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THE USE OF A NEW BIOFEEDBACK INSOLE WEIGHT-BEARING MEASURING DEVICE IN THE ASSESSMENT AND REHABILITATION OF SOCCER PLAYERS: A CASE STUDY‡

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SUMMARY

Partial weight-bearing is usually prescribed to athletes during recovery from lower extremity injury or surgery. Current methods for partial weight-bearing gait training that include scales or force plate platforms systems are mainly subjective, and limited to static applications. Studies also confirm the inability of subjects to reproduce the aimed weight-bearing level. Auditory and visual biofeedback devices are also limited to static weight-bearing positions. A computerized air-insole auditory biofeedback system was utilized in the present study to measure weight-bearing in the heel and forefoot during locomotion, in the case of a soccer player who had undergone medial femoral condyle fracture surgery. The system was successful in accurately training and assessing the player during the three and two week periods respectively at 30% and 60% weight-bearing, until equal bilateral full weight-bearing and gait patterns were achieved.

Key words: Partial weight-bearing, gait training, biofeedback devices, soccer, exercise

ÖZET

FUTBOLCULARIN REHABİLİTASYON VE DEĞERLENDİRİLMESİNDE GERİBİLDİRİMLİ TABAN İÇİ YÜK ÖLÇÜM CİHAZI KULLANIMI: BİR OLGU SUNUMU

Sporculara bazı alt ekstremite yaralanma ve ameliyatlarını takiben kısmi yük verme periyodları önerilmektedir. Günümüzde bu amaca yönelik yürüme eğitimi cihazları sensörlü basküller ve kuvvet platformlarıyla sınırlı olup, kullanımları günlük aktivitelerde yetersiz ve öznel kalmaktadır.

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Çalışmalar olguların hedeflenen yükü vermekte başarısız olduklarını da ortaya koymaktadır. Sesli ve görsel geribildirim cihazları da genellikle statik pozisyonlara uyarlanabilir. Bu çalışmada, medial femoral kondil kırığı için opere edilen bir futbolcunun topuk ve ayak ucuna yük verme düzeyi bilgisayarlı bir ayak tabanı sesli geribildirim cihazıyla ölçüldü. Sistem, oyuncunun bilateral eşit yük taşımasına ve yürüme düzenine ulaşmasına kadar sırasıyla üç ve iki haftalık %30 ve %60'lık kısmi yük verme süreçleri öncesi ve sonrasında test edilip eğitilmesinde başarıyla kullanıldı.

Anahtar sözcükler: *Kısmi yük verme, yürüme eğitimi, geribildirim cihazları, futbol, egzersiz*

INTRODUCTION

Limited weight-bearing is clinically prescribed when athletes use supporting devices during recovery from fractures, joint pathologies, or surgery involving the lower extremity. The general medical prescription in these cases includes non-weight-bearing (NWB), touch-weight-bearing, partial weight-bearing (PWB) and full weight-bearing (FWB). The current methods for PWB or FWB gait training are mainly subjective, and studies confirm the inability of the subjects to reproduce the required weight-bearing result. Until recently, only static methods of measuring weight-bearing and distribution existed. These include scales (2) and various force plate platform systems that utilize strain sensors (4). They are limited in their functional usage, as they can not accurately measure weight-bearing in walking, sitting to standing and stair climbing, all basic functional daily activities. Auditory and visual biofeedback devices that are currently used to encourage weight-bearing are also limited to static weight-bearing positions. Research on these devices has been limited to weight-bearing characteristics of individuals with amputations (3), and various neurological cases (1).

An innovative computerized air-insole auditory biofeedback system (CAIABS, Smartstep TM, Andante Medical Devices Ltd, Omer Israel) (5) was utilized in the present study to measure the weight-bearing in the heel and forefoot during locomotion (Fig. 1).

The biofeedback facility of the system was utilized to accurately train the injured player in order to progressively increase his weight-bearing ability until FWB was prescribed by the referring sports physician. It was thus possible to accurately and objectively quantify the progress until equal bilateral weight-bearing and gait-sequence patterns were again obtained.

