



This edition of the Round Table examines the Javelin. The multi-national panel consists of Fatima Whitbread (GBR), who won gold in the javelin at the 1987 World Championships in athletics and is now a coach; Anders Borgström (SWE), who has been Swedish National Event Coach for the Javelin since 1971; Bill Heikkila (CAN), who has been Canadian National Coach for the javelin since 1980 and competed in the 1968 Olympic Games; Lutz Kühl (GER), who was a coach in the former GDR and has been responsible for the throwing events for the German Athletics Federation since 1991; Alan Launder (AUS), who is Australian Track and Field Coaches Association's National Pole Vault Coach and a Senior Lecturer in Physical Education at the University of Adelaide; Kevin McGill (USA) who is Editor of 'Track Technique' and Head Track and Field Coach at the University of Columbia, USA and regular contributors José Manuel Ballesteros (ESP) and Sergio Guarda Etcheverry (CHI).

1 Do you think it would be a good thing to modify the women's javelin so that its flight characteristics were more in line with those of the men's javelin?

WHITBREAD: Under no circumstances should the technical design of the women's javelin be changed. The current economic climate, plus the lack of competitors in the event, would make it a totally uneconomical proposition.

Currently, neither clubs, schools nor individual athletes have the finance to purchase new javelins let alone completely replace implements.

Today's javelin is more than adequate and the time spent canvassing for change without thinking of the financial consequences would be better spent on providing coaching for young athletes.

BORGSTRÖM: Yes! The change that came into force in 1991 was rather small. I participated in a meeting with some representatives from the IAAF Technical Committee and Women's Committee and other coaches in Arvidsjaur, Sweden back in 1988 where modification of the rules was discussed. At that time it was not considered politically wise to go all the way and the result was a compromise: the position of the centre of gravity (CG) remained the same but the minimum diameter of the rear part of the javelin was increased so that its percentage of the whole is the same as the men's.

This was a step in the right direction but did not go far enough. Even at international level, some throws can land flat, and heptathletes and not so accomplished throwers have even greater prob-

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lems. The change to the men's javelin means that we can now concentrate on the performance of the athletes and not have endless discussions about flat landings. In short, we now have a situation where the referees no longer play first string. I hope that this will also be the case in the women's event some day!

The advice that athletes should choose a javelin whose distance potential equates to their ability has already proved to be nonsense!

HEIKKILA: The men's javelin was changed primarily because of the distances being achieved (in particular Uwe Hohn's world record of 104.80 metres) but also because of the difficulties in judging whether the javelin had landed point first in a 'fair' throw. At the highest level, women throw some 20 metres less than the men and so the distance consideration is not a factor.

However, despite recent modifications in the specifications of the women's javelin, it would appear that there are still occasions where difficult and sometimes controversial calls have to be made by officials when the javelin lands. I believe this problem is particularly acute in the Heptathlon because of the shorter distances achieved and participants' comparative lack of skill.

Because of this, I believe that there is room for improvement in the design of the implement with the aim of encouraging point first landings. This would, of course have to be weighed up against the expense of having (again) to re-equip clubs etc with new models as well as the prospect of further reduced performances at world class level.

KÜHL: No, because in the javelin technical ability and skill will always determine performance while shifting the javelin's centre of gravity to the front reduces the aesthetic appeal of the event.

LAUNDER: Definitely not. The modifications to the women's javelin have been very effective. They have not changed the flight characteristics markedly but javelins now rotate quickly enough in their final flight stages to ensure more accurate judging of legal and illegal landings. I would make the following points:

a) my observations of the 1992 Olympic Games in Barcelona lead me to believe that the Nemeth 600gm javelin does not rotate as quickly in the final stages of flight and tends to land flat - this was not always marked as a foul by the judges which is a cause for concern.

b) there is sufficient difference between the old and new rules javelins and new records should be set both at national and interna-

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tional level. However, it will be a very long time before we see another 80m throw with the womens javelin.

c) if any change is needed it is to the men's javelin. I believe the present specifications have introduced a major element of chance in that it is much more difficult to ensure an effective javelin flight path. Javelins which appear to have been released at the correct attitude and angle often drop almost vertically from what seems potentially to be a much longer flight path.

McGILL: The women's javelin has been a disaster in some US college meetings I have witnessed. If someone throws 40 metres while using a 60 metre javelin, the result is likely to be a flat throw. This scenario duplicates the problem with the old men's javelin, where it really was impossible to say for certain that a javelin landing was flat or not. Cameras can clearly show that errors have been made. This is not to criticise officials, as I believe that a javelin travelling at that speed makes exact judgement impossible. The men's javelin has eliminated this problem, and the women should follow suit.

