Study Group Name: **Microcirculation Study Group**

Topic: **Effect of different abutment materials on human gingival blood flow**

Members of study group:

- Principal Investigator: Prof. Dr. Vág János
- Supervisors: Dr. Mikecs Barbara, Dr. Fazekas Réka, Dr. Molnár Eszter, Dr. Gánti Bernadett (maternity leave)
- PhD fellow: Dr. Nagy Tamás László

Study title: **Effect of different 3D implant abutment configurations on peri-implant soft and hard tissue healing in the aesthetic zone and long-term follow-up - a randomized controlled trial**

Aim of the study

The aim of this randomized controlled clinical trial was to investigate the hard and soft tissue volume changes around individual CAD/CAM vs. factory-made zirconia healing abutments 4 months after their fixation for immediate implant placement (conventional loading). In the next step, we will fabricate factory-made vs individual abutment-anchored, screw-retained all-ceramic solo restorations, where we will follow biological and technical complications at 1 and 3 years in addition to aesthetic evaluation.

The procedure of the test

Phase 1: In navigated surgery, Straumann Bone Level implants are inserted without flap in the anterior region of the maxilla in the test and control groups after tooth extraction in the surgical sites using a surgical template prepared according to the preliminary digital prosthetic plan. The peri-implant gap is filled with a xenograft. Individual CAD/CAM healing abutments will be fixed in the test group and factory-made healing abutments in the control

group. At the end of the surgery, the wound edges are closed without tension in the test and control groups with non-absorbable 5/0 suture material using simple knot and mat sutures.

Postoperative antibiotic treatment (Augmentin 3x625 mg or Dalacin C 3x300 mg in case of penicillin allergy) is administered after implant insertion. After each operation, rinsing the mouth 2 times a day for 2 minutes with a 0.2% chlorhexidine solution for 2 weeks is obligatory. Sutures are removed on the 14th day after surgery. A check-up is required three times a week for the first 2 weeks after the operation, and then once a month until the second operation, combined with a professional oral hygiene treatment. It’s forbidden to chew in the surgical area or wear a removable prosthesis with mucosal support.

Phase 2: 4 months after implant placement, a full ceramic restoration is made with digital workflow on factory made implant abutments in the control group and individual implant abutments in the test group.

Phase 3: After the implant restorations are completed, periodontal maintenance treatment is provided, including professional oral hygiene treatment every 6 months. The stability of the tissue (hard and soft tissue) around the implants is assessed clinically, with surface scanning and radiological methods (intraoral radiographs) annually for 5 years.

Blood flow measurement

Preoperative and postoperative blood flow is assessed using Laser Speckle Contrast Imaging (785nm PeriCam PSI HR System, Perimed AB, Sweden) on days 0-7, 0, 1, 4, 7, 14 and months 1, 2, 4, 6 and 12. Two measurements are taken before surgery, one on the day of surgery and one the week before surgery.

The patient does not eat, drink coffee, brush their teeth or smoke for at least one hour before the measurement.

Upon arrival, the patient will sit in the dentist's chair and lie still in the chair for about 15 minutes. During this time, the patient's name, date of birth, sex, last menstrual period for women, the operator's name, ambient temperature and pulse rate after arrival, together with systolic and diastolic blood pressure values, are recorded in the measurement record. During the measurements, snapshot recordings are repeated three times at a distance of 10 cm from the operating/operated area. Adequate visibility is achieved by using mirrors.

Blood pressure and pulse rate measurements are taken before and at the end of the measurements with an Omron M2 (Omron M2, Omron Healthcare).

Ultrasonic gingival thickness measurement

In the keratinised gingiva of the patients in the study, the gingival thickness is measured at 3 and 5 mm from the marginal gingiva using a Pirop ultrasonic biometer (Echo-Son, Puławy, Poland), before surgery, next to the patient's own tooth, and six months after implant placement - 2 months after the final prosthesis is transferred. We also record the gingival thickness measurement at the end of the first year after surgery to make sure we have information about the final gingival thickness. All measurements are taken 3 times at each measurement point and averaged.

In our clinic we perform blood flow tests and ultrasound gingival thickness measurements.

