Факултет за медицински науки, Универзитет ,,Гоце Делчев”, Штип
Дентална медицина

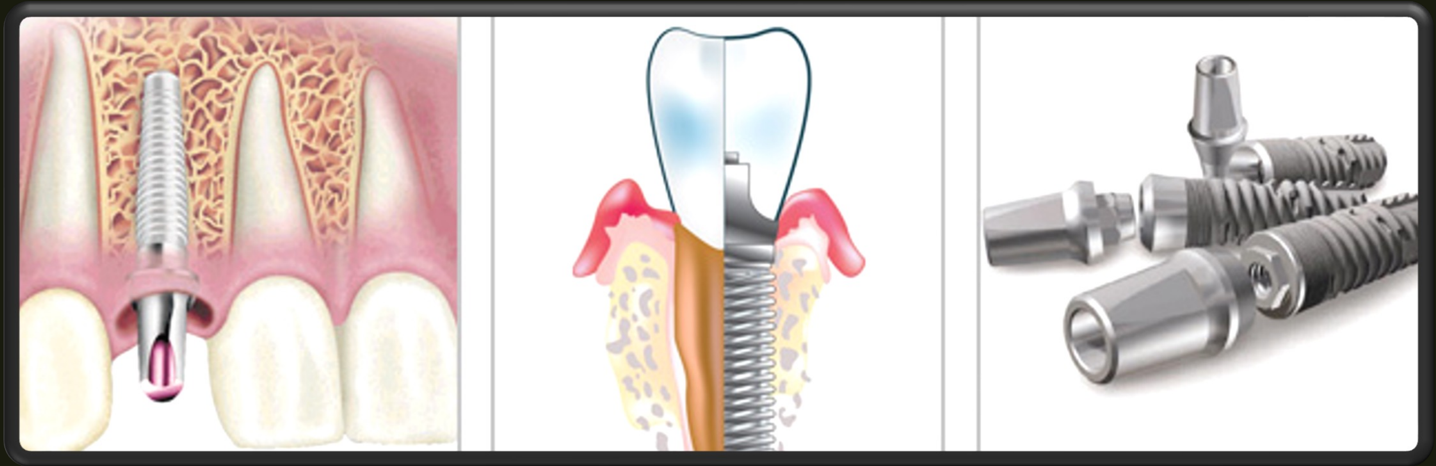
,,Влијание на медицинскиот статус врз имплантниот успех”

Д-р Љупка Арсовски

ljupka.arsovski@ugd.edu.mk

Дентална имплантологија

Дентален имплант



Современите дентални импланти од **медицински** титаниум или титаниум легури (Ti-6Al-4V) ги поседуваат следниве карактерисики: биокомпатибилност, биоинертност, биофункционалност и биоадхезивност.

- остеоинтеграцијата претставува хомеостаза помеѓу забниот имплант, изработен од титаниум и околната коска
- губењето на коската е причина за периимплантитисот - дентален плак
- остеоинтеграцијата на воспалителен процес е причина за реакцијата на *туѓо тело* и губење на коската како одговор на воспалителниот процес

Контаминација на денталните импланти
компромитирање на осеоинтеграцијата на имплантот и
ран имплантен неуспех (implant failure)

*Неорганските загадувачи :
калциум, фосфор, хлор, сулфур, натриум, силициум,
флуор и јаглерод.

*Органските загадувачи се состојат од водород,
карбоксилати, соли на органски киселини, азот, амониум и
бактериски клетки/нуспроизводи.

**Медицински статус на пациентот и лекови кои ги
користи за време на имплантирањето!*

Најчесто поставувани прашања

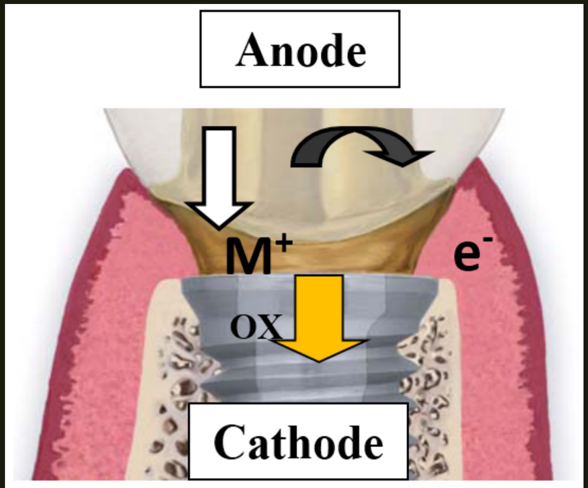
- Дали постои поврзаност помеѓу внесот на лекови и резултатите од имплантирањето (т.е. неуспех на третманот)?
- Кои лекови и соодветните дози се поврзани со неуспехот на имплантирањето?
- Дали неуспехот на имплантацијата се јавува во раните фази на заздравувањето или откако ќе се постигне остеоинтеграција?
- Дали има некои други фактори поврзани со неуспехот на имплантацијата кај пациенти кои земаат лекови?
- Која е силата на доказите за поврзаноста помеѓу внесот на лекови и неуспехот на имплантирањето?