Fig. 1. The computerized air-insole auditory biofeedback system

CASE PRESENTATION

A 22 year old male professional soccer player underwent a surgical procedure to his left knee which included a micro fracture of his medial femoral condyle. This surgical procedure has been previously described in cases of severe local cartilage damage (6). The surgeon's post-operative instructions were NWB gait for three weeks, PWB (30% of BW) for a further three weeks, and finally PWB (60% of BW) for another two weeks. At the completion of the three week NWB period, the player was trained (Fig. 2) using the CAIABS system to weight-bear an average of 25 kg on the operated leg, walking with two crutches.

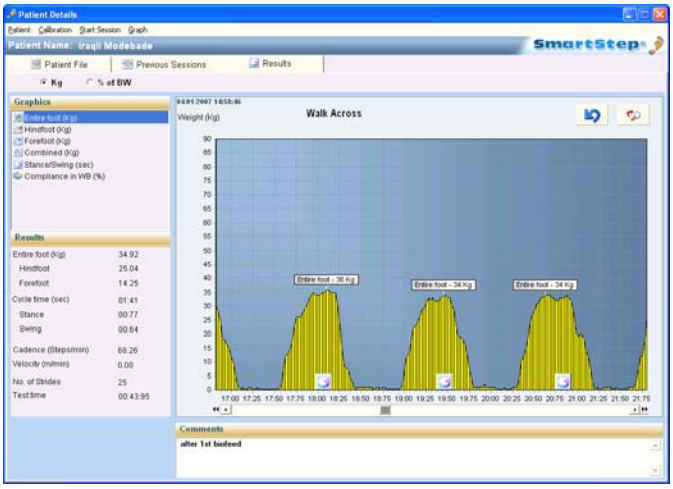

Fig. 2. Results for the first biofeedback session

Following this initial training period, his weight-bearing ability was reassessed to determine whether he had maintained this weight-bearing level. The results exhibited almost perfect maintenance (Fig. 3).

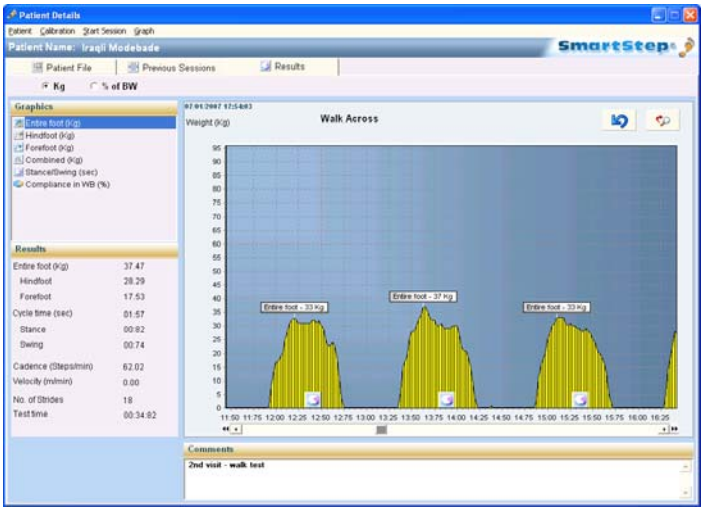

Fig. 3. Results before the second session

At six weeks, the patient progressed to 60% weight-bearing (50 kg), he was again trained and reassessed (Fig. 4), and this weight-bearing was maintained for a further two weeks.

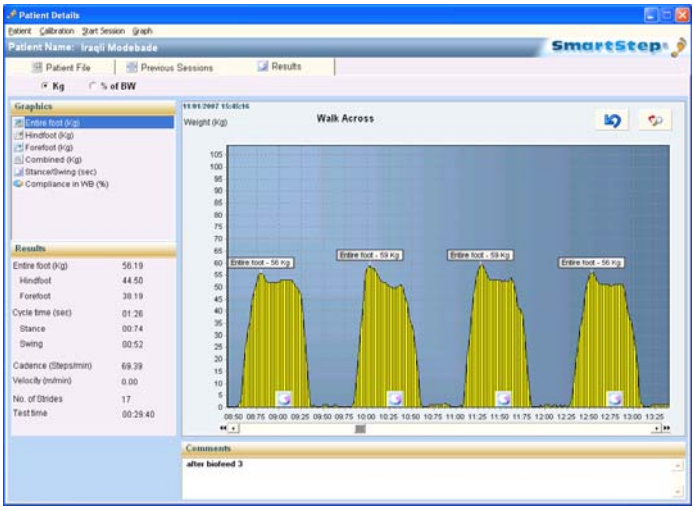

Fig. 4. Results for the second biofeedback session at 6 weeks

Finally, he was reassessed using the system at the end of these two weeks to check that equal bilateral weight-bearing and gait-sequence patterns were reached (Fig. 5).

