

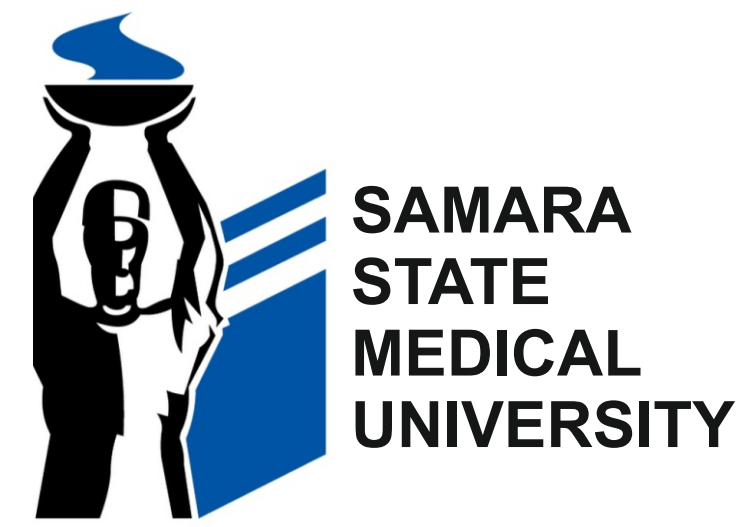


Application of Raman spectroscopy for evaluation of bone condition in periodontitis

