



DEVELOPMENTS IN WOUND DRESSINGS

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INTRODUCTION

Wound dressings form an important segment of wound management products. In earlier days, the dressings used for healing are of bandages and gauze with varying degrees of absorption. They were used to keep the wound bed dry and thereby making the wound as bacteria free environment. The wound treatment scenario is now totally changed, and researchers strongly feel that a warm, moist environment wounds heal so fast (Bolton & van Rijswijk 1991). Introduction of newer dressings with rapid healing capability is focused on the creation of optimum healing environment. They include moist environment, circulation of oxygen and elimination of biofilms (Eaglstein et al 1988). Because there exists several wound types, the dressing cannot be of similar for all wounds. Hence, for effective wound management and use of proper dressing, the knowledge on the type of the wound, healing process, and the properties of dressings are very important (Armstrong & Ruckley 1997).

TYPES OF WOUND DRESSINGS

Wound dressings are classified into the following types based on the materials used for preparation.

Traditional Dressings

Bandages and gauze made of cotton, wool or other materials are termed as traditional dressings (Hoekstra et al 2002). These are dry dressings and will not create a moist environment on the wound surface. Traditional dressings are used as primary or secondary dressings based on their application and function (Jones 2006). Compression bandages can be used for lymphoedema and venous leg ulcers (Dinah & Adhikari 2006). For packing open wounds, sterile gauze pads are used to absorb fluid and exudates. These gauze dressings should often be changed based on the amount of exudates to avoid maceration (Falabella 2006).

Modern Wound Dressings

Main characteristic of maintaining the moisture level is the foremost advantage of modern dressings. They also become a part of drug delivery for the healing of the wound (Hampton 1999).

Hydrocolloid Dressings

Due to the gel forming nature, hydrocolloids are widely used modern dressings with inherent wound healing properties. Gelatin, pectin, and carboxymethylcellulose are the gel forming agents and can be formulated as films and sheets (Schaller et al 2004). They are used in healing of moderately exuding wounds like pressure sores, traumatic injuries, and minor burns. Due to their

absorbent nature, their water vapor permeability also gets increased while forming gels. These dressings are held by an occlusive outer cover which is preventing water vapor exchange (Thomas & Loveless 1997).

Alginate Dressings

Alginate dressings are prepared in the form of foams or fibrous sheets. Due to their higher absorbency, alginate forms gels when it is in contact with exudates. This characteristic feature makes alginate dressing minimize bacterial contamination (Doyle et al 1996). The calcium ions present forms a cross linked polymeric gel when in contact with fluid. When it is compared with hydrocolloid dressings, alginate dressings last longer on the wound surface (Thomas 2000). Human macrophages are activated to produce TNF α and, so the inflammatory signals are initiated (Agren 1996). The calcium ions released, also aids in clotting mechanism. Moderate to heavily exuding wounds can use alginate dressings. These dressings are not suitable for dry wounds covered with necrotic tissue (Thomas et al 2000).

Hydrogel Dressings

Hydrogels are hydrophilic materials, swellable and insoluble dressings. They are prepared from synthetic polymers. The form of the hydrogel dressings may be gel, film or solid sheet (Moody 2006; Luo et al 2000). Significant amount of water is entrapped or absorbed by the hydrogels and retained. Hydrogel dressings are suitable for light to moderately exuding wounds. They can be used as primary or secondary wound dressings. Due to their low mechanical strength, handling becomes

a tedious when it is used alone (Lay-Flurrie 2004; Ueno et al 2001).

Semi-Permeable Adhesive Film Dressings

These semi-permeable dressings were initially prepared from nylon derivatives with an adhesive polyethylene support. Due to nylon, the ability of absorbing water is limited. They tend to wrinkle and become difficult to apply on the wound site. Due to their flexibility, the conformity is good, and the films are transparent. Extensibility, water vapor permeability and conformability differ with the material used (Boateng et al 2008).

Film Dressings

Films are semi-occlusive dressings, which can be used directly on the wound or used as a secondary dressing for a nonadhesive dressing. Hence, the exchange of water and oxygen between the outside environment and wound bed is permitted. Film dressings can be used for moderately exuding wounds to avoid fluid trapping (Fonder et al 2008).

Foam Dressings

Porous polyurethane foam or film forms foam dressings. They provide thermal insulation and maintain a moist environment. Foam dressings are highly absorbent and have a high moisture vapor transmission rate. The absorbency of foam dressings can be controlled by foam properties. They are suitable for light to moderately exuding wounds (Boateng et al 2008).

Biological Dressings

Biological dressings are prepared from biomaterials and also called as bioactive dressings. They are biodegradable and help in new tissue formation. These dressings can be incorporated with antimicrobial compounds and growth factors to be delivered at the wound site (Khan & Davies 2006). Chitosan, collagen and hyaluronic acid are also used as dressing for the delivery of drugs to the wound site (Cho et al 2002).

