SKIN STRETCHERS
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Key Points
- Inherent skin elasticity
- Properties of mechanical creep and stress relaxation
- Uses of “Skin Stretchers” for wound closure

Skin of humans and animals is a nonhomogeneous viscoelastic tissue with the combined characteristics of a viscous fluid and elastic solid. Skin extensibility is dependent upon three factors occurring consecutively as a load, applied to the skin, is progressively increased: (1) convolutions in dermal collagen progressively straighten; (2) dermal collagen fibers align parallel to each other in the direction of the applied load; and (3) fully aligned collagen fibers extend only upon application of great increases in tension. As skin progressively extends, it contracts in a plane at right angles to the applied load.

The inherent extensibility of the skin is subjectively assessed by gently grasping and lifting this skin between the thumb and index finger. Mechanical creep is the biomechanical property of skin in which skin is capable of further extension beyond that the limits of its inherent extensibility. In mechanical creep, collagen fibers align, over time, with subsequent displacement of interstitial fluid surrounding the collagen fibers and fibrils which comprise individual collagen strands. Stress relaxation of the skin, the progressive reduction in force required to maintain the stretched skin's length, is a corollary of mechanical creep. Mechanical creep and stress relaxation can be achieved by application of a constant load to the skin or by intermittent stretching of the skin with periods of relaxation (load cycling).

Tissue expanders, presuturing, load cycling with skin hooks, and a "C-clamp" skin stretching device are examples of methods currently employed to take advantage of these biomechanical properties of skin. Each technique has advantages and limitations to their usage in clinical patients. One common disadvantage of each of these devices, to a variable degree, is their proximity of placement to the surgical site. "Recruitment" of skin is limited to the immediate vicinity of their application. Additionally, each device requires insertion beneath or into the skin to exert their mechanical effect.

The speaker has designed an externally applied, noninvasive device that applies adjustable tension to skin both local and distant to the surgical site. "Skin stretchers" enable the surgeon to gradually increase tension on the skin as this tissue progressively stretches.

Skin stretchers (mpavletic@angell.org) are used to mobilize or stretch skin to facilitate wound closure. Uses include:
1. Prestretching skin prior to elective surgical procedures (e.g. skin tumor removal)
2. Stretching skin during open wound management in preparation for wound closure
3. Application to offset incisional tension post-operatively
