

## The paper that changed my life

09/11/09 | Pressure ulcers | Michael Clark

**Mike Clark chooses a paper by Reswick and Rogers (1976) that attempted to determine how long patients could withstand a static posture without developing pressure ulcers. This is reviewed by Amit Gefen.**

It is rare for a single publication to illuminate fully a complex process such as pressure ulcer development. One highly significant paper, which is hard to obtain in its original format, is by Reswick and Rogers, published in 1976 [1].

This set out data from 980 human subjects, linking the time of exposure to pressure and the magnitude of the pressure to the development of pressure ulcers. While this work failed to provide clear thresholds of either time or load magnitude that would result in damage, it validated earlier work in non-human subjects that identified an inverse exponential relationship between pressure and exposure to loading.

### Reference

1. Reswick JB, Rogers JE. Experience at Rancho Los Amigos Hospital with devices and techniques to prevent pressure sores. In: Kenedi RM, Cowden M, Scales JT (eds). *Bedsore Biomechanics*. London: Macmillan Press, 1976; 301-10.

### Expert commentary



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The Reswick and Rogers (1976) paper is certainly one of the most important publications in the history of pressure ulcer research. The attempt made to determine a quantitative damage threshold for immobilised patients was innovative: it was intended to help predict how much time patients can withstand a static posture without developing pressure ulcers. The most important finding was that injury tolerance appeared to be a function of time of exposure to loads. This confirmed indications from earlier animal model studies that tissue tolerance to load is time-dependent.

Although their concept was pioneering, the Reswick and Rogers study was limited by the use of interface pressures as a measure of tissue loading. With the development of biomechanical computer modelling of interactions between bones and soft tissues in the two decades that followed their publication, it became evident that two subjects can have very similar interface pressures, eg during sitting, but loads in deep tissues (such as muscle and fat) can be substantially different. The Reswick and Rogers pressure-time tolerance curve cannot distinguish between patients with high or low internal tissue loads if they present similar interface pressures, and it is therefore not suitable for predictions of deep tissue injury.

Unfortunately, over the years, there has been consistent inaccuracy in the literature in the interpretation of the Reswick and Rogers pressure-time curve. This misinterpretation states that the curve shows an inverse relationship between pressure and time factors (ie is a hyperbola function in mathematical terms). If this were true, soft tissues would be able to withstand almost any magnitude of load if the load was delivered for just a short time (seconds). Conversely, even very mild loads, such as a gentle touch, would cause irreversible damage if these were to last for very long times (days). However, we know from life experience that very mild loads like those delivered by a wrist watch can be borne by soft tissues for days without causing pressure ulcers. Hence, a better description of the injury tolerance of tissues is a mathematical function that is more complex than the inverse relationship, and is called a sigmoid function [1,2].

In conclusion, the Reswick and Rogers work opened a new, highly important path in the search for a quantitative description of the size of sustained loads that human soft tissues can tolerate. However, the data in their study should not be used as it is for clinical applications because of methodological limitations in their 1976 publication.

### References

1. Gefen A. Reswick and Rogers pressure-time curve for pressure ulcer risk. Part 1. *Nurs Stand* 2009;2(45):64-68.
2. Gefen A. Reswick and Rogers pressure-time curve for pressure ulcer risk. Part 2. *Nurs Stand* 2009;2(46):40-44.