las Vegas and when he was aged four was hitting balls with tennis greats such as Jimmy Connors. His father strung Jimmy's racquets.

At the age of 10 he played at the National Championships and entered Nick Bollittieri's tennis academy. He rebelled against the conformity required here and this was a harbinger of his later flamboyant behaviour. The book details his close relationship with Gil, his trainer. He won his first Grand Slam in 1992 at Wimbledon, beating Goran Ivanisevic, and describes an early crush on Steffi Graf, the women's champion that year. He was disappointed not to get to dance with her at the post-Championship ball.

Growing up as an American he was very conscious of image and his obsession with his hair, or lack of it, crops up repeatedly in the book. He was introduced to the actress Brooke Shields via the wife of Kenny G, the musician, and ended up marrying her.

His volatile behaviour is well described in the book and on one occasion he broke all his trophies in a fit of despair. The highs are included, such as the Olympic final where he won a gold medal in Atlanta in 1996. These contrast markedly with the lows, with his well publicised dalliance with crystal methamphetamine.

After the breakdown of his relationship with Brooke Shields he acquired a new coach in Brad Gilbert and he proved to be a wonderful mentor. Agassi describes meeting Nelson Mandela as one of the highlights of his life.

His dogged pursuing of Steffi Graf is a story well told. He meets her after a practice session and is clearly lovestruck and sends her a birthday card made from the first class menu on the plane. Stefanie, for that is her preferred name, sees his good side and the love story that develops is well told. Peter Graf, her father, is as obsessional as Andre's father and the description of their first meeting is excellent. In particular, Peter Graf was obsessed by the ball machine.

In his later competitive years, he could see the value of setting standards and became a supporter of Wimbledon's "all whites" dress policy. He describes the retirement of his contemporaries like Michael Chang and Jim Courier and regards himself as the last of the 1980s Mohicans.

He donates a substantial portion of his wealth to the founding of the Andre Agassi College Preparatory Academy on the outskirts of Las Vegas. There, he brings in sports stars to meet students, and he sees the irony of how he tried to skip school as a child but now sees the value in education.

In essence, this is a great book. It is definitely from the heart and is a warts and all description of his life. The prose is crisp and clear. I am no sports psychologist but at times the descriptions appear over-dramatic, however this is what one might well expect in a book with its emphasis on the highs and lows. If you haven't read this book already and you are any fan of sporting autobiograpies, get hold of a copy.

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PATIENT ADVICE SHEET

ANTI-INFLAMMATORY DRUGS (NSAIDs) FOR MUSCULOSKELETAL PAIN

1 What are they?

They are medicines that are used extensively to treat injuries and joint pain. The first such drug was aspirin, developed in 1898. All the newer drugs are designed to provide the same benefit, with less frequent dosing and fewer side effects.

2 How do they help in musculoskeletal pain?

In many cases, pain is caused by inflammation. Anti-inflammatory drugs block prostaglandins that cause inflammation. In this way, they reduce pain and swelling.

3 Are there side effects?

Yes, there are common side effects:

a Burning stomach pain. Some NSAIDs can damage the protective mucous lining of the stomach. This affects about 10% of people who take NSAIDs, and can be dangerous in older people who are on cortisone tablets or have heart disease. If you vomit up coffee ground material, this is serious and you should see a doctor the same day.

b Fluid accumulation. You may notice swollen ankles — this is more common in older people. NSAIDs reduce blood flow to the kidneys. In people who are dehydrated (e.g. athletes on hot days) this can cause acute kidney failure, so keep up your fluid intake, especially in hot weather.

c In rare cases, people with asthma who take NSAIDs may notice wheezy breathing. This is serious and should be reported to your doctor.

d Pregnant women should not take NSAIDs, as they can affect the blood circulation in the unborn child.

4 Which types of anti-inflammatory tablets are there?

There are two main types, as listed below:

Traditional (non-selective) NSAID, eg:	*Selective (COX -2) Agents, eg:*
Aspirin (Disprin)	Celecoxib (Celebrex)
Ibuprofen (Nurofen, Brufen)	Etoricoxib (Arcoxia)
Diclofenac (Voltaren, Diclax)	Lumiracoxib (Prexige)
Naproxen (Naprosyn, Synflex)	Meloxicam (Mobic)

The selective (COX -2) agents were developed for use by people who either:

a Had burning stomach pain when taking traditional NSAIDs (ie, a sensitive gut); or

b Were on cortisone tablets, or otherwise at high risk of stomach bleeding on traditional NSAIDs.

They are no stronger than traditional NSAIDs, but cause much less burning stomach pain in those with a sensitive gut.

5 Who can benefit from use of NSAIDs and COX -2 agents?

Anyone with injury or joint pain, where inflammation is present. They are of particular use where there is inflammation in a nearby joint (eg, water on the knee) that may affect muscle function.

6 What are the options for those people who have a sensitive gut? Either:

a Use a selective (COX -2) agent — these agents do tend to cost more, though; or

b Use a traditional NSAID, with the addition of Omeprazole (Losec) or Pantoprazole (Sumac); or

c Avoid anti-inflammatories drugs altogether and use Paracetamol (Panadol).

7 How are these drugs best taken?

To minimise the risk of gut upset, you should take all anti-inflammatory drugs with food.

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