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UNIAXIAL TENSILE PROPERTIES OF SEVEN VAGINALLY IMPLANTED MESHES FOR PELVIC ORGAN PROLAPSE

Hypothesis / aims of study

Recently, numerous polypropylene vaginal mesh kits have been introduced into the market with little known of their differences. As meshes with increased stiffness have been associated with increased rates of complications, we hypothesized that newer products should not be stiffer than the prototypical vaginal mesh kit, Prolift™ which uses Gynemesh PS™ (Gynecare, Somerville, NJ). Differences in the biomechanical behavior of 7 meshes employed in vaginal mesh kits were compared using uniaxial tensile tests.

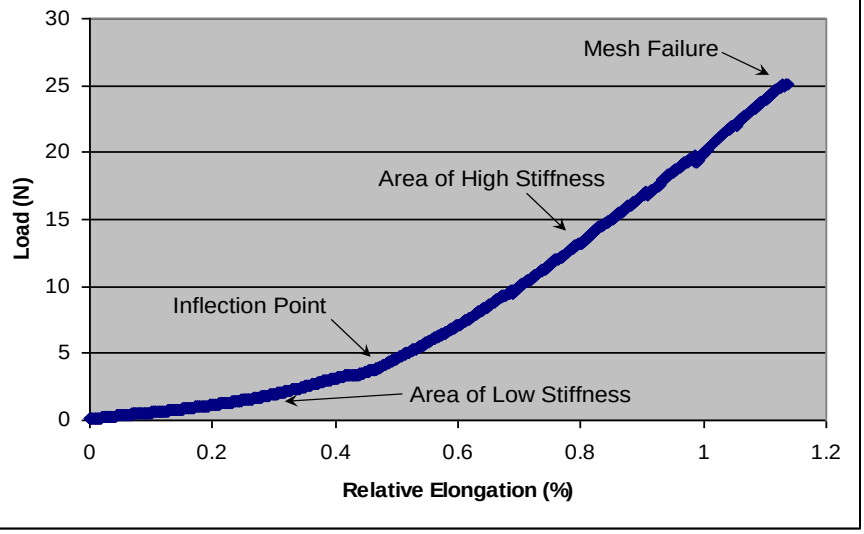
Study design, materials and methods

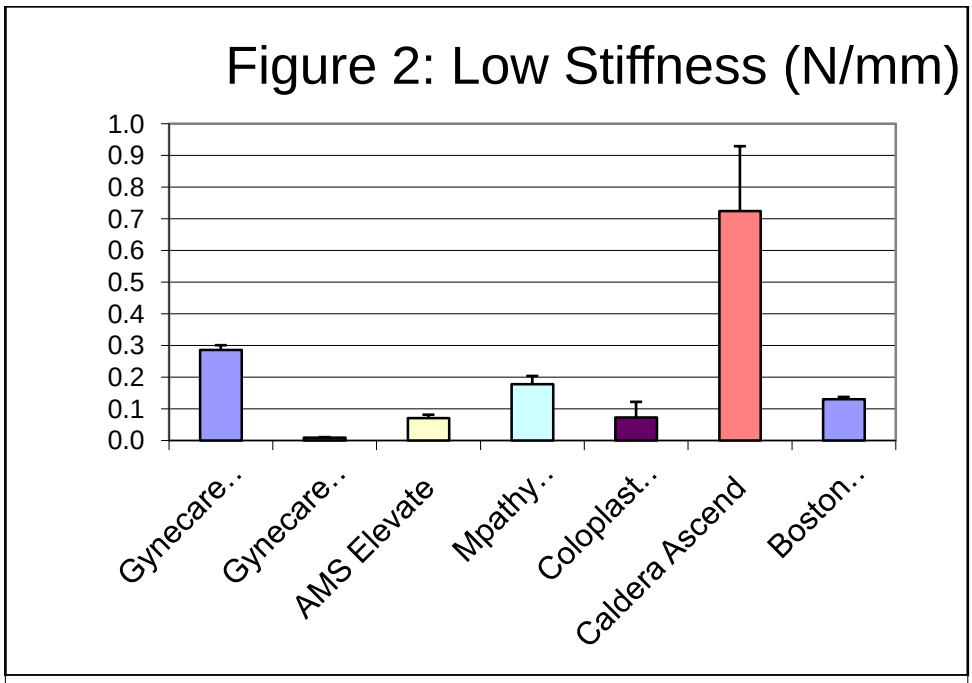
Seven vaginal prolapse meshes including Ascend™ (Caldera, Agoura Hills, CA); Gynemesh PS™ used in Prolift™ and Prosima™ (Gynecare, Somerville, NJ); IntePro Lite™ used in Elevate™, Apogee™ and Perigee™ (AMS, Minnetonka, MN); NovaSilk™ (Coloplast, Minneapolis, MN); Polyform™ used in Pinnacle™ and Uphold™ (Boston Scientific, Natick, MA); Prolift +M™ (Gynecare, Somerville, NJ), and Smartmesh™ (Mpathy, Raynham, MA) were obtained. Five specimens of each mesh were loaded to failure to determine stiffness, failure load, and relative elongation. Additional samples underwent a series of 3 protocols of cyclic loading to determine permanent deformation with submaximal cyclic loading.