Winning grants:

- Semmelweis Egyetem Fogorvostudományi Kari Pályázat 2017. Gánti Bernadett, Vág János: Az íny microcirculatiojának és vastagságának a vizsgálata.
- Semmelweis Egyetem Fogorvostudományi Kari Pályázat 2018. Gánti Bernadett, Vág János. Spreading vasodilatatio jelenlétének vizsgálata humán gingiván a nemek függvényében
- KFI_16-1-2017-0409, szakmai vezető, Élettani kutatásokon és méréseken alapuló új ínyformázási eljárás és prototípus elemek kifejlesztése fogászati implantációhoz 2018.01.01.-2019.12.31.
- Semmelweis Egyetem Fogorvostudományi Kari Pályázat 2019. Mikecs Barabara, Vág János Implantátumok és fogak körüli ínyszövet vasodilatációs reaktivitásának vizsgálata.
- Semmelweis Egyetem Fogorvostudományi Kari Pályázat 2020. Mikecs Barabara, Gánti Bernadett, Vág János Vasodilatatio vizsgálata a humán gingivában acetilkolin és nitrogén-monoxid alkalmazása során.
- Semmelweis Egyetem Fogorvostudományi Kari Pályázat 2021. Mikecs Barbara, Nagy Tamás László, Vág János: Nemek közti különbségek vizsgálata a véráramlás tekintetében.
- Semmelweis Egyetem Fogorvostudományi Kari Pályázat 2023. Nagy Tamás László,

Mikecs Barbara, Vág János: A nemi hormonok keringést befolyásoló hatása a humán gingiva véráramlásában.

Presentations on Congresses:

- Nagy T, Mikecs B, Vág J, Dose-related effect of acetylcholine on human gingival blood flow, Semmelweis Symposium Budapest, 2024
- Nagy T, Mikecs B, Vág J: A nemi hormonok keringést befolyásoló hatása a humán gingiva véráramlásában. Kari Pályázat, Semmelweis Egyetem, Budapest 2023.
- Nagy T, Mikecs B, Vág J, Sex-related differences in vasodilation after application of acetylcholine compared to nitrogen-monoxide in human gingiva, Semmelweis Symposium Budapest, poster presentation, 2023.
- Nagy T, Mikecs B, Vág J, Endothelium-Dependent and Non-Dependent Vasodilation in Human Gingiva, CED/IADR-NOF Oral Health Research Congress, Brussels, Belgium, virtual oral presentation, 2021. szeptember 16-18.
- Mikecs B, Nagy T, Fazekas R, Vág J, Age and Gender-Related Differences in Human Gingival Blood Flow, CED/IADR-NOF Oral Health Research Congress, Brussels, Belgium, virtual oral presentation, 2021. szeptember 16-18.
- Mikecs B, Nagy T, Vág J, Investigation of Vasodilatation Induced by Different Solutions in Human Gingiva, Integrating Vascular Biology & Medicine, European Society of Microcirculation, Online Conference, 2021.
- Mikecs B, Nagy T, Vág J, Nemek közti különbségek vizsgálata a gingiva véráramlásának tekintetében, Kari Pályázat, Semmelweis Egyetem, Budapest 2021.
- Mikecs B, Gánti B, Vág J, Vasodilatatio vizsgálata a humán gingivában acetilkolin és nitrogén-monoxid alkalmazása során, Kari Pályázat, Semmelweis Egyetem, Budapest, 2020
- Mikecs B, Fazekas R, Molnár E, Gánti B, Lohinai Zs, Veress G, Vág J, Gingival Blood Flow at Teeth Versus Dental Implants, CED/IADR-NOF Oral Health Research Congress, Madrid, Spain, 2019 szeptember 19-21.
- Gánti B, Mikecs B, Fekete Á, Heródek P, Makk R, Lohinai Zs, Vág J, Regional Effect of Epinephrine on the Microcirculation of Human Gingiva, CED/IADR-NOF Oral Health Research Congress, Madrid, Spain, 2019 szeptember 19-21.
- Mikecs B, Molnár E, Fazekas R, Gánti B, Vág J, Post-occlusive blood flow

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measurement of the oral gingiva surrounding natural teeth and dental implants, PhD tudományos napok, Semmelweis Egyetem, Budapest, 2019. április 25-26.

