# Morphological Criteria for Normalization of Menstrual Function in Women with Spontaneous Abortion

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Normalization of the menstrual function in women with spontaneous abortion receiving sorbent and bioresonance (extremely high-frequency) therapy was evaluated by morphological criteria (correspondence of structural changes in the endometrium to the phase of the menstrual cycle). The absence of microvilli and cilia on the apical surface of surface and glandular epitheliocytes, presence of intranuclear tubules and giant mitochondria in the cytoplasm, and signs of apocrine secretion in epitheliocytes attested to the luteal phase of the cycle.

**Key Words:** *spontaneous abortion; endometrium; ultrastructure of epitheliocytes*

Abnormality of pregnancy development is an important cause of preterm labor [4,6,7,9,11]. Early therapy effectively prevents endometritis in the post-abortion period, which markedly improves menstrual and reproductive functions [1,2,6,15]. High prevalence of diseases of female reproductive organs determines the need for new methods of their prophylaxis and therapy [9,12-14].

It is important to determine structural reactions reflecting clinical manifestations of chronic diseases and efficiency of therapy [3]. In the present work the most effective method for normalization of menstrual function in women with spontaneous abortion in the post-abortion period was selected by morphological criteria.

## MATERIALS AND METHODS

We performed clinical and morphological examination of 193 patients with pathologies of pregnancy development in the first trimester and 11 healthy women of reproductive age.

Depending on the method of therapy the patients were divided into 3 groups. In the post-abortion period

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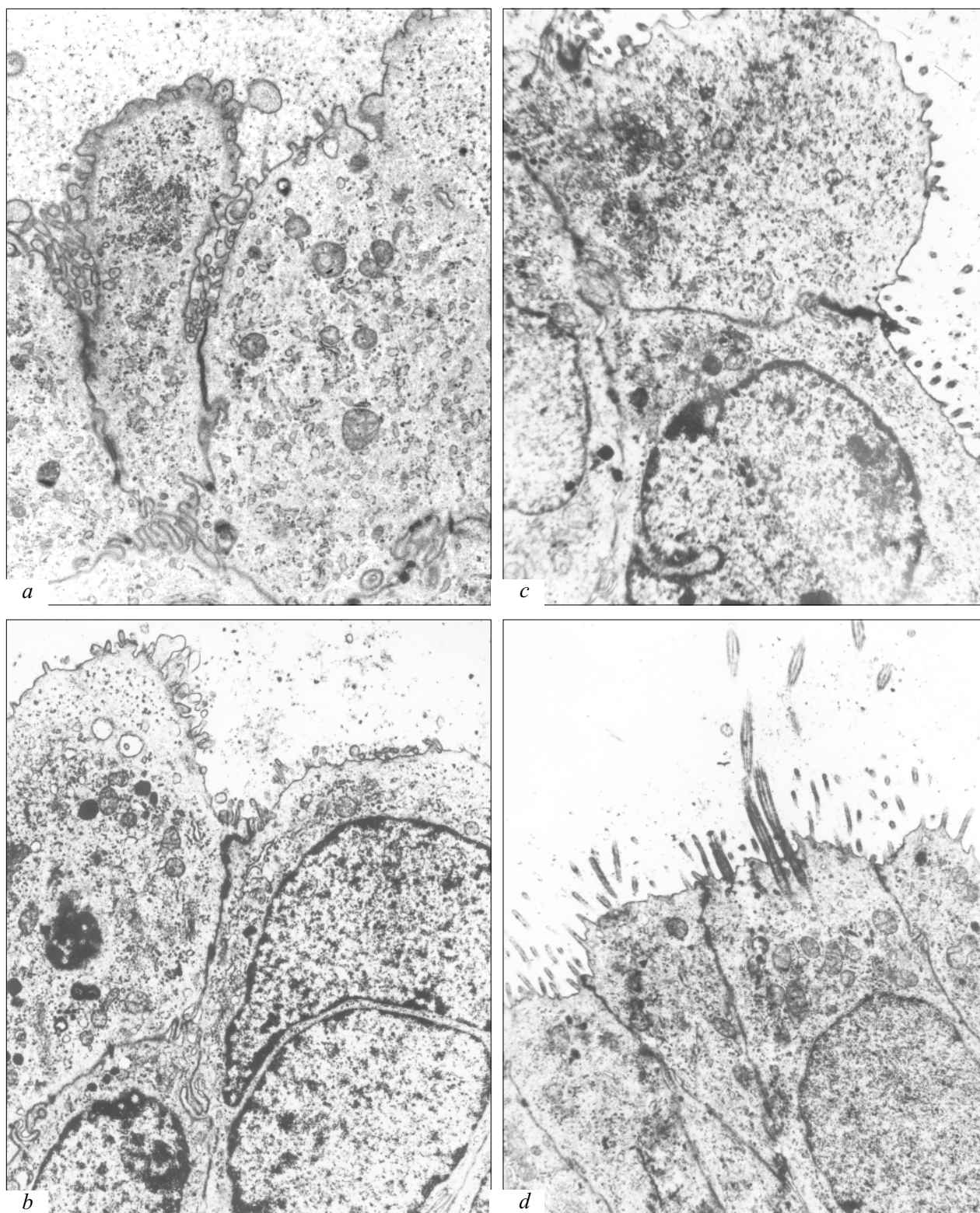
group 1 patients (*n*=58) received standard therapy and complex preparation of enterogel with adsorbed dioxidine, which was administered into the uterine cavity. Group 2 patients (*n*=75) were treated with standard preparations and received 10 sessions of bioresonance therapy: electromagnetic waves in a millimeter range (wavelength 5.6-7.1 mm, power density 8-10 mW/cm$^2$) were applied to points I-18, I-3, GI-4, RP-6, and E-36. Control patients (*n*=60) received only standard treatment, which included infusion (when prescribed), antibacterial, antiinflammatory, uterotonic, and physical therapy.

