Experimentally Measured Lumbar Skin Strains During Activities of Daily Living

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Background and Motivation

- When mechanical stimulation of the skin, post-surgery, is kept at a minimum, the risk for hypertrophic and keloid scarring is reduced.

- Surgeons have used tools such as biodynamic excisional skin tension (BEST) lines to know where to make an incision to minimize scarring.

Methods

- Data was collected for a healthy young cohort of 28 people (25.2 ± 9.3 years, BMI: 23.3 ± 3.3).
- 36 motion tracking markers were placed with reference to the S2 – T11 spinous processes.
- Marker coordinates were used to generate strain field maps during flexion, extension, right/left rotation, and standing up from a chair.

Research Objective:

To measure biomechanical skin stretch during activities of daily living (ADLs)

Discussion and Conclusions

- When mechanical stimulation of the skin, post-surgery, is kept at a minimum, the risk for hypertrophic and keloid scarring is reduced.
- Surgeons have used tools such as biodynamic excisional skin tension (BEST) lines to know where to make an incision to minimize scarring.

Methods

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Optimal scar outcomes are dependent on a minimal stimulation of fibroblasts, commonly aided using wound closure techniques (figure 6), which limit how skin stretches during activities of daily living (ADL). Surgical incision location and orientation influence the likelihood of hypertrophic or keloid scar formation. These results seem to suggest that lower lumbar incisions are exposed to high SI-oriented tensile strains, especially during high-flexion activities. Upper lumbar incisions are exposed to more moderate SI tensile strains, but experience more severe ML-oriented tensile strains during high-rotation activities. ML sutures, which are perpendicular to the direction of high strain after SI incisions, may be more sensitive to suture pullout, wound opening, or tissue damage. High-extension activities, including sit to stand, resulted in negative strains (i.e., “buckling” of the skin), which is unlikely to induce direct skin damage or suture pullout, but may provide opportunities for suture loosening and further fibroblast stimulation. In conclusion, different regions of the back have different magnitudes of strain and thus higher or lower likelihoods of hypertrophic/keloid scar formation.

Significance:

Surgical incision location and orientation change the likelihood of hypertrophic or keloid scarring.

References