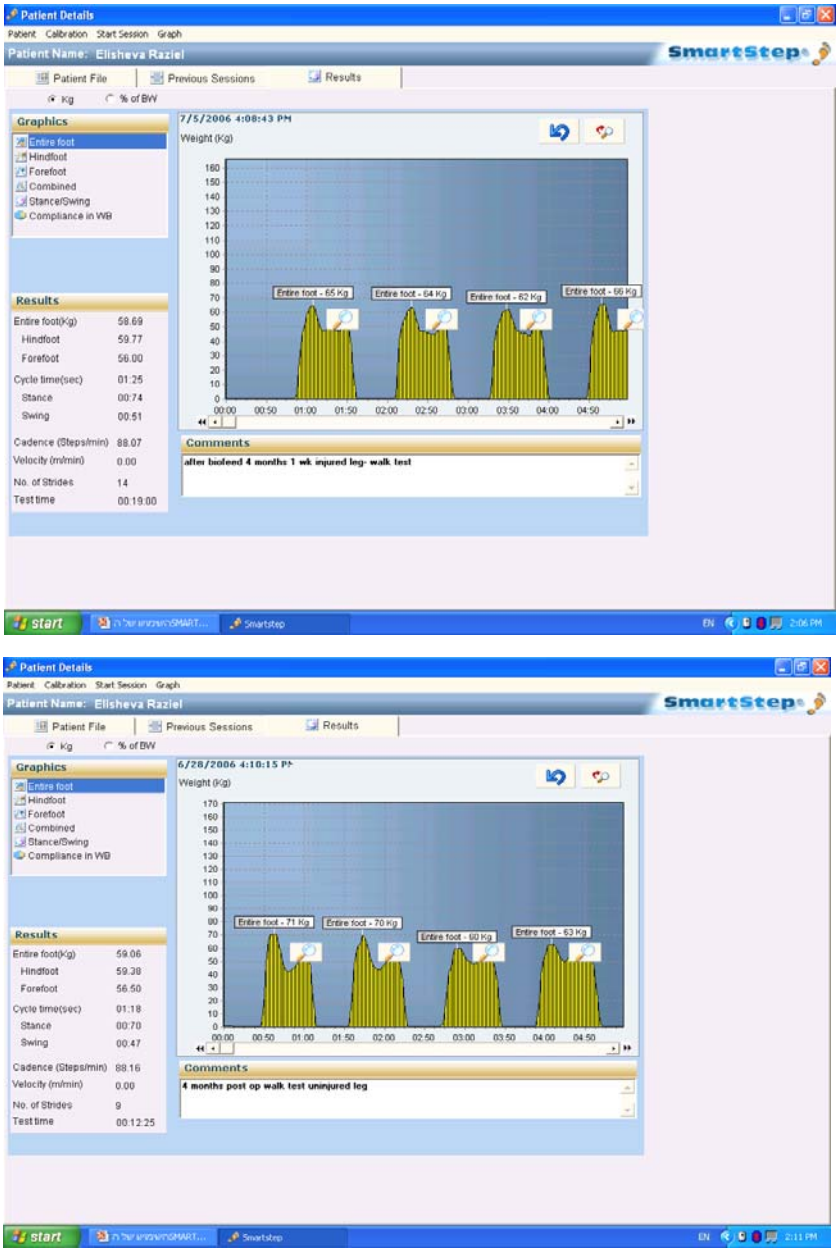

Fig. 5. Comparison of injured and uninjured legs at the end of 8 weeks

CONCLUSION

An innovative computerized air-insole auditory biofeedback system (CAIABS) was successfully utilized to gradually increase the weight-bearing of a soccer player who had undergone sensitive knee surgery. The new system proved to objectively and accurately quantify the weight-bearing during the rehabilitation process. The biofeedback facility was used to train the player to actually "feel" the correct amount of weight-bearing allowed during the treatment sessions, and repeated analysis after the training period revealed the ability to retain what was gained. This is the first reported case study utilizing the CAIABS in the process of graduated weight-bearing in sports rehabilitation.

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