CONCLUSION

Now the emergence of biomaterials have paved new directions in the research on wound care and wound dressing materials. It was reported that the development of dressing combined occlusion with delivery of growth factors helped to solve a specific clinical problem. It was also proposed that the occlusive dressing with angiogenic growth factor delivery is playing a vital role in the stimulation of granulation tissue to speed up epithelialization. The liquid transport and air permeability properties of needle punched nonwovens are governed by the major structural parameters such as constituent fiber properties, geometrical alignment of fiber, contact points between fibers in fabric and porosity of the fabric.

REFERENCES

1. Bolton, L & van Rijswijk, L, 'Wound dressings: Meeting clinical and biological needs', *Dermatology Nursing*, 1991; 3: 146–161.
2. Eaglstein, WH, Davis, SC, Mehle, AL & Mertz, PM, 'Optimal use of an occlusive dressing to enhance healing: Effect of delayed application and early removal on wound healing', *Archives of Dermatology*, 1988; 124: 392–395.
3. Armstrong, DG, 'Manuka honey improved wound healing in patients with sloughy venous leg ulcers', *Evidence-based Medicine*, 2009; 14(5): 148.
4. Hoekstra, MJ, Hermans, MH, Richters, CD & Dutrieux, RP 'A histological comparison of acute inflammatory responses with a hydrofibre or tulle gauze dressing', *Journal of Wound Care*, 2002; 11: 113–117.
5. Jones, VJ, 'The use of gauze: Will it ever change', *International Wound Journal*, 2006; 3: 79–86.
6. Dinah, F & Adhikari, A, 'Gauze packing of open surgical wounds: Empirical or evidence-based practice', *The Annals of The Royal College of Surgeons of England*, 2006; 88: 33–36.
7. Falabella, AF, 'Debridement and wound bed preparation' *Dermatology and Therapy*, 2006; 19: 317–325.
8. Hampton, S, 'Dressing for the occasion', *Nursing Times*, 1999; 95: 58–60.
9. Schaller, M, Laude, J, Bodewaldt, H, Hamm, G & Korting, HC, 'Toxicity and antimicrobial activity of a hydrocolloid dressing containing silver particles in an ex vivo model of cutaneous infection', *Skin Pharmacology and Physiology*, 2004; 17: 31–36.
10. Thomas, A, Harding, KG & Moore, K, 'Alginates from wound dressings activate human macrophages to secrete tumour necrosis factor- α ', *Biomaterials*, 2000; 21: 1797–1802.
11. Doyle, JW, Roth, T & Smith, M, 'Effects of calcium alginate on cellular wound healing processes modelled *in vitro*', *Journal of Biomedical Materials Research*, 1996; 32: 561–568.
12. Thomas, S, 'Alginate dressings in surgery and wound management—Part 1', *Journal Wound Care*, 2000; 9: 56–60.
13. Agren, MS, 'Four alginate dressings in the treatment of partial thickness wounds: A comparative experimental study', *British Journal of Plastic Surgery*, 1996; 49: 129–134.
14. Thomas, A, Harding, KG & Moore, K, 'Alginates from wound dressings activate human macrophages to secrete tumour necrosis factor- α ', *Biomaterials*, 2000; 21: 1797–1802.
15. Moody, A, 'Use of a hydrogel dressing for management of a painful ulcer', *British Journal of Community Nursing*, 2006; 11: S12–S17.
16. Luo, Y, Kirke, KR & Prestwich, GD, 'Crosslinked hyaluronic acid hydrogel films: New biomaterials for drug delivery', *Journal of Controlled Release*, 2000; 69: 169–184.

17. Lay-Flurrie K, 'The properties of hydrogel dressings and their impact on wound healing', *Professional Nurse*, 2004; 19: 269–273.
18. Ueno, H, Mori, T & Fujinaga, T, 'Topical formulations and wound healing applications of chitosan', *Advanced Drug Delivery Reviews*, 2001; 52: 105–115.
19. Boateng, JS, Matthews, KH, Stevens, HNE & Eccleston, GM, 'Wound healing dressings and drug delivery systems: A review', *Journal of Pharmaceutical Sciences*, 2008; 97: 2892-2923.
20. Fonder, MA, Lazarus, GS, Cowan, DA, Aronson-Cook, B, Kohli, AR & Mamelak, AJ, 'Treating the chronic wound: A practical approach to the care of nonhealing wounds and wound care dressings', *Journal of the American Academy of Dermatology*, 2008; 58: 185-196.
21. Boateng, JS, Matthews, KH, Stevens, HNE & Eccleston, GM, 'Wound healing dressings and drug delivery systems: A review', *Journal of Pharmaceutical Sciences*, 2008; 97: 2892-2923.
22. Khan, AT & Peh, KK, 'A preliminary investigation of chitosan film as dressing for punch biopsy wounds in rats', *Journal of Pharmaceutical Sciences*, 2003; 6: 20–26.
23. Cho, YS, Lee, JW, Lee, JS, Lee, JH, Yoon, TR, Kuroyanagi, Y, Park, MH, Pyun, DG & Kim, HJ, 'Hyaluronic acid and silver sulfadiazine-impregnated polyurethane foams for wound dressing application', *Journal of Materials Science: Materials in Medicine*, 2002; 13: 861–865.