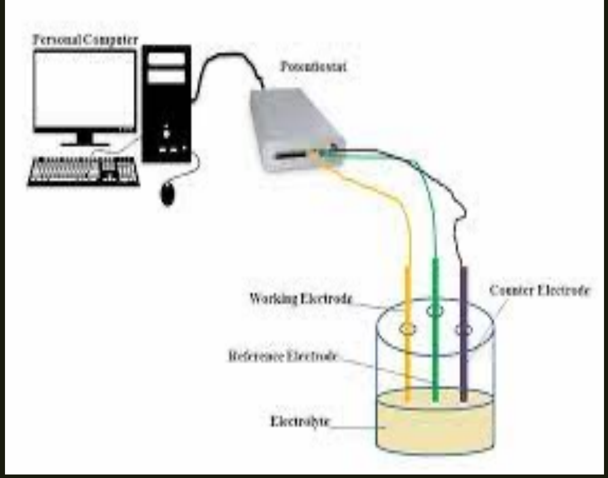
Со помош на **ЕЛЕКТРОХЕМИСКИ ТЕХНИКИ**, се спроведени експерименти на дентални импланти.

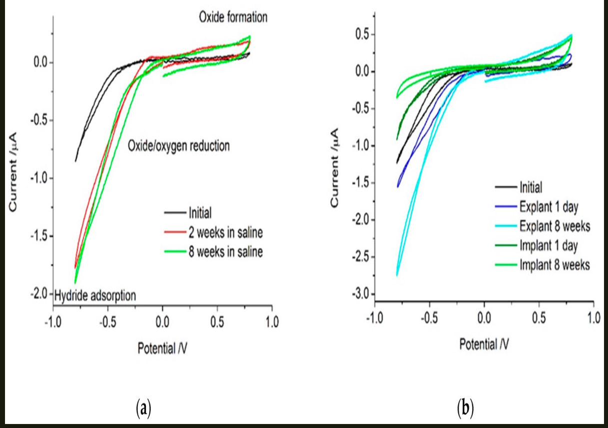
*Активноста на денталните имплатни и евентуалните причини за корозија.
*Влијанието на активни компоненти во дадени лекарства врз активноста и електрохемиските својства на денталните импланти.
*Влијанието на концентрацијата на хемиски системи што се користат во денталната медицина (водороден пероксид, хипохлориди...)
МЕХАНИЗМОТ на акција на испитуваната супстанца врз денталниот имплант.

Како работни техники се користени:

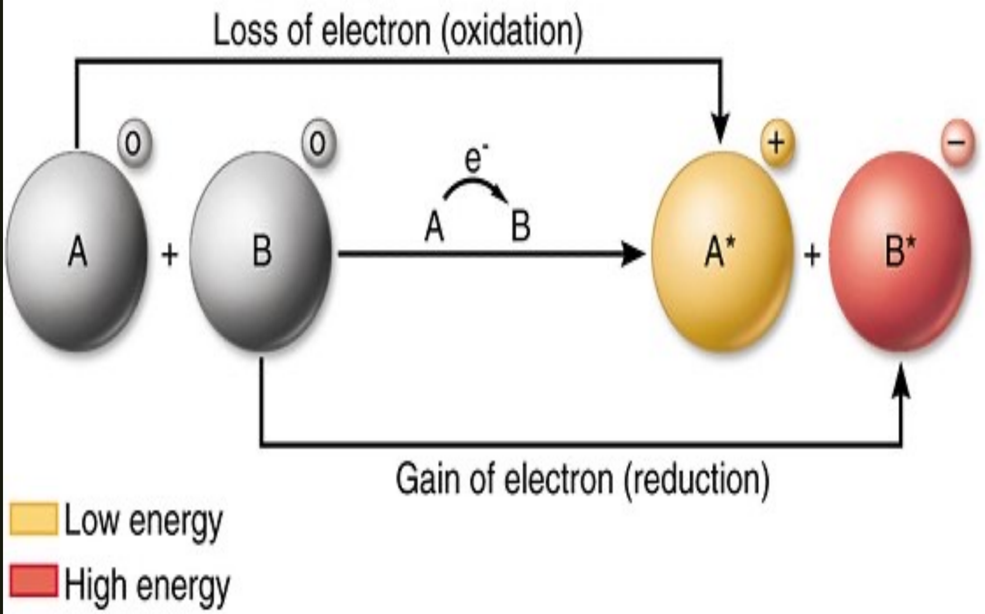
-Циклична волтаметрија
-Квадратно-Бранова Волтаметрија
-Електрохемиска Импеданса Спектроскопија