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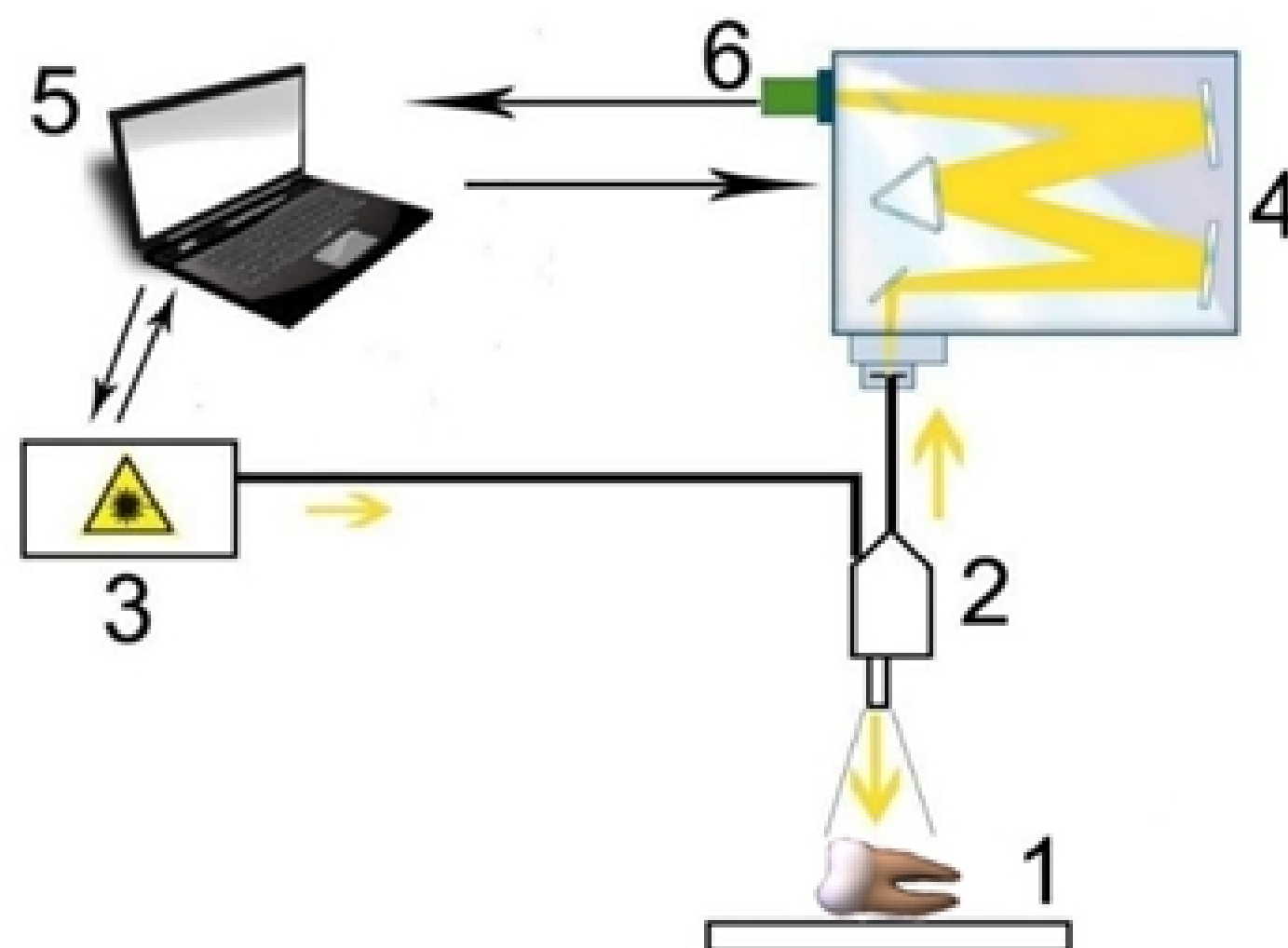
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Annotation

