International Poster Journal IPJ of Dentistry and Oral Medicine

Int Poster J Dent Oral Med 2011, Vol 13 No 4, Poster 559

Histological Evaluation of Modern Cutting Instruments in Oral Mucosa

A Comparative in Vitro Study

Language: English

Authors:
Prof. Dr. Dr. Winand Olivier,
Dental Clinic of Miners' Hospital Bottrop, Germany
Dr. (H.) Judit Gyulay,
Pathological Institute, St. Clemens Hospitals Sterkrade, Oberhausen, Germany
Dr. Klaus Peitgen,
Clinic for General and Visceral Surgery, Centre for Minimally Invasive Surgery, Miners' Hospital Bottrop, Germany
Dr. Àkos Nagy,
Department of Dentistry, Oral and Maxillofacial Surgers, Medical School, University of Pécs, Hungary
Dr. Werner Götz,
Laboratory for Basic Oral Biological Research, Policlinik for Orthodontics, Dental Hospital, University of Bonn, Germany

Date/Event/Venue:
August 26-28, 2010
ICOI World Congress XXVII / DGOI International Congress VII
CCH Congress Center Hamburg, Germany

Material and Methods

Porcine oral mucosa specimens were treated by a conventional scalpel, different laser wavelengths (Er:YAG, CO2, diode and Nd:YAG), high frequency surgery (hf1 SURG®, Vio® 300 D) and ultrasonic activated scalpels (UltraCision®, SonoSurg®) with evidence based settings. All specimens were fixed in 10% buffered formalin solution and embedded in paraffine. Sections were stained with hematoxylin-eosin (HE) and periodic acid-Schiff (PAS) reaction and examined light microscopically by two independent pathologists. The incisions were evaluated measuring the cutting efficacy, the width of damaged tissue adjacent to the incision and the quality of tissue and cells in the damaged areas. Finally the researched dates were described using synoptic gradings.

Results

The cutting efficacy was demonstrated for all examined instruments. The width of the damage zones was within a range from the reference (scalpel = 0) to maximum values between 300 and 400 µm. In weaker magnification the damages were represented by the formation of hyalinized, eosinophilic zones along the defect borders and cleft or bubble formation in the peripheral epithelial and connective tissues. The histological changes were caused by mechanical and thermal influences. Altogether the conventional scalpel obtained best results, followed from laser and high frequency surgery with mid and ultrasonic scalpels with low acceptable results.

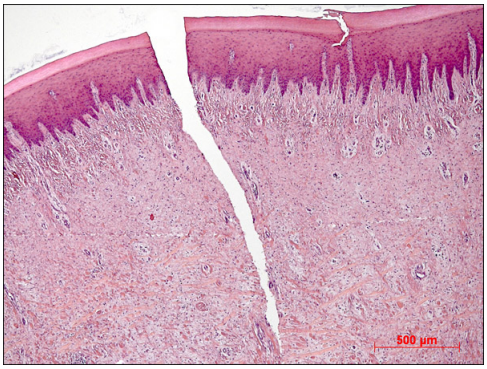


Fig. 1: Narrow, deep acute-angled defect (arrow) penetrating epithelium (e) and lamina propria (lp), smooth cutting margins, no periphereal tissue and cell damaging, H.E. staining

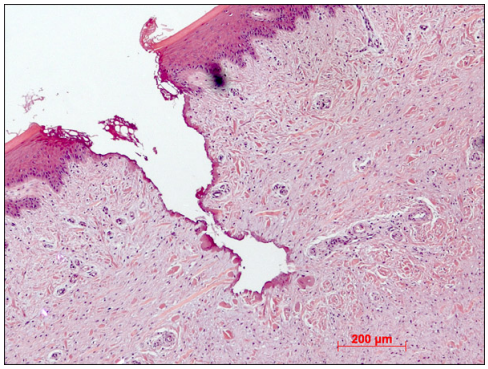


Fig. 2: Ampulla-like defect (arrow) penetrating epithelium (e) and lamina propria (lp); irregular cutting margins; narrow (5-40 µm) hyaline eosinophilic damage zone (asterisks), minimal periphereal tissue and cell damaging, H.E. staining

