Contact Heart Rate Monitors

S-Pulse™ Technology

S-Pulse™ is our patented heart rate sensing technology designed to measure the electrical signals on your skin in the same manner that an EKG or electrocardiogram does. While the Smarthealth™ Heart Rate Watch attaches to your wrist like any other watch, it does not measure or sense your pulse at your wrist. It instead uses **S-Pulse™** patented technology to sense your heart rate by measuring your EKG signal.

The **S-Pulse technology** measures the electronic signals passing through your body that result from the beating of your heart. You may be familiar with the EKG waveform from either personal experience while at the hospital, or from watching popular television medical shows. It is this very same signal that **S-Pulse™** sensing technology measures.

S-Pulse monitor will perform differently on people of various ages, skin types, body types, EKG or electro-cardiogram signal strengths and so on.

In the Smarthealth watch, this measurement is obtained by the Watch's three metal sensors. The back metal plate of the Watch is actually a primary sensor that can measure these electronic signals off your wrist. The EKG monitoring is done when you place your fingers from one hand onto the two top sensors of the Watch attached to your opposite wrist. This creates an electrical loop across your body that the Watch can now read

In our OEM circuit board applications, **S-Pulse™** technology is installed by leading brand name manufacturers in their health & fitness equipment - such as treadmills, stationary bikes, and elliptical exercise machines. In these applications you simply touch a metal sensor with each hand to obtain your heart rate on the machine display.

EKG Accuracy

An electrocardiogram, or EKG, is a measure of the heart's electrical activity. This electrical activity regulates the contraction of the heart, which means the EKG can determine its exact Heart Rate and rhythm.

This independent comparison and evaluation study was performed for Salutron, Inc. by **Sung H. Chun, M.D.** Doctor Chun is Director of Cardiac Electrophysiology at Palo Alto Medical Foundation, and Clinical Assistant Professor at Stanford University School of Medicine.

Introduction

Currently available heart monitoring systems require either two or more wires to be attached, or a strap applied to the body. This causes several potential problems and considerable inconvenience. The connection with either a wire or a strap can become loose and fail to provide accurate monitoring. Both wires and straps can potentially lose accuracy due to external noise interference. Monitoring adhesive pads can cause allergic reaction to your skin.

S-Pulse™ is an electronic and software-based monitoring technique, developed by Salutron, Inc. This technology provides an accurate way to monitor your Heart Rate and allows Heart Rate monitoring without requiring any wires or straps to be connected to your body.

S-Pulse technology was evaluated to assess its accuracy and reliability in obtaining Heart Rates by comparing its output data directly to electrocardiographic (EKG) recordings obtained by a cardiac monitor made by Hewlett-Packard and used in the cardiac catheterization laboratory observation unit at Stanford University Hospital.

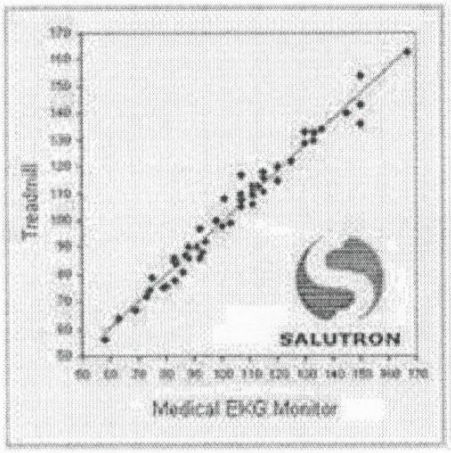
EKG Accuracy

Results

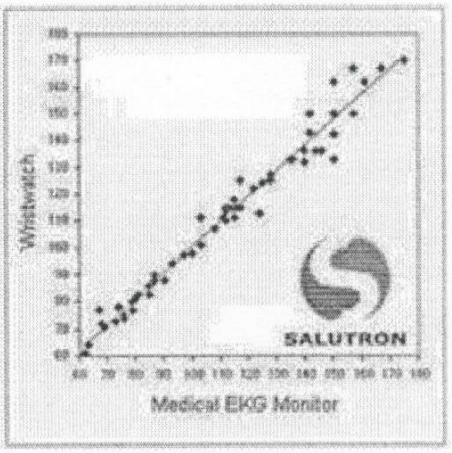
Heart Rate readings using **S-Pulse** and EKG recordings were compared. When a treadmill handle bar method was used, the "at rest" S-Pulse reading provided a correlation coefficient of 0.9691 when compared to the EKG recorded data. During 4 mph and 6 mph exercise phases, correlation coefficients were 0.9735 and 0.9608, respectively. When all treadmill data were combined, the overall correlation coefficient was 0.9870.

Using the wristwatch, its correlation coefficients, as compared to EKG recorded data, were 0.9813, 0.9144 and 0.8782 during rest, 4mph exercise, and 6mph exercise respectively. When all wristwatch data were combined, its overall correlation coefficient was 0.9861.

These comparative values are illustrated in the two diagrams below.



Treadmill Evaluation



Watch Evaluation

Conclusion

This experiment clearly shows that **S-Pulse** technology accurately and reliably provides Heart Rate monitoring data both at rest and during exercise. Salutron's S-Pulse data for both wristwatch and treadmill handle bars showed a very high correlation to the "gold standard" monitoring method of traditional EKG recording. Most importantly, this accurate heart monitoring data was achieved without the necessity of using wires or straps attached to the body. Therefore, S-Pulse was found to be a reliable Heart Rate monitoring method with a proven accuracy level comparable to that of EKG recording used in clinics and hospitals.

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Sung H. Chun, M.D.

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Education & Training

Medical education:	George Washington University School of Medicine, Washington, DC, 1989
Internship:	University of California, Los Angeles, VA West Los Angeles Medical Center
Residency:	University of California, Los Angeles, VA West Los Angeles Medical Center
Fellowship(s):	Cardiology (1993-96) and electrophysiology (1996-97), Stanford University Medical Center
Special training:	Resynchronization therapy for heart failure management and laser lead extraction for pacemakers & implantable cardioverter defibrillators.

Department Cardiology

Clinical Emphasis **Cardiovascular Disease**
Arrhythmia, Electrophysiology, Implant Cardiac Defibrillator, Pacemakers, Radiofrequency Ablation, Ventricular Tachycardia, Wolff-Parkinson-White Syndrome

Professional Interests Dr. Chun is one of the leading physicians in resynchronization therapy and laser lead extraction.

Spoken Languages

Primary:	English
Additional:	Korean (Very Good)

Community Activities American Heart Association, Heart Rhythm Society and American College of Cardiology