Pathomorphological analysis of the endometrium was performed on day 23 of the menstrual cycle 2 months after curettage to study menstrual function. Endometrium biopsy specimens were also obtained from healthy women on day 23 of the menstrual cycle. The specimens were fixed in 1% OsO$_4$ in phosphate buffer, dehydrated in increasing concentrations of ethanol, and embedded into Epon. Semithin sections (1 μ) were stained with toluidine blue and examined under a light microscope. Ultrathin sections (35-45 nm) of selected regions were prepared on an LKB-8800 microtome, contrasted with uranyl acetate, and examined under a JEM 1010 electron microscope.

## RESULTS

Pathomorphological assay of endometrial samples from healthy women and patients of groups 1 and 2

**Fig. 1.** Ultrastructural characteristics of surface epitheliocytes in the uterine mucosa in healthy women (*a*) and patients receiving sorbent therapy (*b*), bioresonance therapy (*c*), and standard preparations (*d*). Smooth apical surface of epitheliocytes (×8000, *a*, *b*); smooth apical surface of epitheliocytes, intranuclear tubules (×10,000, *c*); cilia and microvilli on the apical surface of epitheliocytes (×8000, *d*).
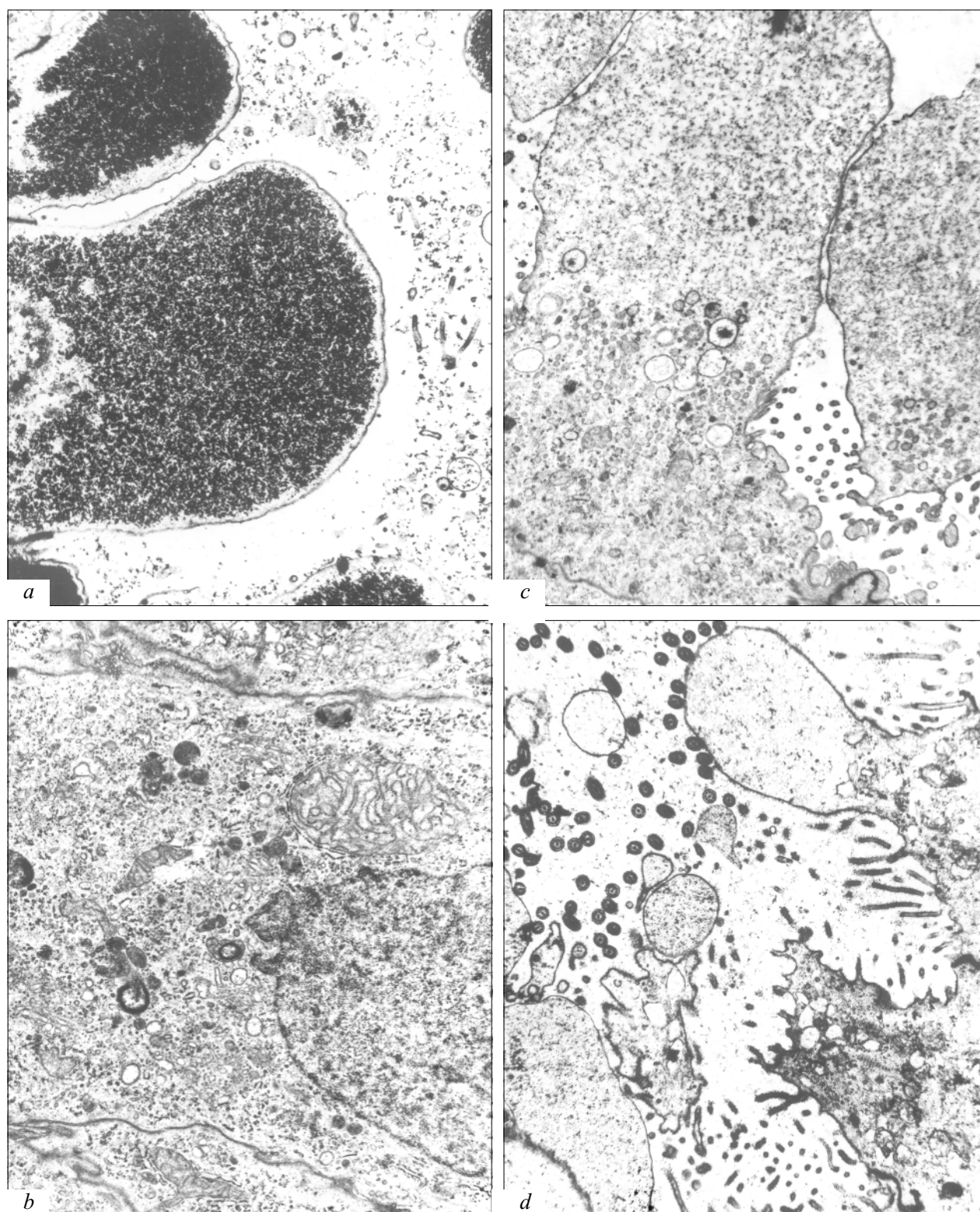
**Fig. 2.** Ultrastructural characteristics of glandular epitheliocytes in the uterine mucosa in patients receiving sorbent therapy (*a, b*) and standard preparations (*c, d*). Accumulation of glycogen in the apical zone of glandular epitheliocytes (×12,000, *a*); giant mitochondrion in epitheliocyte cytoplasm (×10,000, *b*); signs of apocrine secretion in glandular epitheliocytes, low content of glycogen in the secretory product (×12,000, *c*); cilia and microvilli on the apical surface of glandular epitheliocytes (×8000, *d*).