BALLESTEROS: The men's javelin is 40% heavier than the women's. As a comparison, the men's disc weighs 50% more than the women's implement. For this reason results in the men's and women's disc events are fairly similar whereas in the javelin event the women are at a disadvantage in comparison to their men counterparts. For this reason I don't think it is necessary to change the characteristics of the women's javelin.

GUARDA: The technical modifications made to the men's javelin in 1986 attempted to solve two problems facing the event at that time by, on the one hand, reducing the distances being achieved by the world's elite throwers (Uwe Hohn set a world record of 104.80m) and, on the other hand, helping officials whose task of judging whether a 'floated' javelin had landed nose first or flat was an extremely difficult one, especially in pressure situations. The new men's javelin solved both problems by moving forward the location of the centre of gravity of the javelin. This had the effect of altering the angle of projection and the parabola of the javelin's flight thus increasing the angle of landing (javelins now land point first).

Currently, in the women's javelin, there is not the same problem with regard to distances thrown, although there are problems with the judging of the event, which in many cases is left to the interpretation of the officials. From this point of view, it would be advisable to introduce technical modifications to the women's javelin such as, for example, moving the location of the centre of

gravity to increase the angle of landing. Another alternative would be to move the cord grip back along the javelin. This would have the effect of moving the point of release away from the javelin's centre of gravity.

2. In your experience, what are the most common injuries suffered by javelin throwers and what preventive measures would you suggest?

WHITBREAD: In my experience the most common injuries are:

Back: Many international throwers use a weight training belt to help them when throwing. The great Uwe Hohn's (GDR) premature retirement due to severe back injuries is an example of what can happen to throwers.

- Javelin Elbow: Coaches must look out for and correct bad technique, i.e. low elbow - over rotation.
- Knee: Mick Hill (GBR) and Seppo Raty (FIN) are two current world class throwers who have suffered from this injury.
- Achilles: Tessa Sanderson suffered from this injury.
- Abductor/Shoulder: Problems in this area affected Steve Backley (GBR), Miklos Nemeth (HUN) and me!

During my competitive career I was careful to have a good warm-up and wear adequate clothing (thermals). I made regular visits to physiotherapist and osteopaths following the premise that *prevention is better than cure*.

It is also important to *listen to your body*. It is useful sometimes to set aside time for isolated movements to strengthen the 'branches' i.e. the small muscles which work along with large muscle groups like the trunk. I always included specific drills during warm-up to help prepare myself mentally as well as physically.

BORGSTRÖM: Javelin throwers can be affected by a wide spectrum of injuries. The back, shoulder, elbow, knee and foot are all heavily stressed, particularly when throwing but also during preparation. I would like to focus on injuries that affect the elbow, since most throwers suffer from them during their careers. To avoid, or should I be humble and say minimise, injuries a couple of basic factors should be considered:

- It is very important to develop an accomplished technique at a young age. Accuracy in throwing technique and in different training exercises is the most efficient way of avoiding injuries.
- Physical development must be carried out in a harmonious way. Maximum and specific strength should be built up step by step. The elbow must be taken into consideration and plenty of training done to encourage solidity of the joint.

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But even if these basic factors are taken into consideration the risk of injury remains. Athletes and coaches can take comfort from the fact that, after injury and correct treatment/rehabilitation, elbow solidity may be better than when obtained through normal training. I do not mean to encourage younger throwers to injure their elbows deliberately, but rather to underline the fact that injury followed by proper rehabilitation is definitely not a disaster!

HEIKKILA: The javelin throw is clearly one of the most explosive events in athletics and, as such, there is a good chance of injuring a number of areas of the body. One aspect of the explosiveness has to do with the sometimes violent braking action that is exploited to initiate the throw. Indeed, some have suggested that the athlete not only 'run into a brick wall' but look forward to the collision! This can sometimes lead to traumatic injuries caused by the sudden forces that are developed. This is especially true if the athlete happens to be in an 'unsafe' position because of technical error. For example, injuries to the lower left part of the back, can occur if the athlete begins to open up the right side of the body too early. This then leads to the front foot swinging too far to the left so that it lands 'in the bucket'. Other injuries of a traumatic nature can occur most often in the throwing shoulder, elbow, either knee, upper or lower back or groin. These injuries can be the result of poor timing/technique, inadequate warm up or inadequate preparation (throwing too hard too early.)

