

## Video recording of seated shot-putters during world-class events

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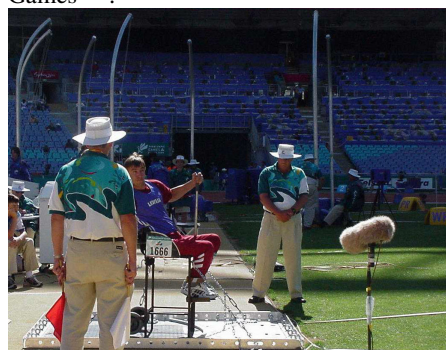
**Background.** Traditionally, the understanding of the performance of elite seated shot-putters is based on video data recorded during training <sup>(1)</sup>. Such recording easily accommodates the usual experimental requirements. However, data is partially representative of the technique implemented by athletes during competition. For instance, elite seated shot-putters perform  $15\pm 9\%$  less than their personal best during training <sup>(1)</sup>. Since 2000, a team from Queensland University of Technology have been collecting realistic information using video data recorded during world-class events such as Paralympic Games (Sydney and Athens), IPC World Championship and Australian national events <sup>(2,3,4)</sup>. The purpose of this paper is to share the outcomes of these innovative video recording experiences.

**Methods.** The QUT team started the recording of elite seated shot-putters during the Sydney 2000 Paralympic Games <sup>(2)</sup>. Two compact, high-speed digital video cameras placed either on both sides or in the front were used to record 717 attempts performed by 93 seated athletes from 10 classes.

**Results.** In this study, 15% of the attempts were missed, 72% were recorded and fully available for analysis, 10% were incomplete and 2% were obstructed (as a percentage of actual attempts). The filming during the Lille 2002 III IPC World Championship provided similar outcomes. However, recording during Australian national events achieved higher successful recording rates due to less crowding around the throwing pit.

**Discussion.** These experiences demonstrated that the missed, incomplete or obstructed attempts were due to a **lack of control over the event** and the **requirements non-disruptive filming**. For example, a retake of a performance was impossible and every attempt of each athlete must be recorded in order to capture the best puts, which was known only at the end of the event. The recording cannot interfere in any way with the athletes, the officials, the referees or the TV crews. For instance, no active or passive markers may be placed on the athlete. This increased considerably the time necessary to track frame-by-frame of the body landmarks of the athletes. The camera views can be obstructed at any time by several factors such as broadcast TV crews, referees and equipment (Figure 1). Furthermore, the number of cameras was limited and their position should not interfere with any of the other on-going events.

Figure 1: Example of the field of view for the side camera and an obstruction caused by a referee during the Sydney 2000 Paralympic Games <sup>(2)</sup>.



**Conclusion.** Coaches, athletes and sports scientists, as well as classifiers and referees benefited from kinematic analyses based on video recording during world-class events.

The outcome of such analyses contributed to the fairness of the event by assisting with classification and judging procedures. This can also be used to enhance future performance by providing information on the influence of different techniques and seat design.

Such video recording allowed **sports scientists** to produce a more realistic biomechanical analysis taking into consideration a number of external factors influencing the performance such as stress, mass-media, referees, use of official equipment, travelling fatigue, etc. and gather information from a significant number of athletes in each class (Figure 2) <sup>(3)</sup>. **Coaches and athletes** can use these videos to complement their observations obtained during training. The understanding of the actual performance can also contribute to improve training methods, seat design, curricula for existing coaching courses and talent identification systems. **Classifiers** dividing disabled athletes into classes according to their pre-event functional level can verify the true compliance of an athlete during the classification. Furthermore, an inter-class analysis can validate the classification principles (Figure 3) <sup>(4)</sup>. **Referees** can also use the video recording as a medium to settle protests of athletes against their decisions as experienced during the Sydney 2000 Paralympic Games on several occasions.

Figure 3: Classification vs the resultant of the speed of release of the put for the men and women gold medallists from F52 to F55 class <sup>(3)</sup>.

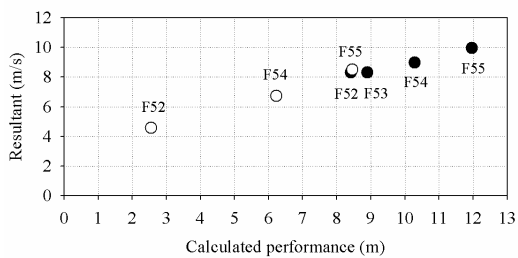
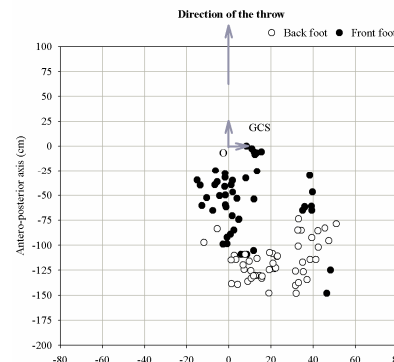


Figure 2: Position in the transverse plane of both feet of the 12 F34 athletes (48 attempts) during the Lille 2002 III IPC World Championship



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## References

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