HISTOMORPHOMETRIC PARAMETERS IN SIMULATED GINGIVAL RECESSION

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ABSTRACT — This study addresses the nature of morphological changes occurring in periodontal tissues through the development of gum recession in the experiment. Gingival recession was found to occur along with a decrease in epithelial thickness of the mucous membrane as well as a decreasing cross-sectional area of blood vessels, whereas the connective tissue featured fibrinoid swelling. Initial tissue ischemia in the affected area can have a negative effect on reparation. This should be borne in mind when planning a periodontal plastic surgery.

KEYWORDS — gum recession, microcirculation, mucogingival plastic surgery, periodontology.

INTRODUCTION

To date, one of the current challenges faced by periodontology is to improve the treatment of gum recession. This is viewed not only as a medical problem but also an aesthetic one [1–13]. Various authors note that the prevalence of gum recession ranges from 40 to 100%, while it is important to keep in mind that the disease prevalence may depend on various subjective factors leading to different interpretations of research outcomes [14]. In case there are no contraindications, surgical intervention stands as the optimal method for treating gum recession, and it is important to bear in mind that surgery planning has to be done in view of the initial status of the tissues at the potential intervention area [15, 16].

In view of the above, relevant is studying the details of knowledge regarding the nature of morphological changes in periodontal tissues through the development of gum recession within the experiment.

Aim of study:
to study the histomorphometric parameters of the rat oral mucosa in experimental gingival recession.

MATERIALS AND METHODS

Our study included 40 male Wistar rats weighting 180–220 g aged 3,5–4 months. The rats were maintained in standard cages under regular daily alternation of light and darkness, temperature 20–22° C and free access to water and food. The studies were carried out in in compliance with the CIOMS-ICLAS International Guiding Principles for Biomedical Research Involving Animals. The animals were fully anesthetized prior to surgical procedures.

To better understand the nature of morphological changes occurring in tissues during gingival recession, the experimental animals were divided into 2 groups. Group 1 included 20 animals whose oral mucosa remained unchanged. Group 2 included 20 animals that had gum recession simulated surgically via an experiment. Animals with gum recession were removed from the experiment 28 days after the surgery. Two fragments of oral mucosa were obtained from each animal in each group. The animals that had undergone surgery, had their fragments obtained from the zone that was — visually — the most altered. Following a standard diagnostics procedure, three micro-preparations were obtained from each fragment. Then, 5 microphotographs were obtained from each micro-preparation, to be further examined employing morphometric methods. The results were processed using the "Statistica version 8.0" software.

RESULTS AND DISCUSSION

When studying the micro-preparations from intact animals, whose oral mucosa remained unchanged, the following results were obtained: no inflammatory infiltration detected; the number of connective tissue cells (fibroblasts and fibrocytes) was 75.8±2.5 cells within vision. The relative area of connective tissue was 82.2±3.4%, i.e. connective tissue accounted for the largest volume of soft gum tissue. The cross-sectional area of blood vessels was 12.5±0.7% whereas the relative area of muscle fibers proved to have the smallest value, 5.8±2.3%. The intact epithelial layer thickness in the rat oral cavity averaged 25.3±1.2 microns.

The experimental group of animals that had gum recession induced in them, featured no inflammatory

infiltration. The number of connective tissue cells decreased compared to the first group. The connective tissue area increased with fibers reaching 86.2±4.3%. There were some changes in the connective tissue thickness to be observed appearing as dissociated and chaotic arrangement of fibers, and accumulation of amorphous matter, which presented signs of fibrinoid swelling. The cross-sectional area of blood vessels went down to 7.1±1.6%. The muscle component area decreased to 4.4±2.2%. The epithelial layer thickness decreased significantly due to reduced nutrition (down to 11.2±0.8 microns). It should be noted that this type of change is typical of dystrophic processes, which offers another proof to the nature of gum recession development.

CONCLUSION

Thus, the study lead us to conclude that a surgery on receded gingiva is performed in the condition of impaired microcirculation at the affected site and, consequently, dystrophic changes in the tissue. Initial tissue ischemia in the affected area can have a negative effect on reparation. This should be borne in mind when planning a mucogingival plastic surgery.

REFERENCES

1. **Ananyeva L.A., Runova G.S., Revazova Z.E.** Vestibuloplasty with simultaneous elimination of the III class gum recession / Clinical dentistry. 2020. No. 1. P. 61–63.

2. **Bulkina N.V., Zyulkina L.A., Ivanov P.V., Vedyaeva A.P., Osipova Yu.I.** Evaluation of the effectiveness of surgical elimination of gum recession using non-invasive methods of vascular wall endothelial dysfunction correction in the area of surgery. Parodontologiya. 2020;25(3):211–215. (In Russ.) https://doi.org/10.33925/1683-3759-2020-25-3-211-215.