showed that the apical surface of epitheliocytes has a convex shape, included small mucous globules, and had no microvilli and cilia (Fig. 1, *a-c*). These morphological signs correspond to the luteal (secretory) phase of the menstrual cycle [8]. In control patients the apical surface of epitheliocytes carried cilia and microvilli (Fig. 1, *d*). We revealed various intranuclear tubules in epitheliocytes of the uterine mucosa in healthy women and group 1 and 2 patients (Fig. 1, *c*).

Uterine glands had a curved shape and were characterized by high density in sections. Intensely stained secretory product was found in the lumen of glands in healthy women and group 1 patients. The endometrial stroma was edematous and contained diffusely localized connective tissue cells. Spiral arteries filled with erythrocytes lay close to glands and basal membrane.

Studies of ultrastructural characteristics of epitheliocytes in uterine glands revealed signs of apocrine secretion. The secretory product contained glycogen. Accumulation of glycogen in the apical zone of epitheliocytes in the uterine mucosa was most pronounced in patients receiving sorbent therapy (Fig. 2, *a*). The cytoplasm of cells included giant mitochondria (Fig. 2, *b*). The presence of intranuclear tubules and giant mitochondria in the cytoplasm of cells is a reliable marker of ovulation [10].

In controls, intensive apocrine secretion in the glandular epithelium was seen. However, the secretory product contained little glycogen (Fig. 2, *c*). Microvilli and cilia were revealed on the apical surface of cells (Fig. 2, *d*). Previous studies showed that estradiol stimulates the formation of cilia and microvilli on the apical surface of epitheliocytes in the endometrium, which prevents nidation of the ovum. The presence of microvilli and cilia reflects incomplete secretory transformations of the endometrium in the luteal phase of the menstrual cycle [8].

Morphological assay showed that in women receiving standard therapy and enterogel with adsorbed dioxidine in the post-abortion period, functional state of the endometrium corresponded to the mid-luteal phase of the menstrual cycle [5,8,10]. This phase is characterized by the following structural criteria: convex apical surface of epitheliocytes, absence of microvilli and cilia, presence of giant mitochondria in epitheliocytes, curved and densely packed uterine glands, spiral arteries close to the basal membrane in the glandular epithelium, stasis of erythrocytes in blood capillaries and arteries, edema of the endometrial stroma, and diffuse localization of connective tissue cells. These signs were observed in the uterine mucosa of group 1 patients.

Studies of the endometrium in group 2 patients receiving bioresonance therapy revealed structural signs corresponding to the mid-luteal phase. In these patients we did not found giant mitochondria in the cytoplasm of epitheliocytes.

In control patients functional state of the endometrium did not correspond to the mid-luteal phase of the menstrual cycle [5,8,10] and differed from that observed in healthy women and patients of groups 1 and 2. Cyclic changes in the uterine mucosa were delayed. Microvilli and cilia were present in the surface and glandular epithelium. We did not found giant mitochondria in the cytoplasm of epitheliocytes. Small intranuclear tubules were revealed only in individual cells. Low content of glycogen in the secretory product indicated that the secretory process was incomplete. It did not always happen that connective tissue cells were diffusely localized in the mucosal stroma. These cells were often assembled into agglomerates.

These data on structural organization of the uterine mucosa indicate that combination treatment with sorbent therapy and standard preparations most effectively normalizes menstrual function in the post-abortion period. Bioresonance therapy is less effective than administration of entorogel and dioxidine.

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