The paper presents the results of bone tissue studies in periodontitis and in the norm. Raman spectroscopy was used as a method to assess the effect of periodontitis on dental bone tissue. Chemometric analysis of the Raman spectra of bone tissue in norm and in periodontitis was performed. Spectral changes in the bone tissue of the teeth were revealed. It was found that in periodontitis, in the bone tissue, there are spectral shifts in the organic matrix and changes in the Raman spectra of the mineral component, which is a consequence of bone tissue resorption in this disease.

Materials and methods of research



Experimental stand

- 1 – studied subject;
- 2 – Raman probe RPB 785;
- 3 – laser module LuxxMaster LML-785.0RB-04;
- 4 – spectrometer Shamrock sr-303i;
- 5 – computer;
- 6 – cooling camera DV420A-OE;

Results

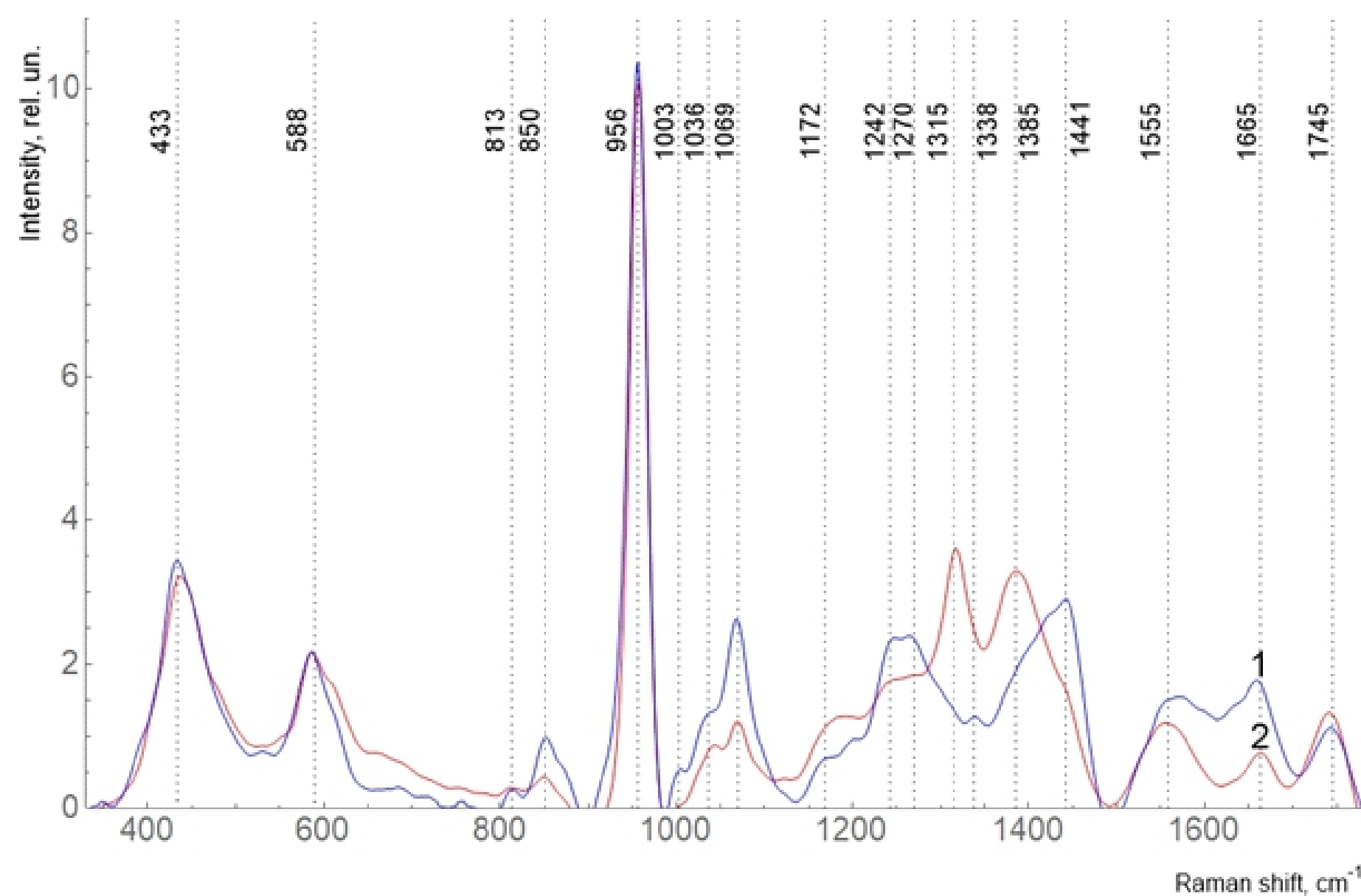


Figure 1: Comparison of bone tissue Raman spectra: 1 - normal, 2 - in periodontitis.