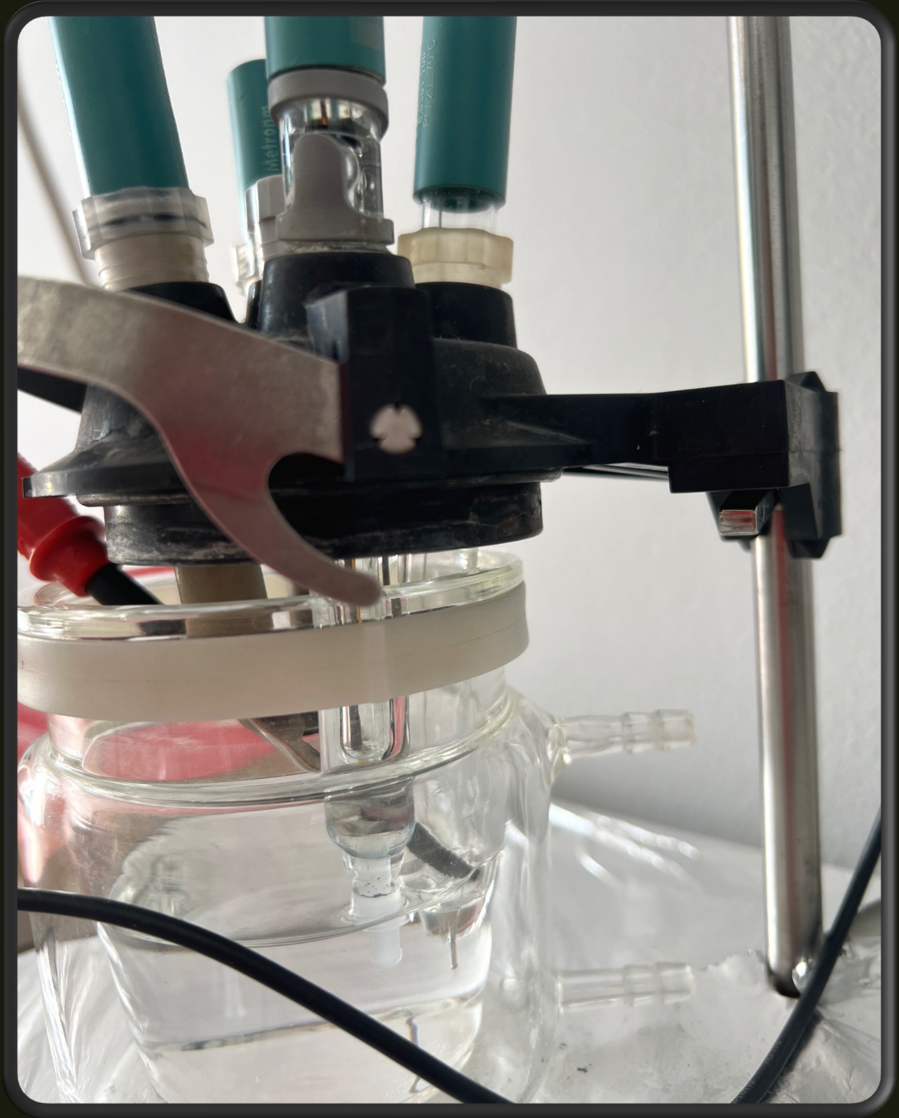




Електрохемијата ги проучува системите кај кои доаѓа до РАЗМЕНА НА ПОЛНЕЖ (ЕЛЕКТРОНИ) помеѓу два соседни системи. При што при контролиран потенцијал доаѓа до проток на ЕЛЕКТРИЧНА СТРУЈА