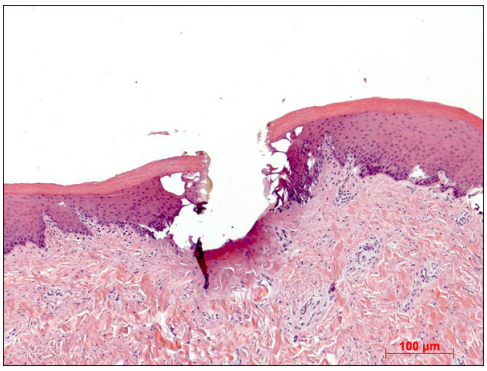


Fig. 3: Flat (100 m) defect (arrow) penetrating epithelium (e) and upper part of lamina propria (lp); hyaline eosinophilic damage zone (ca. 30 µm, asterisks), minimal periphereal tissue and cell damaging, H.E. staining

Fig. 4: Deep defect (arrow) penetrating epithelium (e) and whole lamina propria (lp); irregular cutting margins; broad hyaline eosinophilic damage zone (300-400 µm, asterisks), focal blistering (open arrow), H.E. staining

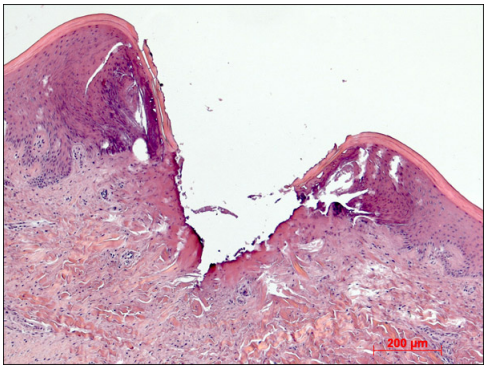


Fig. 5: Crater-like defect (arrow) penetrating epithelium (e) and lamina propria (lp); irregular cutting margins; hyaline eosinophilic damage zone (5-40 µm, asterisks), intraepithelial clefts (open arrows), H.E. staining

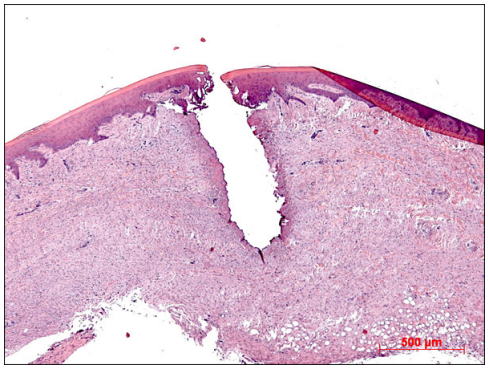


Fig. 6: Tube-like defect (arrow) penetrating epithelium (e) and deep into lamina propria (lp); irregular cutting margins; hyaline eosinophilic damage zone (50-100 µm, asterisks), minimal periphereal tissue and cell damaging, H.E. staining

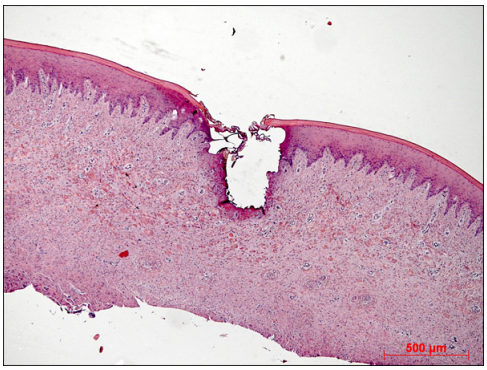


Fig. 7: Nearly rectangular defect (arrow) penetrating epithelium (e) and lamina propria (lp); irregular cutting margins; hyaline eosinophilic damage zone (10-50 µm, asterisks), minimal periphereal tissue and cell damaging, carbonated epithelial rests projecting into cleft opening (open arrow); H.E. staining