There is also a myriad of common injuries due to general overuse and/or the effects of throwing over a period of time with poor technique. These type of injuries occur particularly in the elbow and shoulder and include tendinitis, bursitis, rotator cuff strains or tears etc. Some of these injuries can be traced to inadequate flexibility, especially in the rotator cuff, as well as to too much laxity in the shoulder capsule.

Since it is easy to fall into the pattern of throwing only with the dominant arm one should try to ensure that throwing is also done with the non-dominant arm in order to avoid over-development of the muscles on one side of the body. I also believe it would be useful to train with implements that have handles. These would be placed on the ground just in front of the athlete's left foot. The implement would then be grabbed and thrown up and back over the athlete's right shoulder. This would provide some degree of balance to all other throwing activities which are in the opposite direction.

Other injuries may occur in non-throwing training such as weight training or dynamic locomotor activities. The best preventative methods include proper warm up and execution of movements with good technique. It is also important to stop training before athletes become overly fatigued and not to attempt exercises like heavy lifts that are beyond athletes' capabilities. One should also

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be constantly aware of potentially dangerous training conditions. For example, depressions in the ground where the all-weather run up meets the grass.

When athletes return after injuring their throwing arms it is important to ensure that muscles, tendons and joints have been prepared adequately. I have seen occasions where athletes return after an elbow injury which appears to be fully rehabilitated only to then injure another of the muscles or tendons that are used in the throwing action. In one instance an athlete had an injured ulnar nerve successfully re-routed but then developed problems with his supraspinatus tendon whose 'job' was to stop the arm following the javelin once the throw was completed. So although the elbow had been rehabilitated systematically after surgery another vital contributor to the throwing action had been inactive for a long period of time and should also have been specifically prepared for the return. Some great baseball pitchers have been able to stay in the game for many years although the stresses are similar to those in the javelin event. Nolan Ryan attributes his longevity as a top baseball pitcher to a strict regimen of exercises especially designed to strengthen and protect the rotator cuff. Coaches and athletes involved in the javelin can learn from this.

KÜHL: The most common injuries are: epicondylitis of the right elbow, chondropathy in the bracing leg and inflammatory injuries to the back muscles. The following measures should reduce the risk of injury:

Increase load tolerance with a continuously increasing programme over the course of one or several years. Observe certain physiological/morphological principles of load and recovery within both micro and mesocycles through:

- the development of movement technique;
- mobility training;
- target-oriented medical prophylaxis;
- observance of recuperation and the principles underlying the build-up of form.

LAUNDER: The most common injuries are to the flexors of wrist and fingers, followed in turn by the extensors of the wrist and fingers, the rotator cuff in the shoulder, by injuries to the spine in the fourth and fifth lumbar region and finally, ligament damage to the left knee (of a right handed thrower).

The obvious solution is effective conditioning and improved technique. However, I would like to make the point that we must be prepared to undertake more sophisticated analysis and diagnosis because I do not believe that we have taken sufficient care in the past. We have tended to treat symptoms rather than causes.

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Essentially we must consider injuries not just at their sites but at their 'roots' in the throwing action. Perhaps we need more help from high speed film and biomechanical analysis.

McGILL: I do not have exact statistics on injuries, although I have suggested to some coaches that these be kept. My observation is that women in the US have suffered a very high rate of injuries to knees; men appear to be bothered more by arm and shoulder injuries. Knee injuries could be reduced with emphasis in two areas: (1) correct biomechanical errors in the throw, (2) strengthen the legs with a more comprehensive programme.

The technical errors that I have seen relate to the amount of twist used in the throw. As the thrower lands with the final 'L-R' for the actual throw, I see no reason why the right foot should point 90° away from the throwing direction, which is what I see often. What I also see is that most throwers leave all the spikes in the right shoe for this rotation. This is like gluing your foot to the floor, and trying to turn it! Something has to give, and that something is the knee. I would recommend that throwers take all the spikes out of the right shoe except for the inside front spike, and outside back spike on the ball of the foot. This will be sufficient to prevent slipping, and still allow an easier rotation. Keeping the right foot at no greater than 45° to the throwing direction will also help. The left leg needs to be strengthened by months/years of squats, leg extensions, plyometrics, etc., and then the left foot should be pointed in the throwing direction, so that the pressure is on the upper leg muscles, and not the knee.

