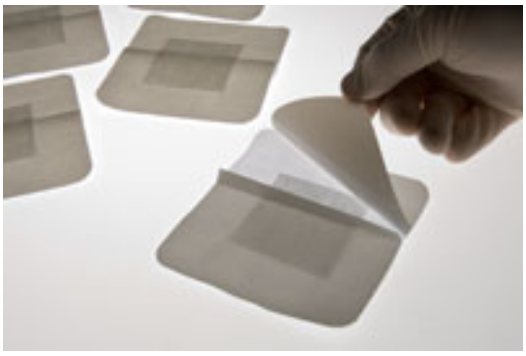
Sticky Silicone

Silicone gel pressure sensitive adhesives are offering a revolutionary solution to applications such as medical device attachment and wound care. Exhibiting a variety of favorable properties for an adhesive that comes in contact with skin, the silicone gel is ideal for use with geriatric, neonatal, and diabetic patients. This article reviews these benefits as well as other aspects of this technology.

By Dr. Jim Jian-Ling Ding



Pressure sensitive adhesives are often a critical component in the manufacture of wound care products.

Dr. Jim Jian-Ling Ding is the vice president of global technology for Scapa Group plc. He is responsible for the company's technical innovation, new product development, and technical support functions. Dr. Ding can be reached at 860-688-8000 or jding@scapana.com.

Adhesives for direct-skin attachment have been potential sources of irritation for patients, medical professionals, and medical device manufacturers. Until recently, some adhesives that bond to the skin for extended periods of time have caused tenderness and inflammation, and have been difficult to remove without discomfort.In today's healthcare environment where geriatric, neonatal, and diabetic populations are rapidly increasing, the adhesive industry has been challenged to develop medical grade pressure sensitive adhesive (PSA) systems that will bond securely, yet gently, to extremely sensitive or fragile skin for continuous long-term wear. The most demanding applications for these adhesive systems are in wound care: burns that involve tissue loss, wounds caused by abrasions or chronic diseases (for example, diabetic ulcers or pressure sores), or wounds such as skin graft donor sites.

Pressure Sensitive Adhesive System

Non-woven materials are often used in single-coated adhesive tape construction.

Pressure sensitive adhesive films and tapes offer a convenient and safe solution to many of the challenges currently facing medical device manufacturers. Natural rubber, synthetic rubber, acrylic, and silicone adhesives are applied to appropriate liners and supports, such as films, tissues, foams, and other materials, to provide a wide array of necessary end-use requirements.Pressure sensitive adhesives can provide strong bonds, high and/or low temperature resistance, and skin-friendly properties that won't damage even the most sensitive skin. These adhesives are available in formulations that are easy to remove from the skin.
There are three basic types of PSA constructions: unsupported transfer adhesives, double-coated tapes (supported products), and single-coated tapes. Most of these constructions require one or more release liners.
A transfer adhesive is an unsupported adhesive layer packaged on one or more release liners. These products are generally available with one release liner in roll form and two release liners in sheet form. Transfer adhesives do not feature any carrier or support.
A double-coated tape is made of a carrier or support coated on both sides with an adhesive and supplied on either one or two release liners. Carriers vary depending on application requirements. Common carriers include foam, film, paper, and metal foil. One important benefit of a double-coated product is that different adhesive types may be used on each side of the carrier. For example, one side may offer a permanent adhesive, while the adhesive on the opposite side is removable. This is especially important to device manufacturers who need a permanent adhesive to bond to a device along with a skin-friendly adhesive that bonds to a patient's skin and removes easily without causing skin trauma.

Soft, water resistant, pressure sensitive silicone gel adhesives are hydrophobic,

ensuring a stable level of adhesion to skin.

A single-coated adhesive tape has adhesive on only one side of a backing. Backings can be made of cloth, various films, foams, and a range of other materials. Single-coated products are available either with or without a release liner.
For wound care and medical device assembly, two types of PSA constructions are typical. Single-coated products are generally designed to stick to another surfaceas in a bandage or wound dressing adhering to skin, or a medical tape holding an IV catheter in place. Double-coated products bond two distinct surfaces togetherin the case of a medical device, one side bonds directly to skin, while the other side attaches to the device. Double-coated tapes with conformable carriers offer excellent flexibility in that they can be customized for applications that require specific characteristics such as two different adhesives, dimensional stability, ease of application, or special properties such as electrical or thermal conductivity or resistance, among others.

