Research and Reviews: Orthopedics

The Use of the D+R Therapy Physiotherapy iPhone Application in the Management of Radial Head Fracture

Alan Saleh[1*], Fatimah Parkar[2] and Amit Tolat[3]

[1]Medway Maritime Hospital, Gillingham, Kent, England
[2]Spire Alexandra Hospital, Walderslade, Kent, England
[3]Department of Physiotherapy, Spire Alexandra Hospital, Walderslade, Kent, England

Case Study

Received date: 05/08/2017
Accepted date: 24/10/2017
Published date: 25/10/2017

***For Correspondence**

Alan Saleh, Medway Maritime Hospital, Gillingham, Kent, England,
Tel: +447415878880.

E-mail: alansaleh@doctors.org.uk

Keywords: Orthopaedics, fracture, Rehabilitation, Trauma, Physiotherapy, Novel system

ABSTRACT

Background: Orthopaedic intervention followed by structured musculoskeletal physiotherapy is key to optimise functional outcome after traumatic fractures. However, patient compliance to physiotherapy remains a challenge. This paper describes the first reported use of a remote monitoring physiotherapy platform, D+R (Diagnostic and Rehabilitation) Therapy, in the management of trauma.

Purpose: This case study was performed to assess the D+R Therapy application and to assess the advantages and disadvantages of such a system.

Method: A 46 year old professional with an undisplaced radial head fracture was invited to use the platform and his progress assessed.

Results and conclusion: The D+R Therapy platform provides a method of remotely monitoring and supervising patients undergoing physiotherapy. By exploiting the patient's own smart phone this system provides a timely and cost effective method of managing patients undergoing musculoskeletal physiotherapy. It may also identify non-compliant patients that may be of interest to both healthcare providers and insurers.

INTRODUCTION

This study aims to report a case on the use of the D+R (Diagnostic and Rehabilitation) Therapy platform in the management of traumatic injury. It is the first reported case study to assess the D+R Therapy application, and to assess the advantages and disadvantages of such a system.

Traumatic fractures in patients aged 16 years or more have an overall incidence of 13.7/1000/year [1]. Data from the American Academy of Orthopaedic Surgeons shows that of the injuries and illnesses resulting in lost workdays, those affecting the musculoskeletal system accounted for the majority of lost workdays in both men and women. In the United States, the cost of musculoskeletal injuries amounted to 41.3 billion dollars in 1995 [2] In the United Kingdom there is no equivalent data however we can estimate that costs are on a proportionate basis.

Following an upper limb fracture, patients require appropriate orthopaedic intervention, immobilization and a subsequent course of musculoskeletal physiotherapy with regular assessment. The latter is essential as physical exercises aim to encourage mobilization, extend range of movement and to improve functional outcome. Evidence suggests that in the management of upper limb fractures, specific exercise regimens reduces impairments and improves limb function [3]. Compliance with physiotherapy is an important factor that influences final functional outcome [4]. With compliant patients achieving better outcomes than non-compliant patients [5].

D+R Therapy

D+R Therapy is a platform that allows patients to be remotely monitored. It consists of a downloadable iPhone Application and linked website. Exercises are prescribed by the physiotherapist via the website and appear on the iPhone screen when the application is initiated by the patient **(Figures 1 and 2)**. A text description and video clip are also included to remind patients of the exercises they are required to perform.

