DYNAMIC BIOMECHANICAL PROPERTIES OF TISSUE FOLLOWING LONG TERM IMPLANTATION OF BIOLOGIC AND SYNTHETIC MESHES IN THE RABBIT ABDOMEN.

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OBJECTIVE: We sought to evaluate the effects on dynamic biomechanical properties of tissue after long term implantation of synthetic and biological graft materials.

BACKGROUND: The use of synthetic and biological meshes in incontinence procedures has gained increasing interest in recent years. These meshes are causing alterations of the biomechanical characteristics of tissues.

METHODS: A total of 72 rabbits underwent laparotomy and were implanted with acellular collagen biomesh (n=36) or polypropylene (n=36) in the abdomen. There was a -no mesh- control group (n=12) and a second -rupture of fascia ,no mesh-control group (n=12). Tissue was harvested 3,6 and 9 months later and underwent dynamic mechanical analysis (DMA) testing over a range of low frequencies (0.1-15 Hz) during which the dynamic stiffness and tissue damping capacities were measured. Results were subjected to General Linera Model statistical analysis with Tukey's post hoc testing (Table 1).

RESULTS: With respect to mesh type, the rabbits tissue in which polypropylene mesh was used, showed greater dynamic stiffness than all other groups. Those with biological mesh delivered the lowest stiffness results, while the 2 control groups had almost similar behavior. As far as time is concerned, the meshes exhibited their highest relative dynamic tissue stiffening effect at 9 months of indwelling inside the rabbits. The first 3 and 6 months delivered increased dynamic stiffness at no significant difference levels however, according to statistical analysis (cf. Table 2).

CONCLUSIONS: Biological mesh causes lower tissue stiffness resulting in inferior mechanical response and thus seems to be inferior to polypropylene for incontinence procedures with contrast to the synthetic one.

Table 1. Percentage of total variation explained by corr. factor (%)

	Storage Modulus	***Loss Modulus***	***tanδ***
Mesh type	4.04^{b}	5.09^{b}	35.13^{b}
Time	0.35^{a}	0.32^{a}	0.98^{b}
Frequency	1.46^{b}	1.30^{b}	-
Mesh*Time	1.00^{b}	1.11^{b}	3.55^{a}

Mesh*Freq	-	-	52.53[b]

(-) Not statistically significant impact
Levels: a: 0.05 Significance, b: 0.001 Significance

Table 2. Estimated Marginal Means for DMA parameters with respect to mesh type and indwell time.

	Sample type	Mean[a]	Std. Error	Indw. Time [months]	Mean[a]	Std. Error
Storage Modulus [MPa]	1	.134	.048	0	.373	.071
	2	.933	.049	3	.520	.051
	3	.551	.073	6	.441	.042
	4	.373	.071	9	.695	.073
Loss Modulus [MPa]	1	.025	.010	0	.076	.014
	2	.208	.010	3	.109	.010
	3	.109	.015	6	.097	.008
	4	.076	.014	9	.151	.015
tanδ [-]	1	.141	.004	0	.154	.006
	2	.410	.004	3	.246	.004
	3	.262	.006	6	.280	.004
	4	.154	.006	9	.291	.006

a. Based on modified population marginal mean.
Sample type: 1.Collagen Mesh, 2. Polypropylene Mesh, 3. Fascia ruptured ,4. Normal.