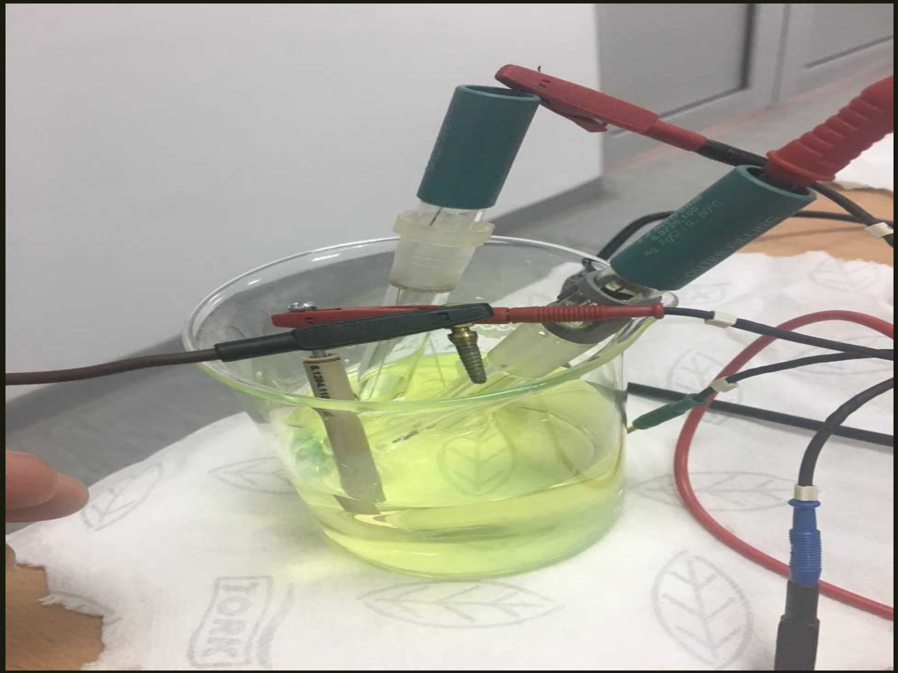


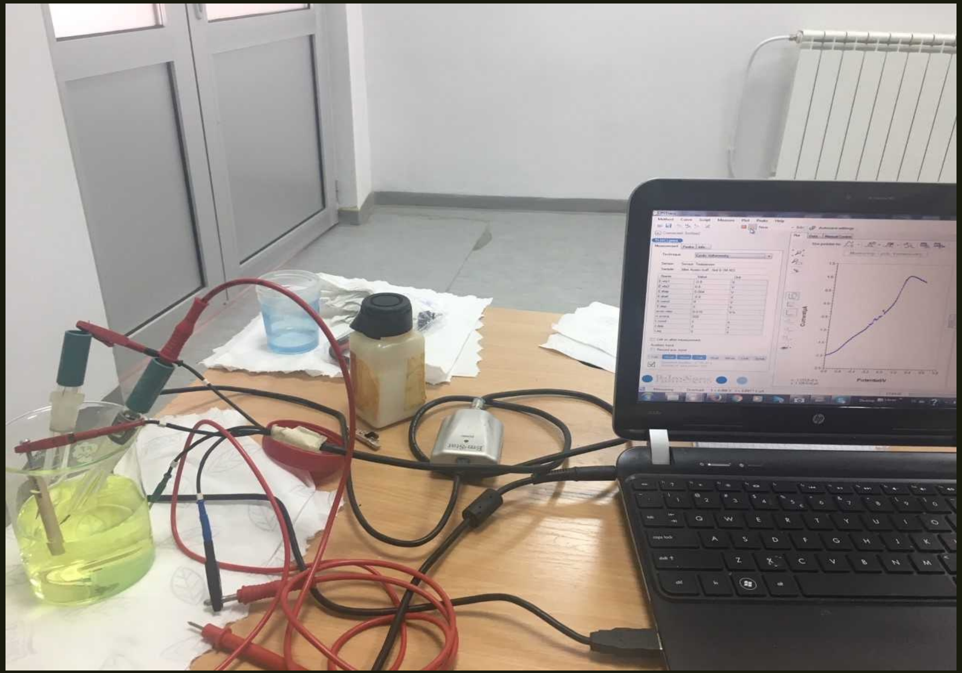

OUTER FILLING
CVE

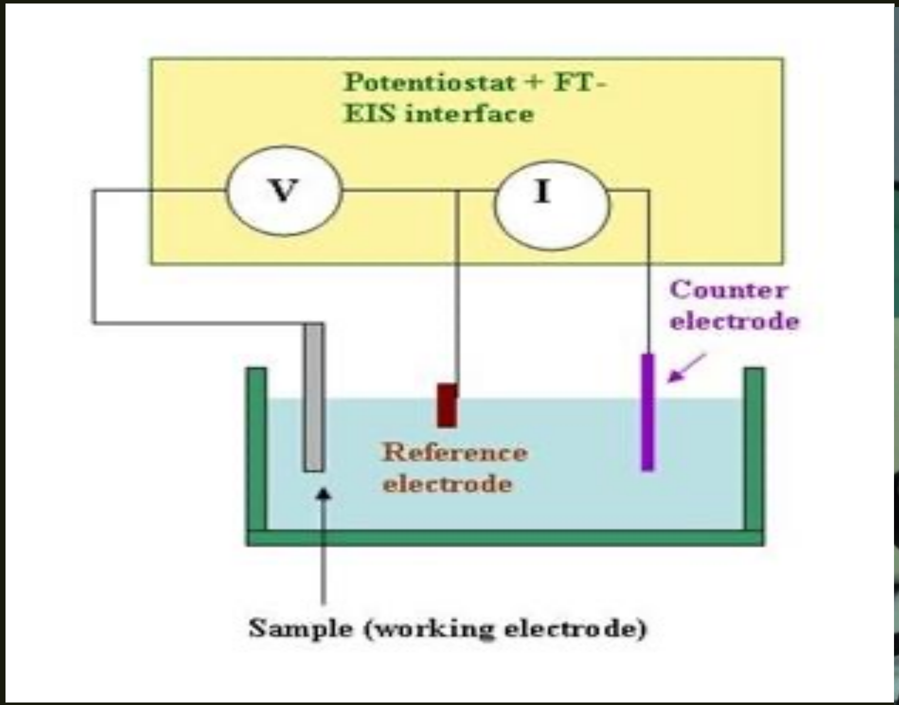


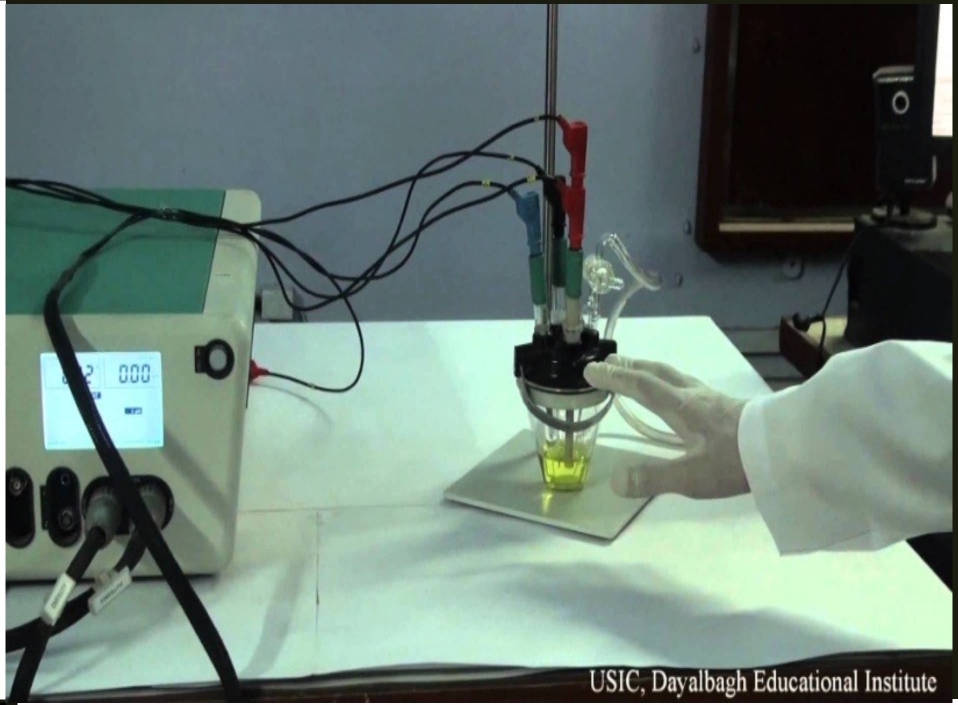
