

RHEOLOGICAL PROPERTIES OF MYOMETRIUM: ASSOCIATION WITH AGE, PREGNANCY, LOADING AND TIME OF CONSERVATION

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INTRODUCTION

The work summarizes the results from two-year study of uterine wall tissue properties. Forty-one samples were tested, of which 32 measurements were usable for final evaluation.

Table 1: Samples sorted according to the experiments

Measurement	Nr. of samples	
immediately after taking	pregnant	4
	non-pregnant	22
after 1 week of conservation	non-pregnant	3
after 2 weeks of conservation	non-pregnant	3

The average age of pregnant donors was 29,3 years., while itreached 49,5 years in non-pregnant donors.

METHOD

The following protocol was used for the experiment:

- stress: simple tension
- stress direction: various
- controlled variable: force (0 to 20 N in 5-N steps)
- loading duration: 60 s /each level
- force-change rate: 4,5 N/sec
- liquid proportion in overall sample volume was not monitored before, during and after the test either
- the samples were not wetted during the test
- air humidity was 78 - 84 %, constant during each test
- temperature ranged from 24 up to 26 °C

The following model was used to describe the response and properties of the samples (Equation 1).

$$w = \frac{F}{K} \left(1 - e^{-\frac{K}{B}t} \right) + \frac{F}{B_1}t + \frac{F}{B_2} \ln t \quad (1)$$

The characteristics of the model K , B , B_1 and B_2 were found by fitting the model response to the measured data.








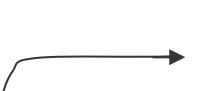
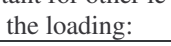
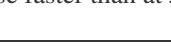
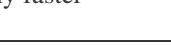
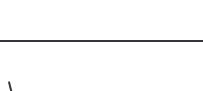
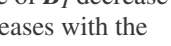
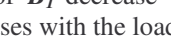
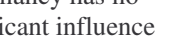
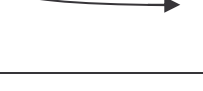
RESULTS (see Tab. 2)

CONCLUSIONS

- no differences were found in responses of the samples to loading in various directions (caudo-cranial vs. latero-lateral)
- all parameters used for description of mechanical properties of the samples were just slightly higher in pregnant donors. Mechanical properties of uterine wall can thus be considered quite stable.
- all parameters of the model were significantly dependent on the level of the applied load
- the uterine wall loses its mechanical properties with age. Their decrease is, however, very slihgt, so we can consider the uterine wall a very stable structure during the whole life

The last phase of the work, which is still going on, is focused on searching of accetable interpretation for the single components of the model and its completion with a parallel elastic part to prevent the unceasing creep.

Table 2: Results (directions of the arrows correspond to the course of the respective variable)

association with parameter	Age	Time of conservation	Pregnancy	Loading
Stiffness K	 - rate of K decrease increases with the loading	 - rate of K decrease increases with the loading	 - pregnancy has no significant influence	
Parallel viscosity B	 - rate of B decrease is increased for 5N and constant for other levels with the loading:	 - at loading levels of 10, 15 and 20 N, B ceases to increase faster than at 5 N	 - increase with loading is in case of pregnancy slightly faster	
Constant serial viscosity B_1	 - rate of B_1 decrease decreases with the loading	 - rate of B_1 decrease decreases with the loading	 - pregnancy has no significant influence	
time variable serial viscosity B_2	 - rate of B_2 decrease increases slightly with loading	 - rate of B_1 decrease decreases with loading	 - the decrease increases with loading	

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