3. **Durnovo E.A., Shashurina S.V., Bespalova N.A., Andreeva M.V.** Comparative analysis of the elimination of gum recessions. Immediate and distant results / Successes of modern science and education. - 2016. – No. 9, volume 3 – P. 174–181.

4. **Trunin D.A., Nesterov A.M., Sadykov M.I., Kostionova-Ovod I.A.** A way to eliminate local gum recession / Ural Medical Journal. 2019 (12): 14–17.

5. **Akimova S.A., Bulkina N.V., Osipova Yu.L., Ostrovskaya L.Yu., Zyulkina L.A., Vedyaeva A.P., Konnov V.V.** Gingival mucosa proliferative activity and epitheliocytes apoptosis indicators in patients with rapidly progresing periodontitis // Archiv EuroMedica. 2019. Vol. 9. № 2. P. 130–133.

6. **Alexiou A., Vouros I, Menexes G., Antonis Konstantinidis A.** Comparison of enamel matrix derivative (emdogain) and subepithelial connective tissue graft for root coverage in patients with multiple gingival recession defects: a randomized controlled clinical study / Quintessence International. 2017. № 48 (5), P. 381–389.

7. **Aroca S., Molnár B., Windisch P., Gera I., Salvi GE, Nikolidakis D., Sculean A.** Treatment of multiple adjacent Miller class I and II gingival recessions with a modified coronally advanced tunnel (MCAT) technique and a collagen matrix or palatal connective tissue graft: a randomized, controlled clinical trial / Journal of Clinical Periodontology. 2013. №40 (7). P. 713–20.

8. **Bulkina N.V., Makarova N.I., Ivanov P.V., Lebedev M.V., Zyulkina L.A., Shasti E.N., Konnov V.V.** Modern methods of non-invasive correction for disturbed regional blood circulation through physiotherapeutic measures (literature review // Archiv Euromedica. – 2019. – V. 9 (2). – P. 17–22.

9. **G.L , Fu E. , Tu Y.K. , Shen E.C., Chiu H.C., Huang R.Y., Yuh D.Y., Chiang C.Y.** Root coverage by coronally advanced flap with connective tissue graft and/or enamel matrix derivative: a meta-analysis/J. Periodontal Res., 2015. № 50 (2), P.220–30.

10. **Domenyuk D.A.** Changes of the morphological state of tissue of the paradontal complex in the dynamics of orthodontic transfer of teeth (experimental study). Periodontology, 2018; Vol. 23; 1–23(86): 69–78. DOI:10.25636/PMP.1.2018.1.15

11. **Gumenyuk A., Ushmarov D.I., Gumenyuk S.E., Gayvoronskaya T.** Potential use of chitozan-based multilayer wound covering in dental practice // Archiv EuroMedica. 2019. Vol. 9. № 3. P. 76–80. https://doi.org/10.35630/2199-885X/2019/9/3.24

12. **Karpyuk V.B., Perova M.D., Gilevich I.V., Sevostyanov I.A.** Cell-potentiated regenerative technologies for restoring jaw bone tissues in case of odontogenic inflammatory & destructive process // Archiv EuroMedica. 2019. Vol. 9. № 2. P. 140–146. https://doi.org/10.35630/2199-885X/2019/9/2/140

13. **Karpyuk V.B., Perova M.D.** Innovation-based approach in reconstruction of reduced jaw alveolar ridge bone using cell regeneration technologies // Archiv EuroMedica. 2019. Vol. 9. № 2. P. 147–155. https://doi.org/10.35630/2199-885X/2019/9/2/147

14. **Imber J.C., Kasaj A.** Treatment of gingival recession: when and how? /International Dental Journal. 2020. P. 1–11.

15. **Roman A., Soancă A., Kasaj A., Stratul S.I.** Subepithelial connective tissue graft with or without enamel matrix derivative for the treatment of Miller Class I and II gingival recessions: a controlled randomized clinical trial / J. Periodontal Research. 2013. № 48 (5), P. 563–72.

16. **Sculean A., Cosgarea R., Alexandra Stähli A., Katsaros C., Nicole Birgit Arweiler N.B., Brecx M., Deppe H.** The modified coronally advanced tunnel combined with an enamel matrix derivative and subepithelial connective tissue graft for the treatment of isolated mandibular Miller class I and II gingival recessions: a report of 16 cases / Quintessence International, 2014. № 45 (10), P. 829–35.