While silicone gel is tacky to the touch, it is very easy to remove and does not leave adhesive residue on most substrates.

Direct Skin Adhesive Options

For medical applications such as wound care and direct-skin device attachment, most medical professionals have relied primarily upon acrylic and rubber-based adhesive products.Both acrylic and rubber-based adhesives can offer good adhesion to the skin, bonding so aggressively, however, that they tend to cause irritation and discomfort upon removal. As these traditional adhesives are relatively firm, they make direct contact with only a portion of the skin's surface, staying in place because of their high adhesion rather than their maximized surface area contact. This high adhesion means that surface skin cells are stripped off upon removal and fragile skin may be torn. Over long-term wear, ripping, tearing, and tugging at dressings can inflame the wound area and diminish critical healing agents.
Skin can become sensitive to and irritated by the chemicals found in both rubber and acrylic adhesives. As most acrylic and rubber-based adhesive products do not provide good permeability to moisture, the patient's skin may become macerated over long-term wear as a result of excess moisture build-up.

Silicone Gel Technology

Pressure sensitive silicone gel adhesive technology is revolutionizing sensitive skin care and meeting the challenges associated with traditional medical adhesive systems. These soft, water-resistant adhesives provide gentle adhesion to the skin. Non-irritating and conformable, silicone gel adhesives are used for neonatal care, medical device attachment, wound care, skin therapy, and hypertrophic scar management.Silicone gel is a man-made polymeric material made up of silicone polydimethyl siloxane. Its unique chemical composition results in a soft gel-like physical form. To many end-users, it feels like a hydrogel. But unlike hydrogels where adhesion properties are compromised by the presence of excess moisture or drying, the hydrophobic properties of silicone gel ensure a stable level of adhesion. Given the presence of moisture in many medical applications, this is a critical advantage of silicone gel technology. End-users are able to realize the benefits of a hydrogel without the risk of adhesion loss caused by excess levels of moisture. While silicone gel is tacky to the touch, it is very easy to remove and does not leave adhesive residue on most substrates. Due to its very low surface tension and excellent ability to flow and wet-out, silicone gel conforms to the uneven surface of the skin, filling minute gaps and delivering a much broader contact area than traditional adhesives. Silicone gel adheres to skin securely, forming an immediate bond.

Non-irritating and conformable, silicone gel adhesives may be used for neonatal care and other sensitive skin applications.

With a peel adhesion range of just 20 to 50 grams per inch, silicone gel does not bond to common surfaces permanently. Its fundamental softness and pliability allow it to be easily and cleanly removed without skin trauma, no matter how long the silicone has been on the skin's surface. Skin cells will not lift off when the adhesive is removed, a factor that can damage the skin after repeated dressing removal. As silicone gel does not lose adhesion when removed from the skin, it can be washed with water, air dried, and reused if necessary.
Under most circumstances, the human body is extremely efficient at repairing damaged tissue using its innate healing mechanisms. A moist wound environment is critical to successful healing. With an insufficient level of moisture, delivery of nutrients and growth of new cells slows and healing eventually stops. Biocompatible and chemically mild, silicone gel is relatively moisture and oxygen

permeable, allowing optimum natural healing. The relative hydrophobic nature of silicone gel means that biological secretions will not dry and stick to the dressing, ensuring easy and painless removal.

Exactly the right level of moisture must be maintained for optimum healing. While exudations from the wound can help keep the area moist and provide important substances to aid in healing, too much exudate can actually hinder the process. Working in cooperation with absorbent materials, silicone formulations can prevent excess moisture build-up and minimize maceration of the skin over long-term wear.Online

For additional information on the technologies and products discussed in this article, see MDT online at www.mdtmag.com or Scapa Medical at www.scapana.com.

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