ЕЛЕКТРОХЕМИСКИ ЕКСПЕРИМЕНТ НА ДЕНТАЛНИ ИМПЛАНТИ

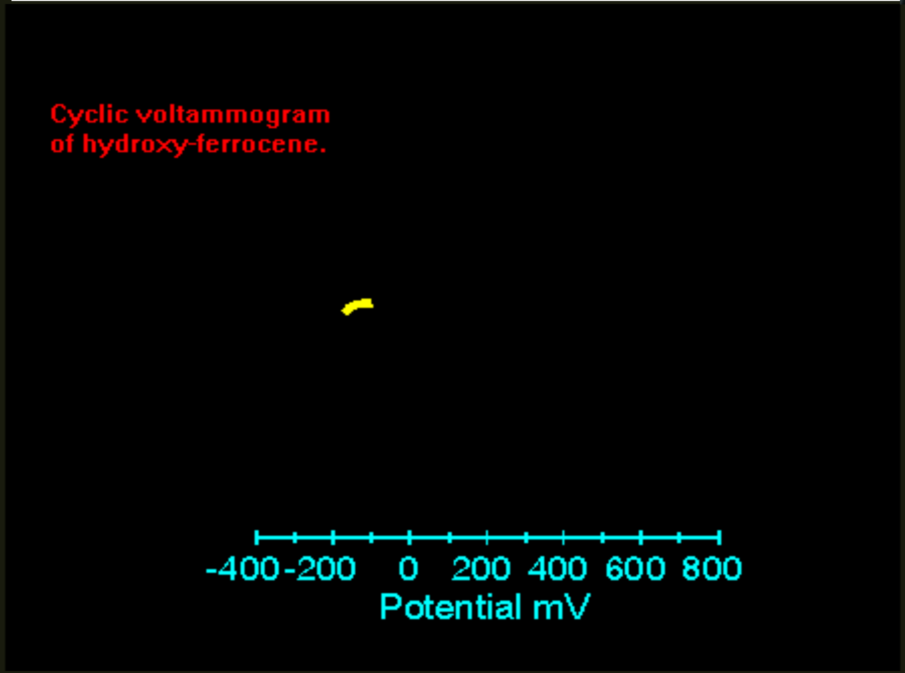
Помошна електрода → Работна електрода **Дентален имплант** → Референтна електрода → Потенциостат