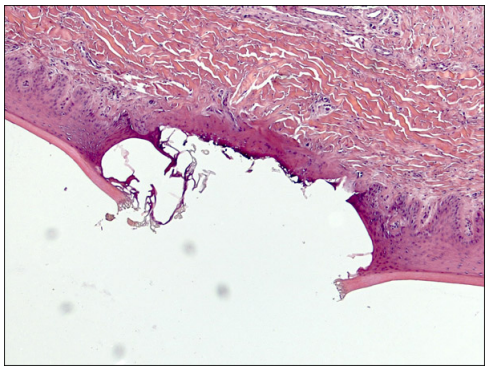


Fig. 8: Hollow defect (arrow) penetrating epithelium (e) and only apical parts of lamina propria (lp); irregular cutting margins; dense hyaline eosinophilic damage zone (ca. 50 µm, asterisks), no periphereal tissue and cell damaging, carbonated epithelial rests projecting into cleft opening (open arrow); H.E. staining

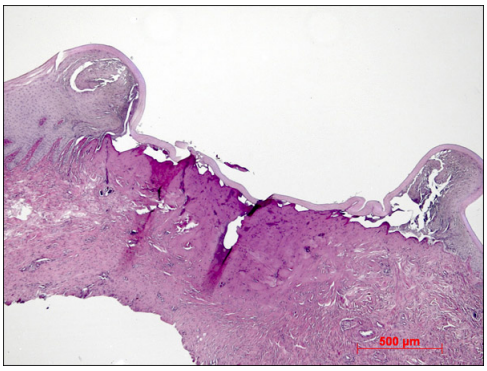


Fig. 9: Very hollow, massive defect (arrow) nearly only penetrating epithelium (e), which is rolled up at the defect borders), remnants of epithelial stratum corneum (c) covering the defect; dense hyaline PAS positive damage zone (ca. 50 µm, asterisks), massive periphereal tissue and cell damaging, e.g. cleft formations in epithelium (e) and lamina propria (lp); PAS staining

Conclusions

The histological evaluation approved the application of established cutting instruments and the principal use of dissection techniques in oral mucosa. The potential advantages of interdisciplinary tools of soft tissue cutting instruments for oral surgery have yet to be better determined.

This Poster was submitted by Prof. Dr. Dr. Winand Olivier.

Correspondence address:
Prof. Dr. Dr. Winand Olivier
Dental Clinic of Miners' Hospital Bottrop
Osterfelder Strasse 157
D-46242 Bottrop
Germany

Poster Faksimile:

HISTOLOGICAL EVALUATION OF MODERN CUTTING INSTRUMENTS IN ORAL MUCOSA: A COMPARATIVE IN VITRO STUDY

Olivier W[1], Gyulay J[2], Peitgen K[3], Nagy Á[4], Götz W[5]

1 Dental Clinic at Miners' Hospital Bottrop, Centre for Esthetics, Implantology and Laser Therapy, Germany
2 Pathological Institute, St. Clemens Hospitals Sterkrade, Oberhausen, Germany
3 Clinic for General and Visceral Surgery, Centre for Minimally Invasive Surgery, Miners' Hospital Bottrop, Germany
4 Department of Dentistry, Oral and Maxillofacial Surgery, Medical School, University of Pécs, Hungary
5 Laboratory for Basic Oral Biological Research, Policlinic for Orthodontics, Dental Hospital, University of Bonn, Germany

BACKGROUND AND OBJECTIVE:

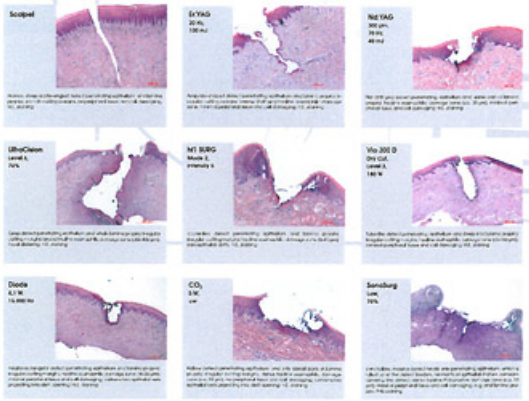
Cutting of soft tissues is an important procedure in oral surgery. Besides of established instruments exist various dissection techniques of minimally invasive surgery, which are not evaluated for oral applications. The aim of this in vitro experimental study was to perform a histological evaluation of incision effects produced in oral mucosa with modern cutting instruments of dental and visceral surgery.

STUDY DESIGN:

Porcine oral mucosa specimens were treated by a conventional scalpel, different laser wavelengths (Er:YAG, CO_2, diode and Nd:YAG), high frequency surgery (hf1 SURG®, Vio® 300 D) and ultrasonic activated scalpels (UltraCision®, SonoSurg®) with evidence based settings. All specimens were fixed in 10% buffered formalin solution and embedded in paraffine. Sections were stained with hematoxylin-eosin (HE) and periodic acid-Schiff (PAS) reaction and examined light microscopically by two independent pathologists. The incisions were evaluated measuring the cutting efficacy, the width of damaged tissue adjacent to the incision and the quality of tissue and cells in the damaged areas. Finally the researched dates were described using synoptic gradings.

RESULTS:

The cutting efficacy was demonstrated for all examined instruments. The width of the damage zones was within a range from the reference (scalpel = 0) to maximum values between 300 and 400 µm. In softer magnification the damages were represented by the formation of hyalinized, eosinophilic zones along the defect borders and cleft or bubble formation in the peripheral epithelial and connective tissues. The histological changes were caused by mechanical and thermal influences. Altogether the conventional scalpel obtained best results, followed from laser and high frequency surgery with mid and ultrasonic scalpels with low acceptable results.



Instruments/ evaluation criteria	Cutting efficacy and morphology	Quantitative damage	Qualitative damage
Scalpel	++	+	+
Er:YAG	++	+	+
Diode	++	+	+
CO_2	++	+	+
Nd:YAG	++	+	-
hf1 SURG	++	+	-
Vio 300 D	++	+	-
UltraCision	++	-	-
SonoSurg	--	-	-

Cutting efficacy (Dissection of epithelio and connective tissue) = yes (+) / no (-)
Cutting morphology = like scalpel (+) / not like scalpel (-)
Quantification of damaged areas (width in µm) = <50 (+) / >100 (-)
Quality of damaged tissue and cells = reversible (+) / irreversible (-)

Results:		Ranking:
Scalpel	++++	1. Scalpel, Er:YAG, diode, CO_2
Er:YAG	++++	2. Nd:YAG, hf1 SURG, Vio 300 D
Diode	++++	3. UltraCision
CO_2	++++	4. SonoSurg
Nd:YAG	+++-	
hf1 SURG	+++-	
Vio 300 D	+++-	
UltraCision	++--	
SonoSurg	----	

CONCLUSIONS:

The histological evaluation approved the application of established cutting instruments and the principal use of dissection techniques in oral mucosa. The potential advantages of interdisciplinary tools of soft tissue cutting instruments for oral surgery have yet to be better determined.

Keywords:
Histological evaluation, oral mucosa, cutting instruments, in vitro study

Senders ref.:
Dental Clinic at Miners' Hospital Bottrop, Centre for Esthetics, Implantology and Laser Therapy, Osterfelder Str. 157, 46242 Bottrop, Germany, phone +49-2041-152318, telefax +49-2041-152319, info@klinik-olivier.de