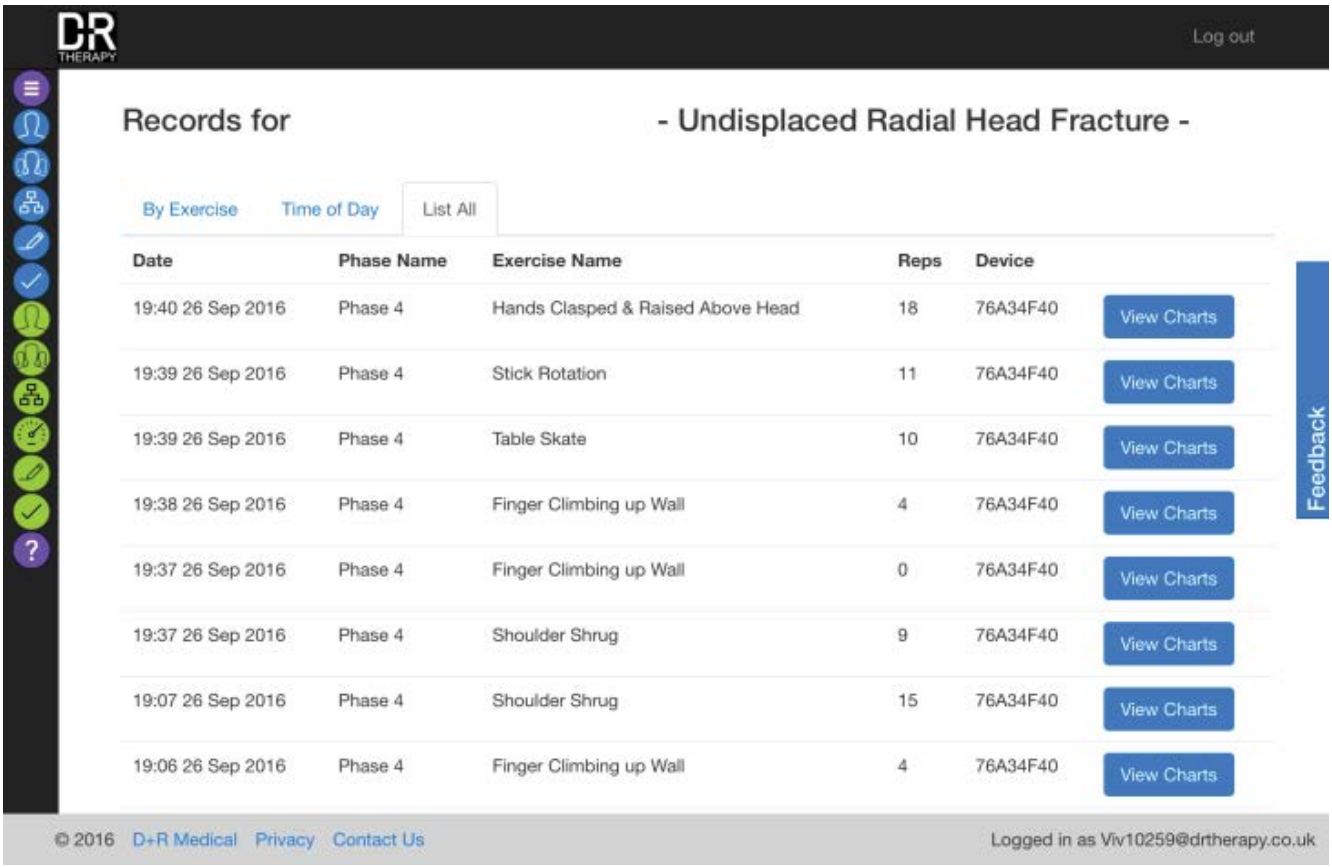

Figure 1. List of patient specific exercises.

