SureTemp and SureTemp Plus
Theory of Operation

TO: Welch Allyn Thermometer Users & Biomedical Engineers
FROM: Whitney A. Bouma, Senior Product Manager

Occasionally, Welch Allyn receives phone calls from SureTemp" and SureTemp" Plus customers questioning how their thermometers function and how they can confirm accuracy of their thermometers on a specific patient. Of these customers, many have indicated that they are trying to take repeat temperatures in quick succession to compare, while others claim they are trying to compare the readings to another thermometer. To understand completely how to identify accuracy of the thermometer on a specific patient, it is imperative to understand how the thermometer functions. To begin with, it is important to understand that specific patient accuracy cannot be tested by taking repeat temperatures on the same patient in quick succession or by comparing the thermometer to another thermometer. This letter will explain exactly why these are not effective methods for testing accuracy and will explain approaches to determining accuracy and your patient's true temperature.

There are a couple of reasons why the SureTemp and SureTemp Plus thermometers (as well as any other electronic thermometer that gives a reading in under 3-5 minutes) cannot be used in quick succession on the same patient or be compared to another thermometer.

1. The thermometers are electronic predictive thermometers that utilize a software algorithm to "predict" what the patient's temperature would have been after 3-5 minutes. Most electronic predictive thermometers also have a monitor mode, which allows the thermometer to be used in a fashion similar to traditional glass mercury thermometers, where the thermometer can be left in place for 3-5 minutes to allow it to come to thermal equilibrium (or for the probe and the mouth to come to the same temperature) and give the patient's "true" temperature.

2. When the thermometer is placed in the patient temperature site, the probe is generally cooler than the patient temperature site and the patient is generally warmer. Because of this, heat is transferred to the probe, causing the patient's body site to be cooled. The body site will then take approximately 20 minutes to fully recover and return to the original temperature. (Source: "Temperature Measurement", http://www.nlm.nih.gov/medlineplus/ency/article/003400.html , Medline Plus ... a service of the U.S. National Library of Medicine and National Institutes of Health, David Webner, M.D., May 23, 2003) If a repeat temperature is conducted prior to that 20-minute period of time, the temperature reading will generally be different. If another thermometer is used to test temperature at the same body site prior to the 20-minute recovery time, this reading will also tend to be different. This is the case with any electronic thermometer that gives a reading in less than 3-5 minutes, regardless of manufacturer.

3. It is also important to note that the same probe cover must never be used twice. This is because the probe covers retain heat and because they are often stretched over the probe to ensure that no air gaps exist between the probe and cover. Air gaps will cause inaccurate readings for any thermometer that is calibrated as a system with a probe cover. This covers all thermometers where probe covers are used.

4. If a user attempts to compare their SureTemp or SureTemp Plus thermometer to another brand or type of thermometer, the readings will tend to be different. The reason for this is that other manufacturers have different predictive algorithms that can cause a prediction on some patients to be different. Software prediction algorithms are developed differently be each manufacturer and are based on a sampling of patients' temperatures at the desired quick predict time versus their 3-5 minute temperature. Because the algorithms work based on minimizing the average difference between the predictive temperature and the 3-5 minute monitor mode temperature, there will be differences in algorithms and may be differences between patients, depending on the time it takes to predict and the specific patient and/or condition. With most electronic predictive thermometers, whether it is a Welch Allyn or competitive thermometer, the user can place it into monitor mode to verify a patient's true temperature. (See the manufacturer's instructions for details.)

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It is also important to make sure that the thermometer is being positioned appropriately in the patient body site in order to obtain an accurate reading. If the probe is positioned incorrectly, the predictive temperature reading will tend to be low. Please refer to the Operator's Manuals or to the clinical support materials for detailed instructions. The clinical support materials that you may find helpful can be ordered by contacting Welch Allyn and requesting the following "SM" numbers:

LITERATURE FOR SURETEMP MODELS 678 / 679 / 986

Order Number	Description
SM2453	8 1/2 " PICTURE OF SUBLINGUAL POCKET FOR PROPER ORAL PROBE PLACEMENT
SM2391	8 1/2" X 11" SURETEMP QUICK REFERENCE GUIDE FOR ORAL TEMPERATURE TAKING
SM2393	8 1/2" X 11" SURETEMP QUICK REFERENCE GUIDE FOR PEDIATRIC AXILLARY TEMPERATURE TAKING
SM2392	8 1/2" X 11" SURETEMP QUICK REFERENCE GUIDE FOR RECTAL TEMPERATURE TAKING
SM2556	4" X 6" RANGE OF NORMAL TEMPERATURES CHART

LITERATURE FOR SURETEMP PLUS MODELS 690 / 692

Order Number	Description
SM2549	SureTemp Plus 690/692 In-service Video (American Version)
SM2548	SureTemp Plus 690/692 In-service CD (Worldwide Version)
SM2453	8 1/2 " PICTURE OF SUBLINGUAL POCKET FOR PROPER ORAL PROBE PLACEMENT
SM2552	4" X 6" SURETEMP PLUS QUICK REFERENCE GUIDE FOR ORAL TEMPERATURE TAKING
SM2553	4" X 6" SURETEMP PLUS QUICK REFERENCE GUIDE FOR ADULT AXILLARY TEMPERATURE TAKING
SM2554	4" X 6" SURETEMP PLUS QUICK REFERENCE GUIDE FOR PEDIATRIC AXILLARY TEMPERATURE TAKING
SM2555	4" X 6" SURETEMP PLUS QUICK REFERENCE GUIDE FOR RECTAL TEMPERATURE TAKING
SM2556	4" X 6" RANGE OF NORMAL TEMPERATURES CHART
SM2559	SURETEMP PLUS INSTRUCTIONAL WALL CHART FOR USING THERMOMETER IN ALL MODES

Finally, if you have confirmed that you are using proper technique and you still feel that you need to verify a patient's true temperature, place your SureTemp or SureTemp Plus thermometer into monitor mode to obtain your patient's true steady state temperature.

1. This can be done by taking the patient's fast predict temperature and then, while leaving the probe in the patient's body site, press and hold the mode selection key for 2 seconds. The thermometer will then go into monitor mode, as indicated by the "M" on the screen of the SureTemp thermometers or the snail icon and word "Monitor" on the screen of the SureTemp Plus thermometers. Another method of putting the thermometer into monitor mode is to remove the probe from the well and wait for 60 seconds until the thermometer emits a long beep and automatically goes into monitor mode (the probe must not come into contact with patient tissue before going into monitor mode in this method).

2. Once the thermometer is in monitor mode, the probe must be held in position at the patient body site for 3 minutes for oral and rectal temperatures or 5 minutes for axillary temperatures. This is the amount of time that it takes for the probe and the patient's body site to come to thermal equilibrium (or the same temperature). This is the same time as required for the old glass mercury thermometers to reach thermal equilibrium.

3. Record the patient temperature before removing the probe from the patient's body site. Once the probe is removed from the patient body site, the temperature will drop and the temperature reading will NOT be stored in memory.

If you have any questions regarding your thermometer, how to use it, or the information contained within this memo, please feel free to contact Welch Allyn at 800-535-6663 for further assistance.

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