Raman spectroscopy for the diagnosis of the state of the compact substance of the femoral bone in phlegmon.

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The aim of the work: the use of Raman spectroscopy in the diagnosis of the state of the compact layer of the femur in gangrene and phlegmon to identify differences in damage to the compact layer in the above diseases

Research Materials and Methods

Allogeneic femoral compact bone tissue from 20 recipients of both sexes, aged 58 to 76 years, with established conditions (gangrene, phlegmon), and from conditionally healthy individuals (without bone pathologies) were used as study subjects.

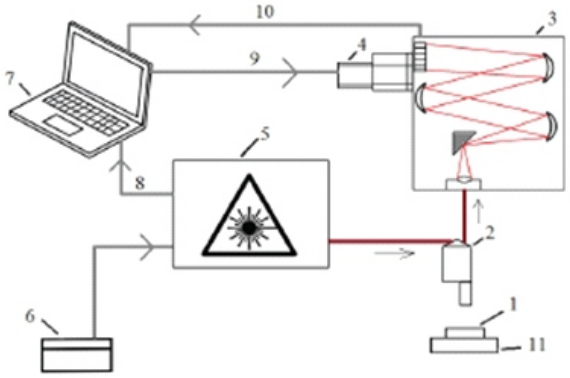

Figure 1 – 1 – object under study; 2 – Raman probe RPB785;
3 – Shamrock sr-303i spectrometer; 4 – built-in DV420A-OE cooled camera;
5 – LuxxMaster Raman Boxx-785.0 RB-04 laser module;
6 – power supply of the laser module; 7 – computer;
8, 9, 10 – information electrical cables; 11 – coordinate table

RESULTS

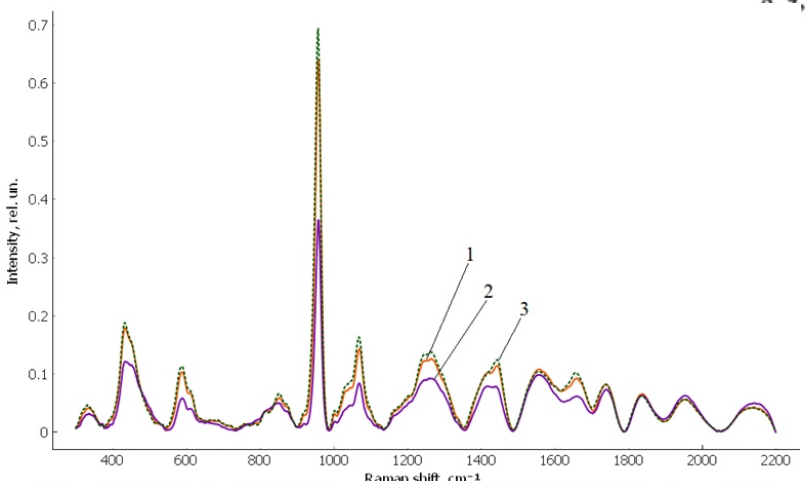

Figure 2. Averaged Raman spectra of the studied groups of samples for cortical bone tissue:
1 – with gangrene, 2 – with phlegmon, 3 – control

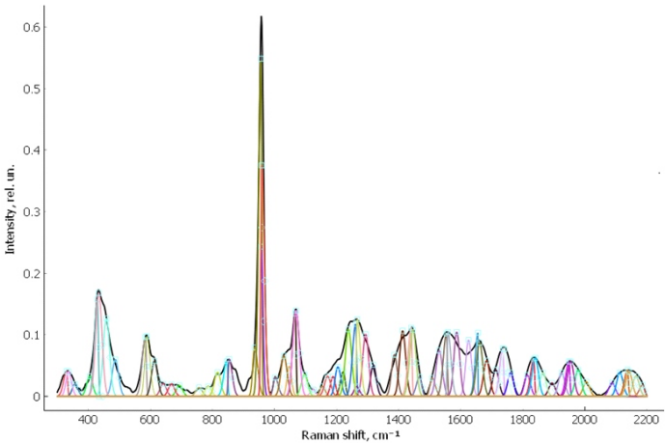

Figure 3 – Decomposition of the Raman spectra of the studied samples

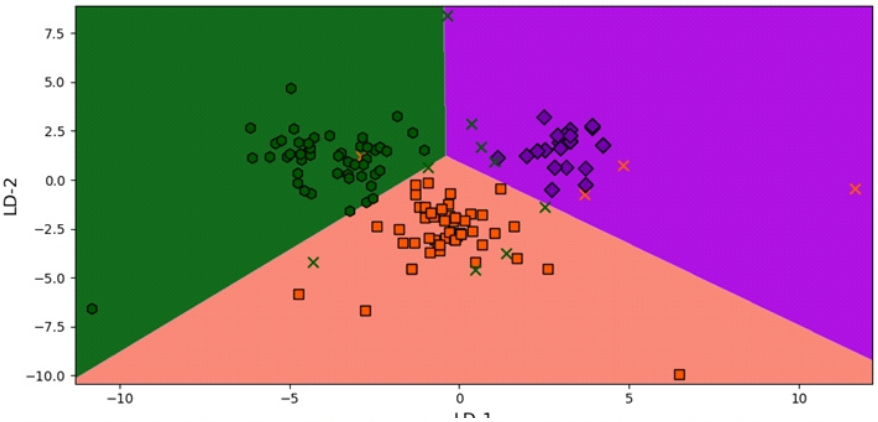

Figure 4. Results of linear discriminant analysis - graph of the values of the linear discriminant function:
1 - for gangrene (orange), 2 - for phlegmon (purple), 3 - control (green)

CONCLUSIONS

1) Spectral changes in compact bone tissue associated with changes in the mineral-organic matrix were diagnosed in phlegmon. These changes are most likely due to secondary bone tissue damage in this disease.

2) A decrease in the intensity of Raman lines corresponding to phosphates, carbonates, and amides in compact bone tissue in gangrene was found. These spectral changes in bone tissue in gangrene are less pronounced than in phlegmon and are most likely associated with the initial stage of bone tissue destruction in this disease.

3) These results allow for diagnostic evaluation of the femoral compact bone in gangrene and phlegmon, which will subsequently help adjust treatment for these types of diseases.