Arm and shoulder problems can be alleviated, but never eliminated. I am surprised to find throwers still using basic power lifts, and only some snatch and clean. Exercises have been devised (mainly from baseball) to strengthen the arm and shoulder, and these should be incorporated. In the US, the medicine ball is finally seeing wide use, and perhaps this will have an effect in years to come. The arm action still has to be coached and studied, to make sure that the elbow is well above the shoulder as it passes, and that the thumb of the throwing hand points down at the end of the throw, palm away from thrower. It may take hundreds of reps to get a perfect arm action, but I believe people don't take enough attention to it. If a young fellow pops a 64 metre throw in high school, the general assumption is you do not mess with the arm action.

BALLESTEROS: 'Javelin elbow' is evidently the most common injury, followed by those affecting the shoulder. In any case, the risks of the javelin event are numerous: the vertebral column, adduction muscles and knees may also suffer at times. Prevention depends on introducing strength training with adequate loads and correct throwing technique as soon as athletes take up the event.

GUARDA: In many years of teaching and coaching athletics, I have introduced the javelin event to many novices and coached some top South American throwers, both junior and senior, but have observed few injuries. I believe this has been because: a) I have been very careful, when initiating athletes to this event, to ensure a balanced and harmonious physical development, b) I insist on an adequate general and specific warm-up in every training session and c) I insist on the execution of correct technique in all types of throws, regardless of the implements used.

With elite athletes it is important, before starting highly demanding technical work, to develop an adequate and progressive programme of physical conditioning. This is aimed principally at strengthening those muscle groups that are brought into the throw and improving the joint mobility and muscle elasticity around the shoulders and hips. Exercises may be done either alone or with assistance and with or without implements.

In any case, the injuries most frequently observed are tendinitis of the throwing arm elbow, pain in the lumbar region and, in some cases, pain in the right foot generally the result of throwing on grass without special javelin footwear.

With regard to tendinitis of the elbow, I would advise a revision of throwing technique. This is because the pain often occurs when throwers execute the final action with a wide sweep of the arm and a low elbow. In other cases, it is caused by overtraining: too many throws in a session or throwing with heavy implements. As well as technical measures which can be applied, it is sensible to reduce training loads, to apply ice to the painful area and to apply strapping below the elbow. These measures will diminish the tension around the joint. I would recommend the use of a weightlifter's belt as a way of preventing injuries to the lumbar region, both in strength training sessions as well as while throwing.

3 What are your views regarding the exact timing of the withdrawal of the javelin during the approach run?

WHITBREAD: In the early part of my competitive career, I was most comfortable with a withdrawal during the last seven strides - I felt I needed the extra room to set myself up. However, once I had established my optimum approach run (total 11 strides), I withdrew on the first of the last five strides.

With my young training squad, I introduce them to this phase by letting them do several javelin alignment runs and withdrawing on the first of the last five strides when they feel *ready*.

I will not generalise on this point because I feel the coach/athlete understanding is of *paramount* importance.

BORGSTRÖM: This must be adapted to each individual thrower! Athletes should aim to be capable of keeping good balance and rhythm in the final part of the approach, and of reaching the throwing position in a good position of the 'system thrower/javelin' with

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sufficient speed. If they do this, then individualistic interpretations of technique are acceptable. The only advice I would give is: Don't overcomplicate!

HEIKKILA: The withdrawal of the javelin should begin the moment the left foot touches the ground either five or seven steps away from the throw. For example, if the athlete is using a five step final approach, the fifth from last step should be with the left foot just as the javelin begins to be withdrawn. It will be fully withdrawn by the time the cross step begins off the left foot, on the count of three, with the throwing stride taking place on the count of two-one. The athlete's final check mark should be on the left side of the approach at the point where the fifth (or seventh) from last step will strike. It is important that the left shoulder begins to turn to the athlete's right at the same time as the left foot touches the ground and the withdrawal begins. This should be followed immediately by a sweep of the left arm across the body to counter the action of the right leg swinging forward. This facilitates movement forward in the final steps of the approach and throw.

KÜHL: Because the moment of initiating the acyclic phase of the total movement is critically important, timing within a five-stride-rhythm is of great significance but not as important in rhythms of seven-strides or more. The withdrawal of the javelin should be accomplished during 2 to 2.5 strides; in the case of faster approach speeds the withdrawal should be accomplished during 1.5 to 2 strides. The timing, however, is not of fundamental importance. The last three strides are much more important

In general, all types of timing depend on:

- the athlete's technical training state;
- the main task of the mesocycle within the final phase of the perfection of technique;
- the exploitation of the optimum dynamic potential. This presents the greatest problem because of the great forces and velocities that are entailed.