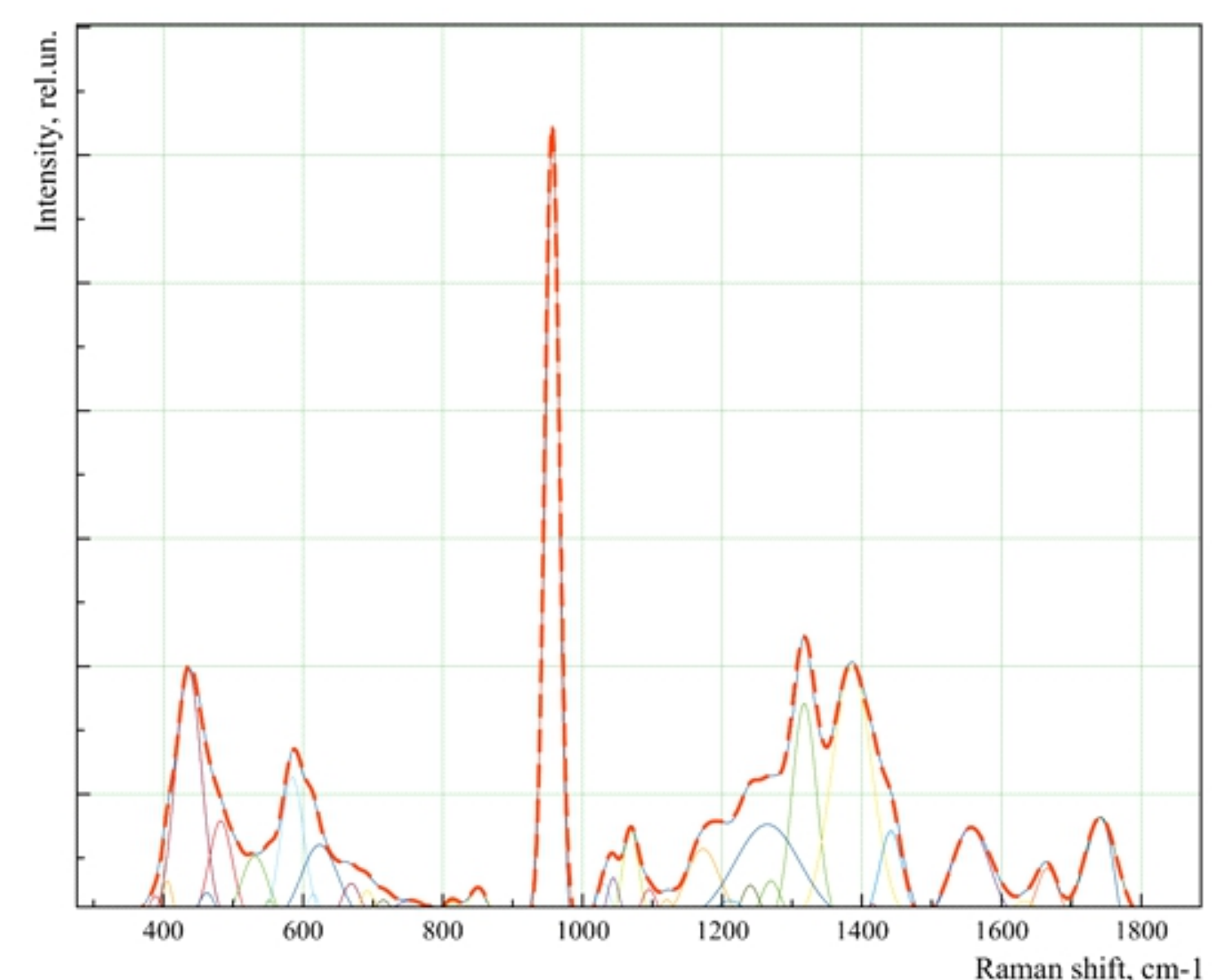


Figure 2: Spectral contour decomposition for bone samples.