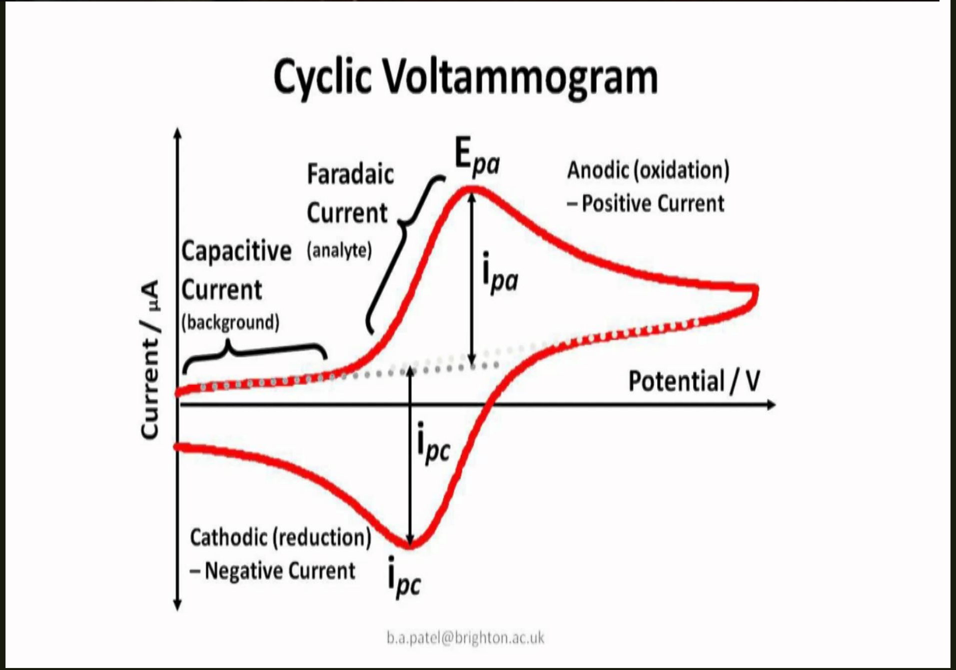


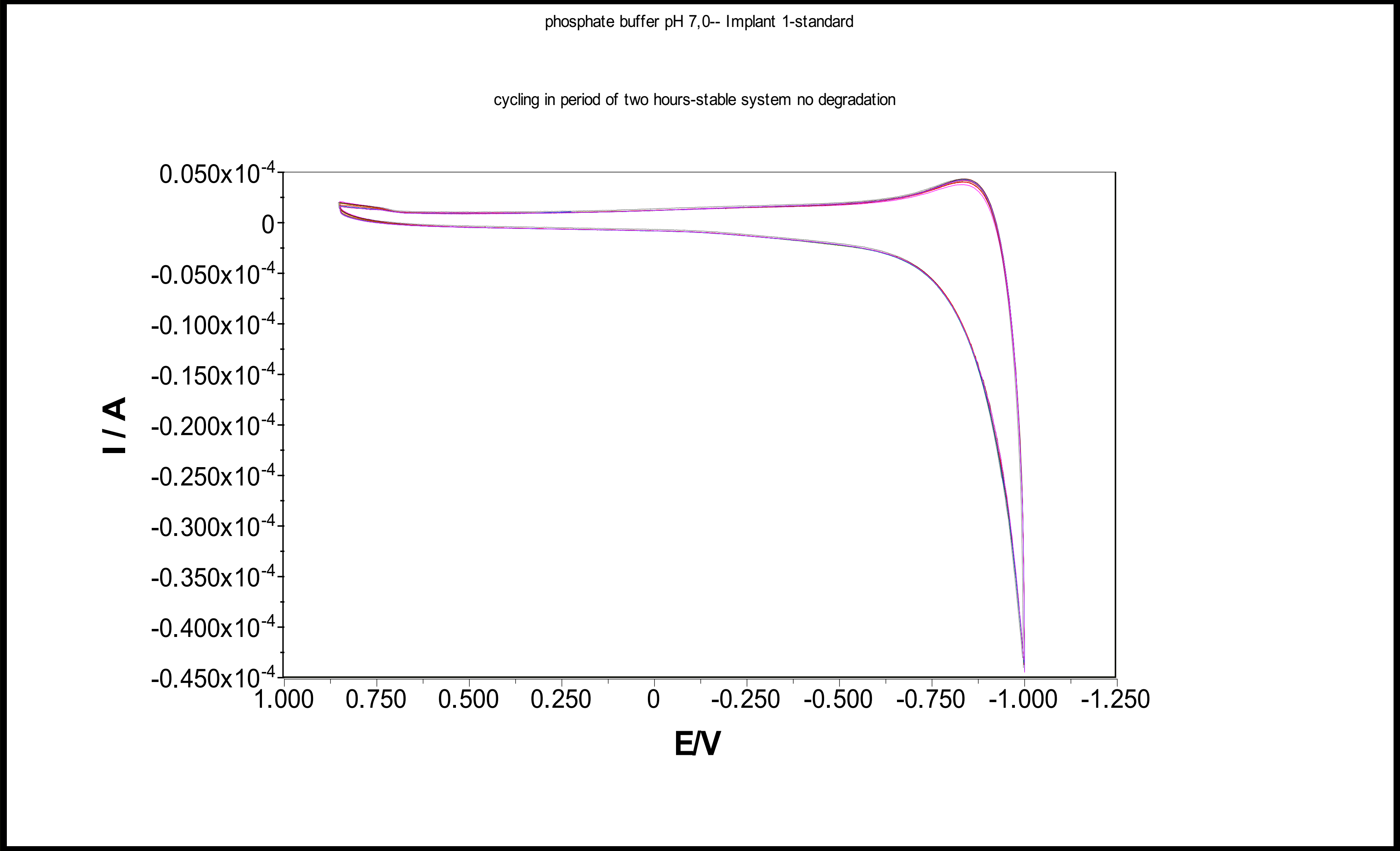



Potentiostat + FT-
EIS interface
V
I
Counter
electrode
Reference
electrode
Sample (working electrode)

