Biodegradable Electrospun Nanostructured Polymer Dressings for Enhanced Burn Wound Healing.

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Abstract

The pursuit of the ideal wound dressing has remained a persistent challenge throughout human history. The demand for treatments that are rapid, effective, affordable, and painless has catalysed the development of skin substitutes and grafts for injuries that compromise natural protection, hinder healing, and prolong suffering, thus exacerbating tissue damage and pain. Recent technological advancements, particularly the advent of nanotechnology, have rekindled interest in electrospinning—an ancient material fabrication technique widely utilised in industry—which is now being harnessed with innovative substances for health research. The emergence of the nanometric scale has prompted the scientific community to reassess traditional manufacturing methods, including the time-honoured process of electrospinning, which has proven efficient in producing nanofibres from both synthetic and biological materials, woven at micro, sub-micro, and nanometric scales[1]. These nanofibres have demonstrated promising results when employed as skin substitutes[2].

This study seeks to evaluate the applicability of a biodegradable polymer dressing in the treatment of burn wounds. The randomised, controlled experimental trial was conducted with patients presenting with clean or potentially contaminated wounds, who were hospitalised in Manaus, Brazil. The average diameters of the poly(ε-caprolactone) (PCL) nanofibres and drug-modified PCL nanofibres were 1.16 ± 0.99 µm, 1.53 ± 0.92 µm, and 0.98 ± 0.66 µm, respectively. Figure 1 illustrates scanning electron microscopy (SEM) images and histograms depicting the fibre diameter distribution during the fabrication of PCL[3,4].

All dressings resulted in a significant reduction in pain among the treated patients, with no incidence of infection, thereby confirming the efficacy of the sterilisation method and its suitability for wounds extending to the deep dermis. The production of these dressings was rapid, uncomplicated, and cost-effective.

Keywords: Electrospinning; Biodegradable Polymers; Wound Healing; Burn Treatment; Nanofibres; Poly(ε-caprolactone) (PCL)

References

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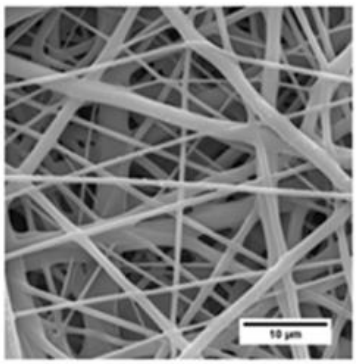
Figures

(a)



(b)

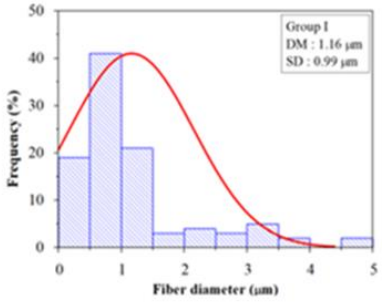


Figure 1. Figure 1. SEM images and histograms of fiber diameter distribution of the fabrication of PCL.