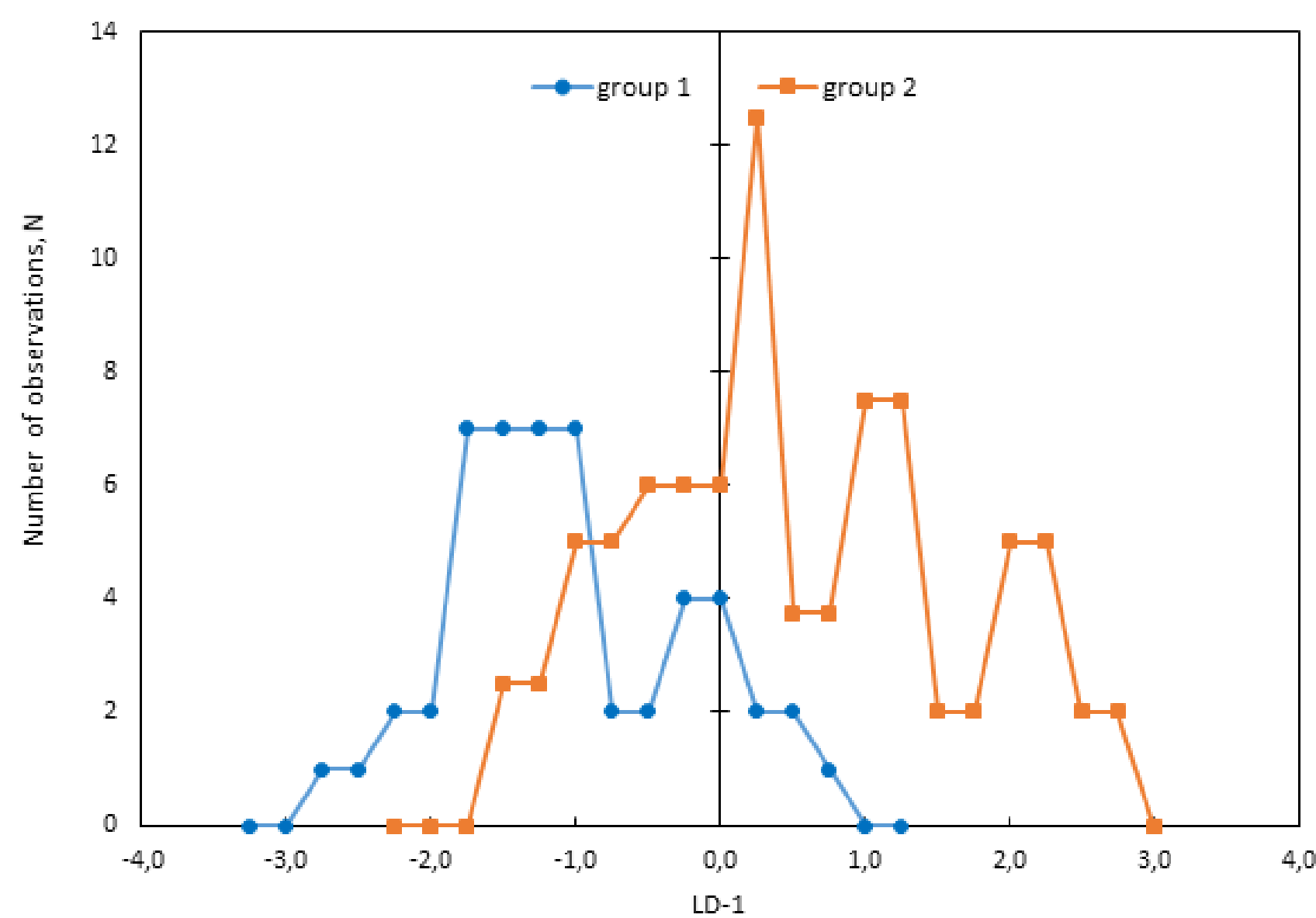


Figure 3: Graph of the linear discriminant function values.

