Using colour exhibited by venous leg ulcers to develop a range of hues that represent the clinical manifestations of erythema and wet necrotic tissue.

Submitted by

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Dedication

I dedicate this thesis to my late father who passed away as the thesis was being written. The standards he set and his undying love provided me with the commitment and resourcefulness required to undertake the study and complete the thesis. The pride he derived from my achievements will remain with me always.

Acknowledgments

Whilst this thesis has one author listed on the title page it is a culmination of work that has involved the support of several other people.

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SUMMARY

This project sought to develop a system that facilitated the visual inspection of venous leg ulcers by establishing a selection of reliable parameters. The project had three principal aims: to develop a reliable method for capturing the colours exhibited by a venous leg ulcer; to establish a colour range that experienced clinicians believed represented wet necrotic tissue and erythema; and to develop software that highlighted the two manifestations in digital photographs.

The project method was divided into three phases. The first phase examined images taken from twenty-two patients over forty-seven episodes of care. During each episode three sequential images were captured using a frame to control for orientation, magnification and lighting resulting in a bank of 141 images. The reliability of the system to accurately capture colour was then determined by examining the amount of colour variation recorded across the set of three images taken at each episode. The second phase asked eight experienced clinicians to examine a set of twenty photographs taken from the bank established in phase one. On each photograph the clinicians were asked to identify areas of wet necrotic tissue or erythema and outline the areas with a colour pen supplied for each manifestation. A colour range was then constructed to represent each manifestation by measuring the range, mean and standard deviation of pixels that were located within the outlined areas. The third phase developed a computerised system that used the colour range established in phase two to highlight areas of a digital image that represented either erythema or wet necrotic tissue. The validity of the

highlighted areas was then tested by asking experienced clinicians to identify their level of agreement with the areas selected by the computer system.

Analysis of the results from phase one indicated that the system used to record images at each episode of care provided a reliable method for maintaining consistent orientation, magnification and replication of colour. Results from phase two yielded a two distinct colour representation of erythema and wet necrotic tissue. Erythema ranged from 360^0 to 378^0 of hue with a mean of 369.21^0, and wet necrotic tissue ranged from 367^0 to 390^0 of hue with a mean of 387.73^0. Results from phase three indicated that whilst clearly delineated areas of erythema and wet necrotic tissue were visible, the validity of the representations was varied. 50 per cent of experienced clinicians agreed with the areas selected as erythema and 60 per cent agreed with the areas selected by the computer system as wet necrotic tissue.

The system developed during this study for recording images of venous leg ulcers provides a reliable method for further research into the visual progression of this disease. However, the colour range identified as being representative of erythema or wet necrotic tissue and the computer system developed to highlight such areas in a digital image, requires further investigation before it is applicable to the clinical setting. The findings do however provide further insights into the varied nature of expert opinion when judging the colour of venous leg ulceration.