

Smartphone and Cloud Based Monitoring for a Post Spinal Surgery Patient – Case Study

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INTRODUCTION

Lumbosacral orthotics (LSO) and thoracolumbarsacral orthotics (TLSO) are quite commonly prescribed for patients who have experienced spine trauma or have had spinal surgery. Effectiveness of bracing for these indications is a function of the patient's compliance to the prescribed wearing time. Often a surgeon will instruct wearing an LSO or TLSO for 8 hours or more per day. Without the means to verify patient compliance, the physicians and therapists rely on the honor system during patient visits. Post-surgical patients improve their outcomes if doctors' orders to gradually increase their mobility and minimize recumbent time are followed¹. Recognizing the need for compliance verification a Bluetooth enabled sensor with a smartphone app was developed for remote and near real-time verification. In addition, the sensor can measure upright versus recumbent time and mobility while wearing the brace.

MATERIALS AND METHODS

A 41-year-old female underwent a unilateral laminectomy with a microdiscectomy between Left L5 and S1, partial facetectomy and foraminotomies on the left L5 and left S1.

Surgery and recovery were uneventful. The patient was instructed to wear a BREG Basic Lumbar Support back brace during the day for 6 weeks (42 post-operative days) and remove when lying or in a reclined position. Hours of movement were not prescribed although walking was encouraged to decrease stiffness and increase blood flow.

Sensor Placement

The iLink™ sensor (Figure 1) was secured using Velcro in an existing pocket. The location of the sensor during wear was the patient's right side approximately 5.5 inches under the axilla (armpit).



Figure 1 – iLink Sensor

The side of the sensor facing the patient was covered with 1.3 mm of brace material. The brace manufacturer instructs the patient to wear a light layer of clothing prior to donning the brace so approximately 2.5 mm of material was between the patient and the sensor when the brace was worn. The sensor location in the brace and on the patient is illustrated in Figure 2.



Figure 2 – a) Brace stretched out with the side against the patient facing up. b) Sensor secured with Velcro in pocket. c) Actual patient with brace on, front view, sensor is not visible but its approximate location is shown. d) Position of sensor on complete body representation.

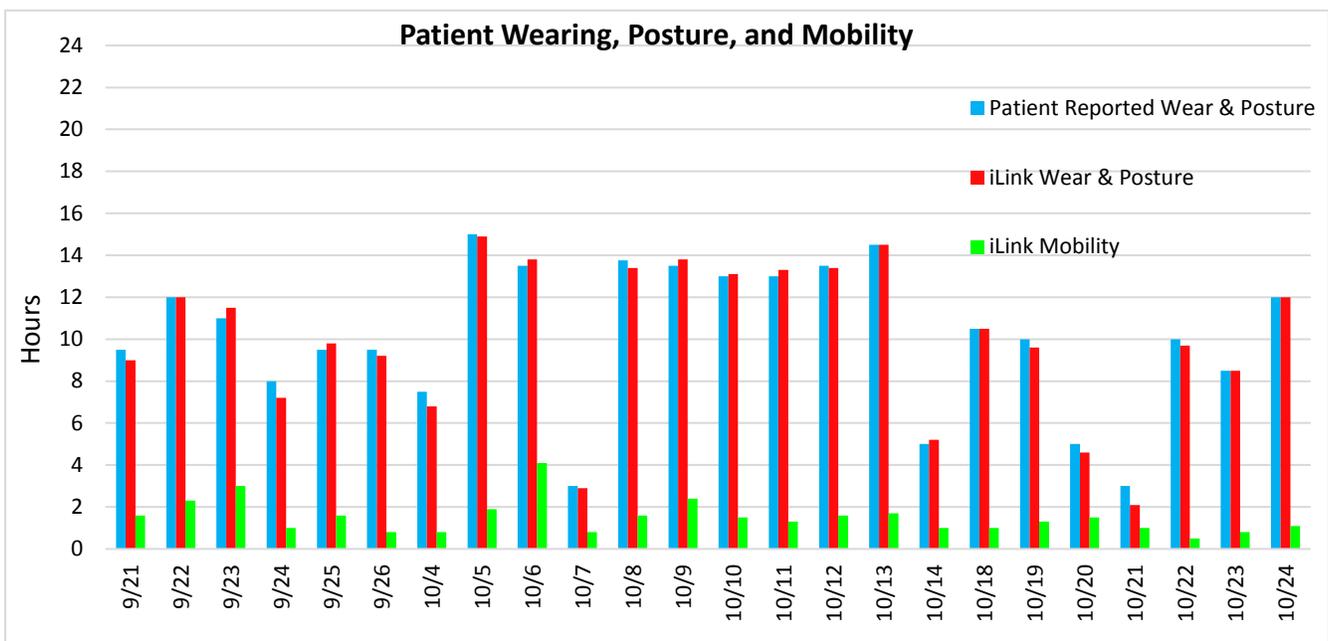


Figure 3 – iLink hours for wearing, posture and mobility. Data for wearing time collected via iLink as shown compared to log of wearing time kept by patient over a period of 26 days.

iLink Data

The patient wore the brace 41 out of 42 prescribed days. The iLink sensor was used to record 26 days of data beginning on post-operative day nine (9/21/18). The data recorded by iLink up to 10/14/18 was communicated via an Android tablet. After that date, an iPhone 6s was used to communicate with the sensor. In addition to this information being displayed on the Android and Apple devices, the data was also uploaded to the cloud for access on a secure web site. The data stored on the web portal is available to the physician for review and monitoring of patient brace wearing compliance. The patient also provided self-reported records that correspond to the data logged by iLink. The wearing time and hours of upright posture averaged 10 hours per day with a maximum of 14.5 hours and a minimum of 2 hours. On average the patient was mobile for 1.5 hours per day.

iLink Performance

The iLink sensor was able to measure and record data for wearing compliance, posture detection, and mobility sensing for the duration of the study. While this study was limited to 6-weeks, the iLink sensor is capable of providing patient monitoring for a minimum of 12-weeks without replacement of the battery.

During the course of the study, the presence of the iLink sensor did not hinder or

bother the patient. Additionally, the sensor did not interfere with harnessing or unfastening of the brace.

Both Android and Apple devices were used with the iLink sensor to demonstrate compatibility across devices. Additionally, the de-identified data logged on these devices was also uploaded via the cloud to the secure web portal for viewing by study personnel.

SUMMARY

As a result of patient brace monitoring with iLink, data was obtained for the following activities.

Wearing/ Posture Compliance: The patient wore the brace and maintained an upright posture for an average of 10 hours per day throughout the recovery period. Final review showed that the self-reported data totaled 243.75 hours compared to 240.8 hours as measured by the iLink sensor, which is a difference of 1.21%

Mobility Index: The patient maintained an average of 1.5 hours of movement per day.

REFERENCES

1. Epstein NE. A review article on the benefits of early mobilization following spinal surgery and other medical/surgical procedures. Surg Neurol Int 2014;5:S66-73.