LAUNDER: I believe there are many 'roads to Rome' and that there are only two important criteria: that the javelin is lined up so that throwers can hit through the point and that athletes approach the release with a relaxed upper body. My method is not the only approach. Indeed I would dearly like to experiment with the 'Lusis' method because I believe that it may have advantages in creating the pre-stretch sought for as the throw is initiated, as well as meeting the above criteria. Anyway, in South Australia a simple 8/5 or 12/5 run-up pattern is used in which the withdrawal begins as the

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right foot hits a check mark five strides before release. At this point the thrower runs past and away from the javelin in the next two strides. We believe that this method gives the thrower enough time to line the javelin up correctly but not so much time that the withdrawn carriage of the javelin causes tension in the arm or upper body.

McGILL: This fellow with the world record, Jan Zelezny, according to one report, does not even use a measured run. The question on timing is an easy one in one sense: with a five step rhythm, just leave the javelin in space when the left foot lands. If you use a seven step, leave it on the first left landing. I assume we will use the simple count 'left-right-left ... right-left'. Unless one has the great leg action of Backley, I see no benefit to the seven step rhythm, or more. My concept is that less side action is better. The real key to the javelin throw is the rhythm in the last two strides. The five step rhythm is like the three turn throw in the hammer; you can attack quicker.

The drop style withdrawal is tricky, but has worked for more than one world record holder in the men's javelin. It appears that a regular withdrawal, or 'leaving the javelin alone', would provide more stretch capability in the shoulder. On the other hand, Zelezny may be getting some form of stretch reflex ... I am not sure. In order to follow correct walk/run action with the arm, athletes should initiate this action as the left foot lands, whatever style they choose.

GUARDA: The action of withdrawing the javelin is part of the last five steps of the throw. It should be realized during the first two simple steps of this phase, without reducing the speed of transfer, in a harmonious and controlled way. The body's balance and fluidity of movement should not be altered, and the action should lead on to the three final preparation steps of the throw.

For the withdrawal of the javelin any of a number of techniques can be used: from above the head and to the rear, from the level of the shoulder directly to the rear, or from below that level towards the rear (e.g. Janis Lysis). The important thing is that at the end of this action the throwing arm finds itself naturally extended towards the rear, with the palm of the hand directed upwards and the javelin positioned in an oblique ascending plane, aligned in the direction of the runway.

Athletes who have problems coordinating this action would be advised to withdraw prematurely, that is, to use seven final steps instead of five. With this technique novices can avoid a marked interruption in the rhythm of the approach. However, athletes should incorporate two linking steps between the finalisation of the withdrawal and the three final steps. This permits acceleration in those final steps.

4 What type of weight training would you recommend to help the javelin thrower make the transition from junior to senior ranks?

WHITBREAD: I started out with circuit training, progressed to stage training and at the age of sixteen commenced a light weights programme.

I was tutored by several experienced weight lifters who taught me the correct technique – this is vital.

I also progressed with my aerobic and anaerobic sessions, mobility and a plyometric training programme. All these components helped to improve my general strength. As my career progressed, my weight training programme increased to 4/5 sessions per week. Two of these weekly sessions included exercises which were specific to the event.

It is important to periodise weight training programmes. I did it the following way:

- (1) conditioning, (i.e. 4 sets x 10 repetitions);
- (2) strength period (using pyramid programme);
- (3) competition and maintenance period from May to September.

Also, the junior/senior transition is about commitment. Athletes must dedicate their lifestyles to the event. Training is a way of life with its cycle of exercise and rest and should pay attention to proper diet, with warm weather training, if possible, for a change of environment to stimulate the body and mind.

BORGSTRÖM: For young or beginner athletes, the technique of javelin throwing must be developed before starting traditional weight training. When training with free weights I prefer to concentrate on teaching a precise technique in different exercises using mainly light weights. When athletes reach an advance stage they should also reach a peak when it comes to weight training, especially with regard to the number of sets and the range of exercises. At the top level, athletes should concentrate on exercises that will directly influence javelin performance. The general background will have been built up previously. With regard to traditional weight lifting this can mean very few exercises. Taken to the extreme, this can mean just the snatch! Lifts should be started off the ground (hanging) and carried out at highest possible speed (approximately 60-105% of maximum). There should be no more than three sets. It is very important to produce the highest possible starting power.