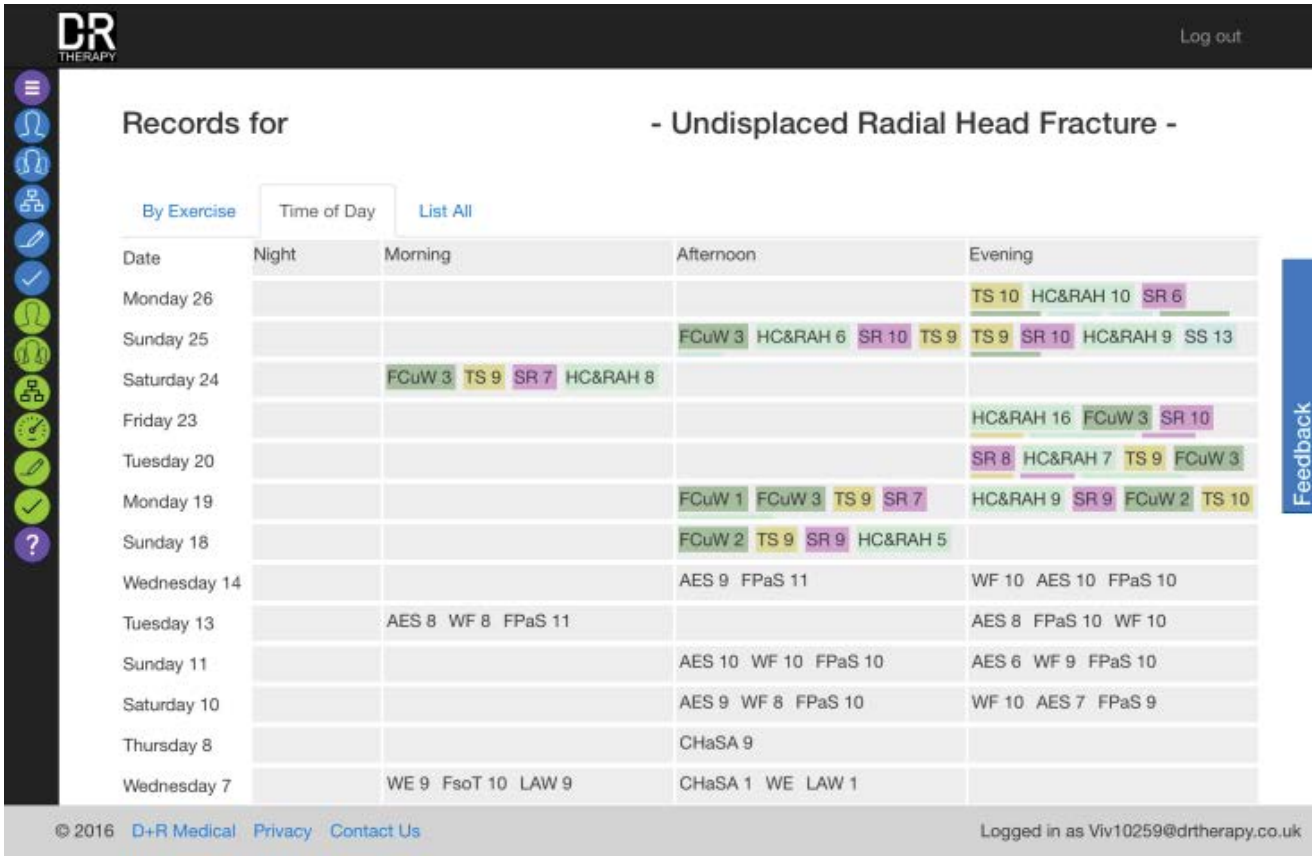

Figure 2. Overview of exercises based around time of day.

Patients undertake their musculoskeletal physiotherapy exercises whilst wearing their own smartphone on the appropriate limb e.g. the forearm for certain elbow exercises **(Figure 3)**. Movement is detected by the iPhone and data recorded and sent to

the website where it can be accessed by their clinician for review. Data can be displayed as a simple dashboard and graphically if required **(Figure 4)**. Depending on the specific exercise, data can be gathered to study the range of movement in different planes as well as acceleration. The system is written using Microsoft's azure platform and is HIPPA compliant as security is essential.

A clinician is able to identify those patients who are non-compliant, who would then require encouragement, as well as those who are progressing rapidly and whose exercises should be altered accordingly, as in the case of professional athletes. We therefore undertook this case study on a volunteer who had sustained a traumatic upper limb injury to trial this remote platform.

Figure 3. Photograph of exercise setup.

Figure 4. Performance feedback on specific exercise.

CASE STUDY

A 46 year old professional presented to our team having fallen from his bicycle. He complained of left elbow pain, limited range of movement of his left elbow, and marked pain on forearm pronation and supination. XRAYs and a CT scan of the left elbow joint confirmed an undisplaced radial head fracture. After immobilisation in a full length upper limb cast for two weeks, a physiotherapy referral was made.

