Hypothesis / Aims of Study

Uroflowmetry is a non-invasive measurement of urine flow rate with some privacy. Current uroflowmetry is designed to observe patient’s urination while maintaining privacy. However, some patients cannot void well because of the unfamiliar environment or inconvenient self-timing to void. The need for comfortable, convenient and even portable, home-based device has led to the development of technology in uroflowmetry. Traditionally, the rate was calculated by weight transducer, spinning disc or change in capacitance. Acoustic uroflowmetry is a novel technique to capture and analyze sounds generated during voiding, offering clinical-grade results including flow curves, maximal flow rate, average flow rate, voided volume and voiding time. Based on the technology, we implemented a mobile application to check urine flow at home. The mobile app uses the internal microphone of a smartphone and requires no additional hardware for its work. In this research, we investigated how people use the app in their daily lives and environment and what type of flow patterns would be captured from them.

Design and Methods

A mobile app was distributed to test groups, in which persons who consented to participate the test and agreed to terms of use and privacy policy conducted the test from November 17, 2018, to January 4, 2019. Test users installed the distributed app on their iPhones and recorded the urinating sound with the app. The app analyzed the recorded sound and showed the results in a minute. A flow curve, the maximal flow rate (Qmax), average flow rate (Qavg), voided volume and voiding time were included in the result. Test users checked their own measurement results easily on the screen of the app.

Results

A total of 67 men (Korean or American) participated in the trial. Mean age was 41.6 years old (24–56 years old). Out of the 67 users, 9 measured not once after installation and registration, so they were screened out. 58 of users measured their urine flow at least once, 19.1 times on average per users. The researchers collected 1107 recordings in total. After analysis of the measured data, 265 were classified as invalid, and the rest of 842 were successfully processed to provide a flow curve and parameters for each voiding event.

Mean Qmax and Qavg were 22.3 ml/s (3.5 - 49.4 ml/s) and 12.6 ml/s (1.7 - 33.8 ml/s), respectively. Mean voided volume was 252.9 ml (331.1 ml - 982.8 ml). Chart 1 and 2 show the distribution of Qmax and Voided volume per range. Average of voiding time was 22.3 sec (5.8 - 77.4 sec). Well-known flow patterns from conventional uroflowmetry were also captured in the test. Figure 1 shows the most common and representative flow patterns selected from the measurement results.

Conclusions

This study investigated the potential of this technology and mobile app to be used as a self-monitoring tool for checking urine flow at home. Test participants of 58 males in the US and Korea measured and checked their urine flow using the app. Typical urine flow patterns similar to the results from clinical uroflowmetry were captured. Further validation and efficacy studies would be required for broader use of this mobile app as a patient-physician engagement tool.

References