Medical Wearable Device Adhesives:
Get the Performance You Need

Choosing the right adhesive for your wearable device can be trickier than once thought. Tape is just tape, right? - No, not all adhesives are created equal or with the quality needed to produce a successful wearable device product. Through innovation and the development of medical grade adhesive tapes, there are quite a few options that will help your device "stick" to the skin or some other substrate, but what is the correct adhesive for your application?

Adhesives in the medical device industry, and more specifically, the wearable device market should be one of the first components thought about in the development stages of your new product. Adhesives may interact with the polymers used, the device itself or with other adhesives to impact the final form, fit and function of the device. This may include accuracy in monitoring and telemetry devices, shelf life, wound healing and/or wearability. Choosing the wrong adhesive or waiting until the device is already finished to start thinking about the adhesive could mean costly delays in trials and launch efforts.

Product developments such as additional chemistries and technological improvements in manufacturability have helped support the growth of the medical device industry to offer different characteristics such as short versus long term wear and atraumatic removal from the skin to avoid MARSI (Medical Adhesive Related Skin Injury). Ensuring that the adhesive you've chosen will not cause any manufacturing issues is vital to actual production of your product. Adhesives have many different properties that can potentially slow down the production of your finished device, but determining these from the beginning will save you a lot of time in the long run. You will want to make sure that your adhesive isn't too soft. The adhesive should be provided in a format that will optimize the process such as in the selection and construction configuration of the liner and support options of the device. These components don't seem like much in the finished device, but these factors could cause major issues if not taken into consideration early in the product's development.

There are many different purposes for an adhesive in a medical device. Whether your product is intended to stick directly to the skin or attach devices or components together, functionality of the device falls into the hands of the correct adhesive. Attaching devices or components together may seem like an easy choice, right? Choosing the strongest adhesive possible and covering only the open area of the device are not always the answer. When a device is on a body that is constantly moving, whether that be physical activity or just the compressions of taking a breath, we have to design for those movements. A proper blend of adhesion, tack and shear should be considered during the design of the device. Adding a border around the device instead of confining the adhesive to the open area is an option to provide more stability while also potentially increasing the stability of the device and wear time.

Stick-to-skin applications' success is determined by the adherence of the device to the skin over a certain period of time. If the adhesive chosen does not have the properties to stick to the skin long enough, or falls off the skin before the device can do its job, the accuracy of the data generated, if any, will be compromised.

The same can be said at the other end of the spectrum with an adhesive that is too aggressive. A device that is only meant to be worn for a short period of time can cause extensive trauma (MARSI) to the skin with an adhesive chosen that is too strong.

You must also take into consideration the skin itself. Skin is the largest organ on the body so taking care of your skin is vital to your health. The skin as a substrate provides many challenges based upon its characteristics such as:

- The skin is constantly changing and regenerating
  - Temperature, Moisture, Cell Growth, Cell Death
- The skin's surface can vary from person to person
  - Hairy, Oily, Dry, Wrinkly, Stretchy, Smooth
- The skin is subjected to shear
  - Clothing rubbing, Limb movement
- The skin is exposed to various environments and contaminants
  - Humidity, Cold, Heat, Precipitation, Sweat, Lotion
- Skin condition
  - Age, Wounds and/or abrasions, Sensitivity

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Despite some of these more challenging skin characteristics, medical grade adhesive technology has made it possible for you to wear a device to track and monitor almost anything. Asking some of the questions below will help you in deciding which adhesive will work best for your product:

- Who is my target market? Who will be wearing my device?
  - A target market which includes fragile skin types may require specialized atraumatic adhesives.

- Does my device design utilize adhesives with no direct contact with the skin?
  - Not all of the potential adhesives in a medical wearable device are skin contact adhesives. Conductive pressure sensitive adhesives (PSAs) are often used on the "device side" of the application as a bonding, or connecting component. These adhesives should be considered when choosing the skin contact component to avoid any potential material incompatibility issues.

- Where on the body will my device be located?
  - Unlike those wearing these medical wearable devices for fitness and activity tracking, there is also a large number of people who are wearing these devices to treat and/or monitor a medical condition. These people may not want to broadcast or draw attention to their condition, therefore warranting a smaller, more discreet device that can easily be hidden.

- How long does my device need to be worn?
  - Short term and long term wear can cause you to look down specific adhesive paths. Knowing the intended use of the device can help narrow down which adhesive path makes sense for your product.

- What is the area and shape of my device?
  - Determining the shape of a product can seem like no big deal at all… and that may be the case in most instances, but when an adhesive is involved, shape plays a big role. A device with square corners for example, can fall off more quickly from a shirt rubbing or friction from movement than a product with rounded corners. Adhesive area may impact the weight bearing aspect of a device which ultimately impacts the wear time of the device.

- Does my device need to be repositioned?
  - Do I need to take my device off and put it somewhere else on my body? Each adhesive system has a unique set of characterisitics and is not one size fits all. The repositionability of a hydrogel or acrylic PSA is not going to be the same as that of a silicone gel. Learning those requirements up front helps in choosing the best adhesive for the finished device.

- Will my device need to be sterilized?
  - Determining whether or not a device needs to be sterilized, and if so, the type of sterilization can affect a range of factors. Sterilization methods vary dependent upon not only the adhesive itself, but also on the other components of the device. For example, if you are designing a product that requires gamma sterilization, with the current available adhesive systems, the silicone gel adhesives wouldn't be an option for your device.

- What environmental factors will my device be exposed to?
  - Is this device meant for rigorous physical activity?
  - Is this device going to be exposed to water or perspiration?
  - Is this device going to be worn in extremely cold or extremely hot environments?
  - Are there any other factors or contaminates that could compromise my product's integrity like lotion or other skin care products?

Working with a supplier that understands your form, fit and functional requirements and provides compatible options through extensive material knowledge will save you a lot of time in the research and development phase of your application. Polymer Science is committed to providing you with today's most innovative skin contact adhesives for the medical industry. Our diverse team of highly skilled engineers and technical staff, in conjunction with our state-of-the-art equipment, provide you with a quality product that is consistent with your application requirements. Our design team works quickly to provide the solutions you need, allowing your project to expeditiously move from conception to commercialization giving you the edge to ensure your next project is a success.

Polymer Science offers P-DERM® skin contact adhesives ranging from the conventional acrylics and medical grade adhesives to our innovative atraumatic, pain free removal silicone gel and hydrogel adhesives. Our coated materials are specifically formulated and fabricated to meet the technological challenges found in the medical industry today with a range of different characteristics to meet the requirements of your application. All P-DERM® skin contact adhesives are made in the USA.

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