Following consent, musculoskeletal exercises were prescribed on the D+R Therapy website (www.drtherapy.co.uk) and appeared on the patient's iPhone5 via the pre-downloaded application. The patient was asked to attach his smartphone to the medial aspect of the forearm by means of an armband. The application was initiated and used to record limb movement for each exercise. Examples of exercises included 'stick rotation', 'finger climbing up wall' and 'shoulder shrug'. The patient reviewed on a weekly basis in the physiotherapy department. Here, the physiotherapist would review the patient's progress as well as discuss any limitations that the patient was experiencing. Modifications to the exercises could be tailored to the patient based on the charts generated in the application, as well as the patient experience. The therapy lasted a total of five weeks and the patient re-gained his full range of movement after six weeks.

DISCUSSION

The elbow is a complex joint in which there are three articulations– the humeroulnar, humeroradial and proximal radioulnar. Together these allow for flexion and extension of the elbow as well as pronation and supination of the forearm respectively. Injury to the radial head can lead to a significant reduction in range of movement but particularly loss of supination and extension with prolonged recovery and associated pain.

This case study has exploited a novel iPhone/web platform that allows the remote monitoring and supervision of patients undergoing physiotherapy. The patient was able to access the exercises prescribed on the Application, and as he was aware that he was being monitored, felt encouraged to perform the listed exercises. The platform is "gamified" with 3 gold stars appearing on screen if the exercise had been completed well (the patient was irritated when he felt that he had completed the exercise well to only receive 1 star). The physiotherapist caring for the patient was able to monitor his progress, by both simply reviewing the summary charts from each day's activity, but also by reviewing the charts generated describing the range of movement and acceleration (it was possible to identify where the subject tired during the exercise). In this case study, patient motivation was enhanced and compliance ensured.

The data could also be reviewed with the patient to provide feedback and allow him to understand his own rate of progress, hence improving compliance. Advantages of the current platform are that no additional hardware was required, the system exploiting the patient's smartphone, and the simple dashboard that allowed the patient's progress to be rapidly assessed.

Theoretically, this efficient aspect of the application would be useful for busy physiotherapy practices as well as patients in rural communities who may experience difficulties with transport.

Notwithstanding, this being a case report, the individual had no problems using the Application and encouraged the return of early function with it. In particular, the early return of supination and extension are encouraging. Further research, with a larger cohort of patients is needed to establish these encouraging findings of improved patient compliance and return of early function using this novel approach.

CONCLUSION

The findings of this Case Study suggest that a remote method of assessing the compliance and progress through a physiotherapy programme is now a practical possibility. Additional research is required to formally compare the rate of progress and functional outcomes of this novel platform as one may anticipate improved compliance to improve final functional outcome. This novel approach would offer improved monitoring which is of both clinical and medico-legal importance. By using a patient's own smartphone, rather than requiring additional hardware, the platform may prove to be cost effective. It may also identify poorly compliant patients which may be of interest to both healthcare providers and insurers.

REFERENCES

1. Court-Brown C, et al. The epidemiology of fractures. In: Rockwood CA, Green DP & Bucholz RW, Rockwood and Green's fractures in adults, Philadelphia, PA, Wolters Kluwer Health/Lippincott Williams & Wilkins. 2010.53-76. Print.
2. Koval KJ and Cooley M. The epidemiology of fractures. Part 2: Experience in the United States. In: Rockwood CA, Green DP & Bucholz RW, Rockwood and Green's fractures in adults, Philadelphia, Lippincott Williams & Wilkins. 2006;113-143.

3. Bruder A, et al. Exercise reduces impairment and improves activity in people after some upper limb fractures: A systematic review. J Physiother. 2011;57:71-82.

4. Hayden JA, et al. Systematic review: Strategies for using exercise therapy to improve outcomes in chronic low back pain. Ann Intern Med. 2005;142:776-785.

5. Vermeire E, et al. Patient adherence to treatment: Three decades of research. A comprehensive review. J Clin Pharm Ther. 2001;26:331-342.