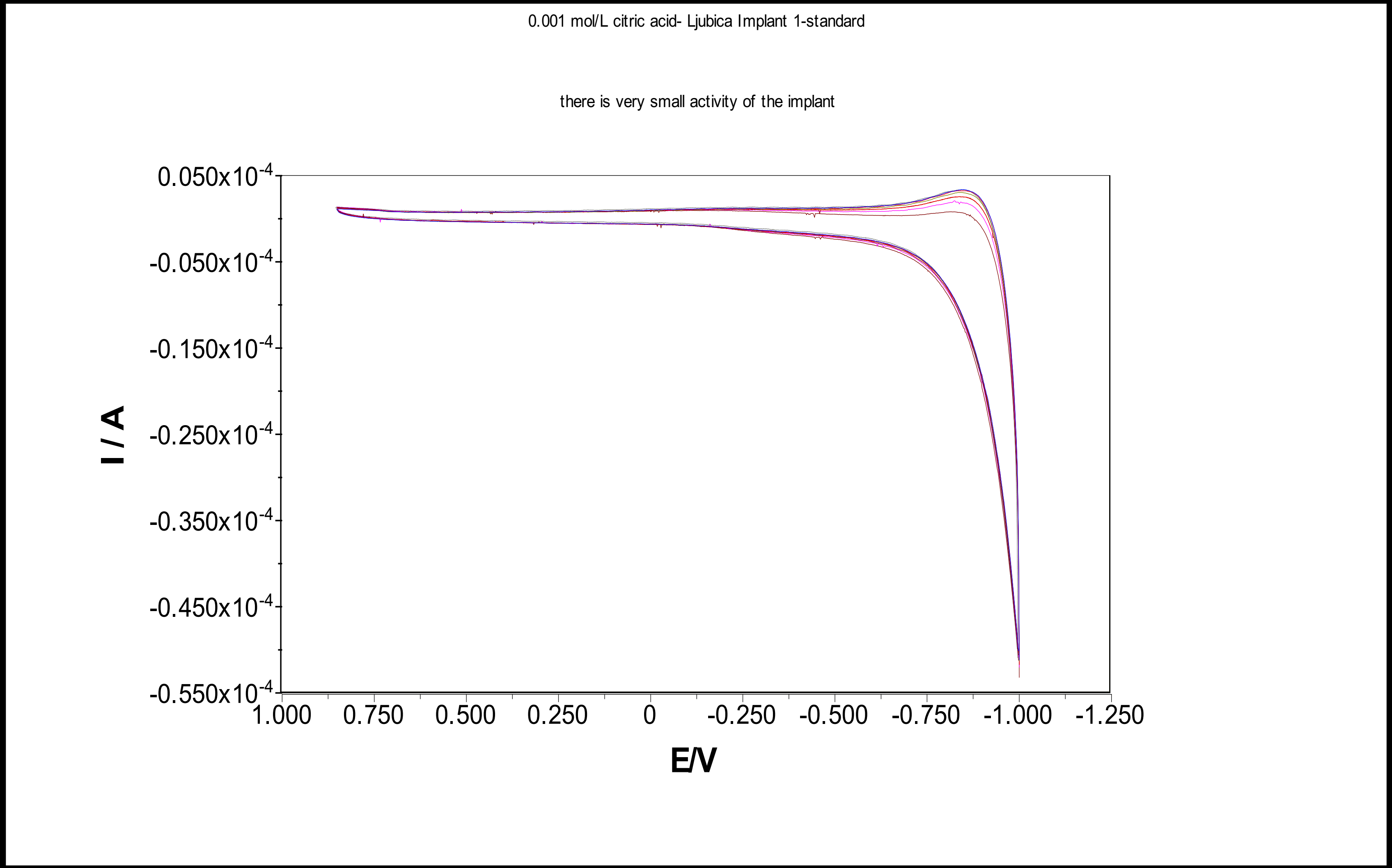

USIC, Dayalbagh Educational Institute


Cyclic voltammogram
of hydroxy-ferrocene.
-400 -200 0 200 400 600 800
Potential mV