The javelin thrower should not 'live' in the weights room! It is much more important to develop the required specific throwing strength. Having built up the necessary background of general and maximum strength, this can be achieved in more efficient ways than just lifting weights.

HEIKKILA: There are a number of ways for young javelin throwers to become stronger. As well as traditional weight training using free weights or machines, methods employed can typically consist

of medicine ball training, bounding and jumping activities and calisthenics and circuits using body weight resistance. Given the myriad choices on the 'menu', the answer to this question is not a simple one. I think, however, that one of the most important considerations should be the preservation and enhancement of the athlete's technical development. In other words, anything that has an adverse effect on technical development should be avoided.

Perhaps the most striking illustration of this is my own experience of watching the Finnish thrower Kimmo Kinnunen at various periods of his life. I first met Kimmo when I visited his illustrious father Jorma. I vividly remember how the former world record holder was teaching his four year-old son how to throw sticks properly 'javelin style' with an all-important scream at the end! It later became obvious that this youngster was extremely well taught technically, as he went on to establish national age group records of 44.90 (aged 9), 49.84 (aged 10), 57.64 (aged 11) and 61.86 (aged 12) with the 400 gram javelin.

In the first World Junior Championships in Athletics in 1986 where he placed fifth, Kinnunen was basically still a skinny kid in comparison with other athletes but had impressive technique. Five years later, at the World Championships in Athletics in Tokyo, Kinnunen won gold and, although obviously a much bigger and heavier man, had retained the all important technique. This is just as necessary when throwing an 800 gram javelin over 90 metres as when throwing a 400 gram javelin over 60 metres, whether one is 12 years-old or not!

KÜHL: In general, this question is difficult to answer because:

- a) all types of strength training (general strength training, maximum strength training, special strength training) are interdependent. This means that the predominance of one type of strength training leads to the neglect of necessary training stimuli and to the development of muscular imbalances or performance stagnation;
- b) all types of strength training are suitable for the javelin thrower, and a variety of strength training is necessary to develop strength;
- c) the methodical training build-up over one year contains varying proportions of general and special strength training;
- d) Over a period of years, greater strength stimuli are necessary. The limits of these stimuli depend on:

- load tolerance;
- the state of athletes' strength technique;
- total training time available.

Other factors to remember are that:

- Periodisation over the course of the year (in micro, meso-and macrocycles) is essential;

- The athletes' total development is only possible when strength training is a continuous process and if the components of all strength training forms are effectively exploited;
- Strength training must be effective: highly specific strength training should only be used if, during high-performance training, the limits of all other types of strength training have been reached. Beware! The premature introduction of highly intensive or highly stressful types of strength training can limit the development process.

LAUNDER: The answer to this question is determined by the word transition. In Australia at the present time, the biggest problem is that, because of low standards at senior level, juniors rush to make the transition and often take short cuts which can lead to the injuries described. Therefore, I believe that weight training should be part of an integrated approach to conditioning for the javelin where the weakest link of a chain can produce not only an inconvenient injury but a career ending one. Clearly, weight training contributes to efficient development of strength in the major muscle groups of the legs, trunk, shoulder and arms. But this should only be part of a total programme of conditioning which includes plyometrics and must include throwing all kinds of implements of various weights in many different ways.

McGILL: This question on junior to senior transition with weight training is excellent. In general, I believe juniors need to concentrate on strength/flexibility, rather than speed movements. For instance, I see little benefit in juniors performing rapid power cleans, etc. My concern, basically, would be to make athletes stronger in all movements. If hypertrophy were to be given greater emphasis over power, this would be the starting point. I would like to see a well-balanced muscular development, which can later take quick lifts, and harder plants in throwing.

While a recent study at the University of New England, Australia (McEvoy and Newton) indicated that weight training is more effective than medicine ball training in improving throwing velocity in baseball players, I would still suggest that a well rounded medicine ball programme be implemented, if it has not been. Certainly, the success of young Finnish javelin throwers indicates that the medicine ball should play an important role. Other suggestions would be to experiment with various weighted balls and javelins, as part of a weight training programme. Ideally, a computer programme such as Analyze, developed by Ed Harnes, would be available to help guide the coach as to what concepts to emphasize. Coach Harnes devised this programme to show the coach graphically what the athlete should work on, after undergoing a series of tests.