- Mikecs B, Veress G, Vág J, Implantátumok és fogak körüli ínyszövet vasodilatációs reaktivitásának vizsgálata, Kari pályázat, Semmelweis Egyetem, Budapest 2019.
- Mikecs B, Vág J, Molnár E, Fazekas R, Gánti B, Post-occlusive blood flow measurement of the oral gingiva surrounding natural teeth and dental implants, EFOP-3.6.2-16-2017-00006 Translational interactive hands-on training and conference on epithelial ion transport including two symposia „natibacterial and mucolytic therapy in cystic fibrosis" and „Research in oeal cavity-from basic science to clinical use", Budapest, 2018.
- Gánti B, Molnár E, Fazekas R, Mikecs B, Lohinai Z, Vág J, Investigation of the spreading vasodilatation on human gingiva, EFOP-3.6.2-16-2017-00006 Translational interactive hands-on training and conference on epithelial ion transport including two symposia antibacterial and mucolytic therapy in cystic fibrosis" and „Research in oeal cavity-from basic science to clinical use", Budapest, 2018
- Molnár E, Fazekas R, Mikecs B, Gánti B, Vág J, Reliability of Laser Speckle Contrast Imaging to assess human gingival micricirculation, EFOP-3.6.2-16-2017-00006 Translational interactive hands-on training and conference on epithelial ion transport including two symposia „natibacterial and mucolytic therapy in cystic fibrosis" and „Research in oral cavity-from basic science to clinical use", Budapest, 2018.
- Mikecs B., Molnár B., Fazekas R., Molnár E., Tóth Zs., Vág J.: A humán palatinalis nyálkahártya gyógyulásának vizsgálata Laser Speckle Contrast Imager segítségével műtéti sebzést követően. Magyar Haemorheologiai Társaság XXV., a Magyar Mikrocirkulációs és Vaszkuláris Biológiai Társaság és a Magyar Szabadgyök-Kutató Társaság VI. Közös Kongresszusa, Balatonkenese, 2018.
- Gánti B., Mikecs B., Mikó S., Lohinai Zs., Vág J.: Spreading vazodilatáció jelenlétének vizsgálata humán fogínyben. Magyar Haemorheologiai Társaság XXV., a Magyar Mikrocirkulációs és Vaszkuláris Biológiai Társaság és a Magyar Szabadgyök-Kutató Társaság VI. Közös Kongresszusa, Balatonkenese, 2018.

Publications:

- 2022: Vag J, Nagy T, Mikecs B. „Sex-related differences in endothelium-dependent

vasodilation of human gingiva" BMC Oral Health. 2022, DOI 10.1186/s12903-022-02186-2. PMID: PMC9107103 https://pubmed.ncbi.nlm.nih.gov/35562729/

- 2021: Mikecs B, Vág J, Gerber G, Molnár B, Feigl G, Shahbazi A. „Revisiting the vascularity of the keratinized gingiva in the maxillary esthetic zone." BMC Oral Health. 2021, DOI: 10.1186/s12903-021-01445-y.PMID: 33766000 https://pubmed.ncbi.nlm.nih.gov/33766000/
- 2021: Mikecs B, Molnár E, Fazekas R, Vág J. „Microvascular reactivity of peri-implant mucosa in humans: effect of abutment material." Int J Periodontics Restorative Dent. 2021 Sep-Oct; 41(5):761-768. doi:10.11607/prd.5343. PMID:34547080 https://pubmed.ncbi.nlm.nih.gov/34547080/
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- 2019: Gánti B, Molnár E, Fazekas R, Mikecs B, Lohinai Z, Mikó S, Vág J. „Evidence of spreading vasodilation in the human gingiva evoked by nitric oxide." J Periodontal Res. 2019 Oct;54(5):499-505. doi: 10.1111/jre.12650. Epub 2019 Mar 13. PubMed PMID: 30865289. https://pubmed.ncbi.nlm.nih.gov/30865289/
- 2019: Gánti B, Bednarz W, Kőműves K, Vág J. Reproducibility of the PIROP ultrasonic biometer for gingival thickness measurements. J Esthet Restor Dent.2019; 31(3):263-267. doi: 10.1111/jerd.12446. Epub 2018 Dec 6. PMID: 30520211. https://pubmed.ncbi.nlm.nih.gov/30520211/
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