Efficacy of stability-based training with visualisation

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Summary

Visualisation is the connection of biomechanical analysis and virtual reality. This produces real-time results, by accurately monitoring movement and progress, using virtual reality to create a diverse, challenging, and controllable environment, representative of real-world situations [1]. This study aimed to assess the efficacy of stability-based training using gold-standard motion analysis equipment, real-time feedback to create the visualisations.

Participants (n=12) attended 8 stability-based training sessions, either with visualisation (n=7) or without (n=5). Prior to, and on completion of training, the Star Excursion Balance Test (SEBT) was performed for comparison.

The stability-based training with visualisation improved the reach distance on average, and in 5/8 reach directions (p>0.05), compared to standard practice. Results suggest that rehabilitative practice could benefit from incorporating visualisation using biomechanical analysis and customizable protocols. . This potentially leads to an earlier return to functional activities, with a reduced risk of re-injury.

Introduction

For rehabilitation to work the musculoskeletal systems effectively, the clinician and patient must communicate realistic goals and create a programme, which can be adhered to [2]. Virtual reality (VR) systems have been shown to provide the stimulating and motivational environment needed to do this more successfully [3]. Visualisation is the connection of biomechanical analysis and VR. This produces real-time results, by accurately monitoring movement and progress, using VR to create a diverse, challenging, and controllable environment, representative of real-world situations [1]. This study aimed to assess the efficacy of stability-based training using gold-standard motion analysis equipment, real-time feedback and visualisations.

Methods

The study population consisted of 12 physically active individuals who were randomly assigned to either the training group with visualisation (n=7), or the group without. The control group performed balance exercises typical of standard care (n=5). Stability-based training was completed twice weekly for ~35 minutes, over 4 weeks (8 sessions). Prior to, and on completion of training the Star Excursion Balance Test (SEBT) was performed for comparison, as a valid and reliable tool [4]. The limb which led to the smaller reach distance on average pre-training was analyzed. Following training the Physical Activity Enjoyment Scale was completed (PACES-8) [5]. All statistical analyses were performed in Minitab 18.0 (p<0.05) (Minitab Inc., 2018).

The Strathclyde Cluster Model [6] and pointer calibration [7] were applied to all participants. Movement was tracked using Vicon Tracker (Vicon, Oxford, UK), with the testing controlled and recorded using D-Flow (Motek Medical, Amsterdam, The Netherlands) to produce real-time results.

Results and Discussion

When visualisation training was used, there was a 1.75% greater increase in reach distance on average compared to the control group (p=0.57). This included increases in the anterior (A), posterior-lateral (PL), posterior (P), posterior-medial (PM) and medial (M) directions. Between groups the greatest training effects were in the PM, M, and P directions, reporting 8.90%, 4.35% and 2.99% increases (p>0.05), respectively. The significance of this result is limited by the small sample size.

There is no research noted to date to assess stability using the SEBT after visualisation training specifically, however results further findings following wobble board-based training using exergames [8]. In addition to this, a 16.5% increased enjoyment (p=0.175) was reported by the visualisation training group. This supported increased interest and enjoyment (p<0.05) from using the exergames [8]. This could influence rehabilitation adherence, thus leading to improved performance.

Conclusions

Results suggest that by incorporating visualisation, biomechanical analysis and customizable protocols, rehabilitative practice could benefit. This potentially leads to an earlier and more prepared return to functional activities, with reduced risk of re-injury.

References

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