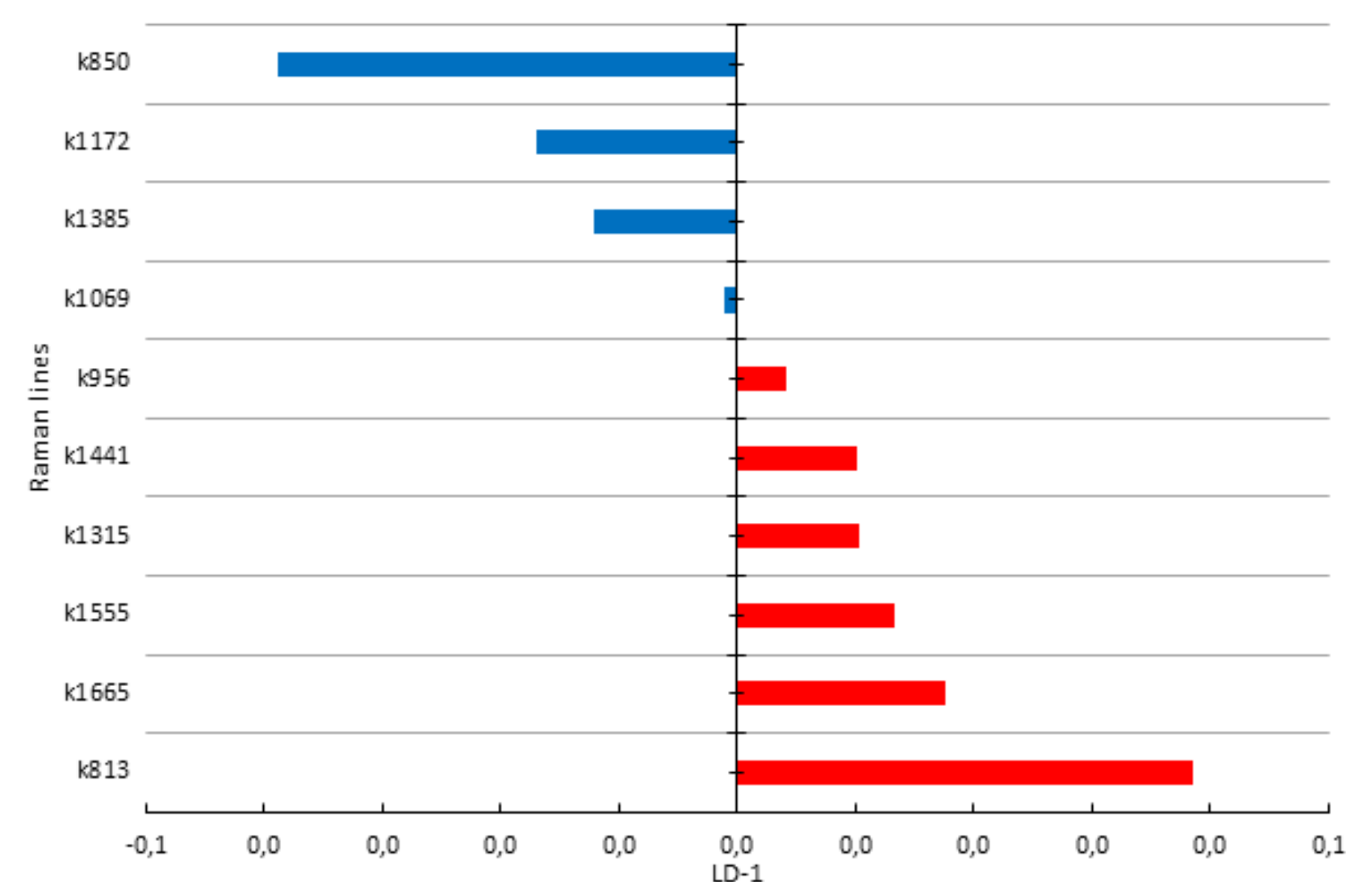


Figure 4: Values of factor structure coefficients.

Conclusion

Chemometric analysis of Raman spectra of bone tissue in norm and in periodontitis was carried out as a result of the research. Spectral changes in the bone tissue in periodontitis were revealed, which are manifested in changes in the relative intensity of KR lines 850cm⁻¹ (Proline benzene ring), 956 cm⁻¹(ν₁P-O symmetric stretch (PO₄3⁻), 1069 cm⁻¹(C-O inplane stretch (CO 3ν₁)), 1172 cm⁻¹(Tyrosine, phenylalanine, C-H bend (protein)), 1242-1270 cm⁻¹(Amide III), 1315 cm⁻¹(Amide III (α helix)) 1385-1441cm⁻¹(CH₂ scissoring and CH₃ bending fluctuations of lipids and proteins), 1555cm⁻¹(AmidII-N-H), 1665cm⁻¹(Amide I), 1745cm⁻¹(phospholipids).

It is shown that at periodontitis, in the bone tissue, there are spectral changes similar to the changes at osteoporosis which are caused by the breakage of transverse bonds in the organic matrix, that in its turn causes changes in the mineral composition of the bone tissue at periodontitis as well.

Thus, Raman spectroscopy can be used to assess bone tissue in periodontitis. The results obtained can be used to correct the treatment of this disease.