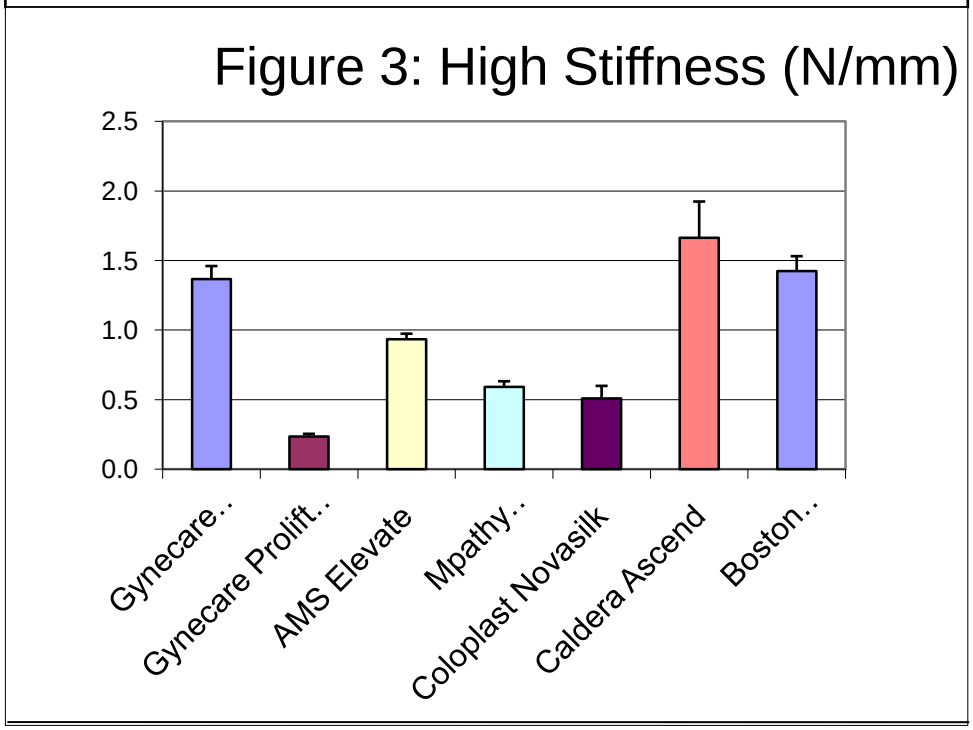
Results

From load to failure testing, the load-elongation curves demonstrated a bilinear response with a period of lower stiffness (N/mm), followed by a period of higher stiffness (figure 1). Ascend™ was the stiffest mesh in both the low and high regions (0.72N/mm, 1.66N/mm). It also had the lowest relative elongation at transition to higher stiffness (13.4%). All other meshes were significantly less stiff with a later transition to high stiffness when compared to Ascend™ and when compared to Gynemesh PS™ (figures 2 and 3). Polyform™ had the highest load at failure which was significantly higher than Gynemesh PS™ (53.84N vs. 42.32N, p=0.038). All other meshes had significantly lower failure loads. Prolift +M™ had the lowest failure load (7.83N). Novasilk™ (89.4%) and Prolift +M™ (87.9%) had the highest relative elongations at mesh failure while Ascend™ had the lowest (40.2%). Comparatively, Gynemesh PS™ had a relative elongation of 66.67% at mesh failure. Ascend™ had the least relative elongation after all 3 protocols of cyclic loading (3.0%, 9.8%, 9.7%, respectively).

Figure 1: Typical Load- Relative Elongation Curve with Bilinear Behavior







Interpretation of results

The mechanical behavior of the seven test meshes varied significantly. Only Ascend™ was stiffer than Gynemesh PS™, which may be predictive of a higher rate of patient morbidity. An ongoing studying is examining how these ex vivo properties relate to in-vivo incorporation into native tissue, while further testing is also warranted to determine what the optimal stiffness is to minimize surgical failures.

Concluding message

All newer generation vaginal meshes for pelvic organ prolapse other than Ascend™ are less stiff than Gynemesh PS™ used in the prototypical vaginal mesh kit Prolift™. This should result in fewer mesh erosions. However, further testing is warranted to determine how these properties relate to in-vivo behavior.

Specify source of funding or grant	**We are supported by grants from the National Institute of Health via grant NIH HD061811 with Pamela Moalli as principal investigator. We have no other conflicts of interest or funding or significant disclosures.**
Is this a clinical trial?	**No**
What were the subjects in the study?	**NONE**