



Comfort and Function When Designing a Stick to Skin Patient Monitor

There are both obvious and subtle similarities and differences between designing a wearable device vs. another type of medical device. There is a big difference between designing a body-worn wearable and developing an adhesive wound dressing or ostomy flange that must be worn for an extended time period.

Here are just a few reasons why wearable devices present unique design requirements.

- **Patient autonomy** — Wearable medical devices are often designed to be attached and activated in the patient's home, which may be many miles from the nearest healthcare provider or institution. One must be able to easily apply the device to oneself, perhaps single-handedly. Tack plays a key role here, especially for drug-delivery applications in which the patient needs a quick, secure attachment. Materials suppliers may be able to engineer adhesives for repositionability if the patient is likely to miss the ideal securement spot on first attempt.
- **Patient mobility** — Whereas a hospitalized patient may be confined to a bed or somewhat limited in his or her movements, most patients using wearables will be going about their usual routines in their personal lives at home or at work. The wearable needs to move with the patient through daily activities, such as exercising, showering, sleeping and dressing. An appropriate level of static shear and peel adhesion is necessary to ensure the wearable can stay secure during all of this motion. And, unlike a wound dressing, the wearable must not only stick to the patient but also have the strength to hold and secure the weight of the device itself. While this weight may only be a few grams, it can make a big difference in terms of the demands it puts on the adhesive. All the while, the skin will be exuding sweat and regenerating cells, so device materials must also manage this fluid and exudate.
- **Patient discretion** — In general, a wearable medical device should be small and unobtrusive. Again, within the inpatient setting, there are procedures and protocols that are very familiar (e.g., taping a catheter to a patient's arm or attaching electrodes with wires to the chest). However, this approach becomes less acceptable in a non-medical setting. For example, a patient may be willing to endure the inconvenience of having these monitors attached to his or her body for a surgical procedure and the immediate postoperative period or for a stress test that takes about an hour. But once back at home in the swirl of professional and personal life, a device usually works best when it disappears under the clothing and can be all but forgotten about. For wearable device design, this means the adhesive material must offer long-term wear, which requires excellent moisture management, peel adhesion and static shear.

One major reason why wearable device design is so complex is the diversity of expertise required to bring these solutions to market. Consider that many wearables bear more of a resemblance to consumer electronics than medical devices. Depending on the device's functional footprint, it may need to be Bluetooth enabled or able to dock with a USB port. Specialized software algorithms will be needed to convert the device's digital data into meaningful clinical information. A cloud computing infrastructure may be required to move and store enormous amounts of data. These ensure the delivery of all this data to healthcare providers and patients in a highly accessible, secure and easy-to-digest way.

Reference: 1. Prakash, Deepak. "Designing Wearables: How to Make Sense of Your Material Options." Medical Design & Outsourcing, 9 Mar. 2018, www.medicaldesignandoutsourcing.com/designing-wearables-material-options/.

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