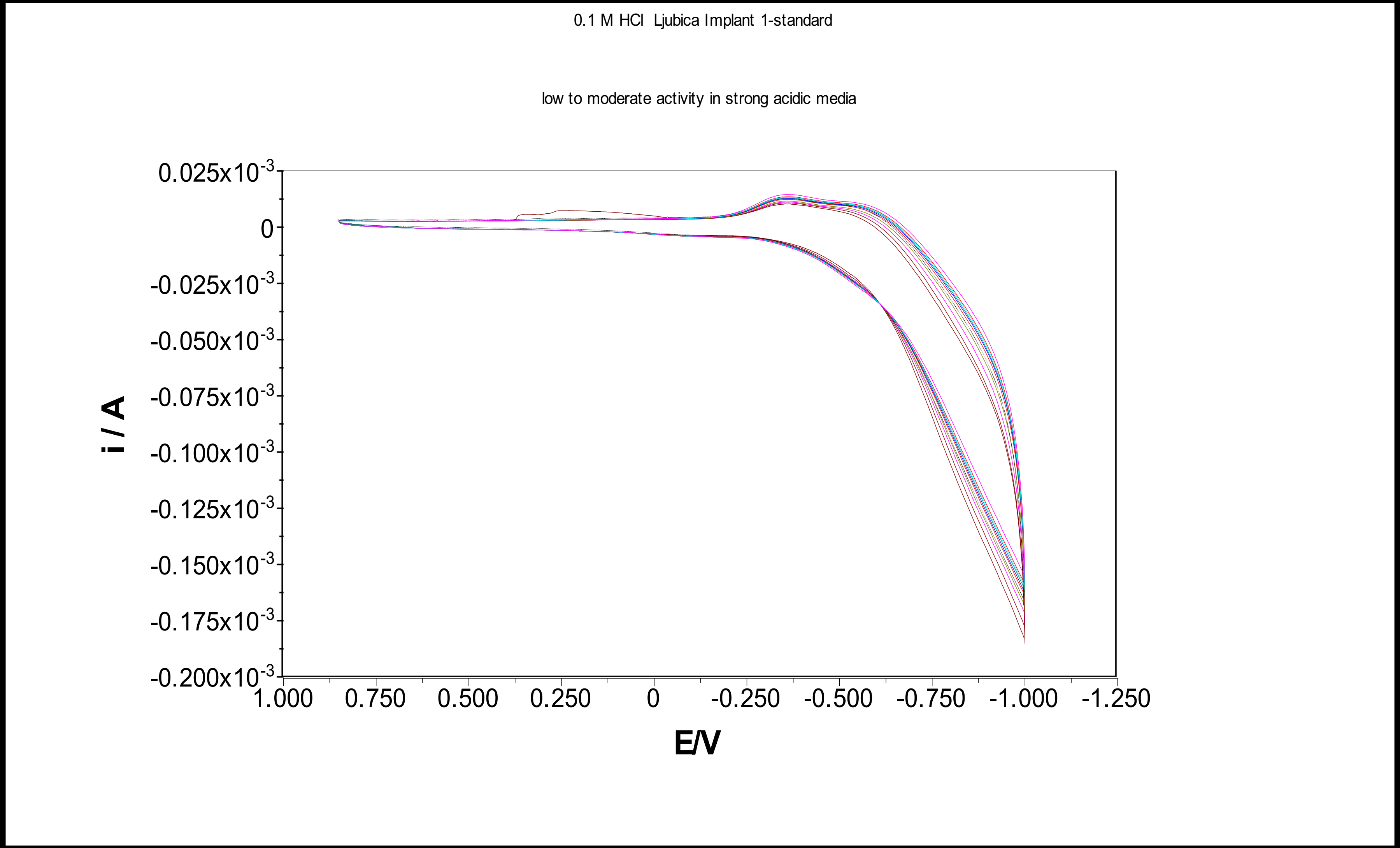

Cyclic Voltammogram
Epa
Faradaic
Current
(analyte)
Anodic (oxidation)
– Positive Current
Capacitive
Current
(background)
ipa
Current / μA
Potential / V
ipc
Cathodic (reduction)
– Negative Current
ipc
b.a.patel@brighton.ac.uk



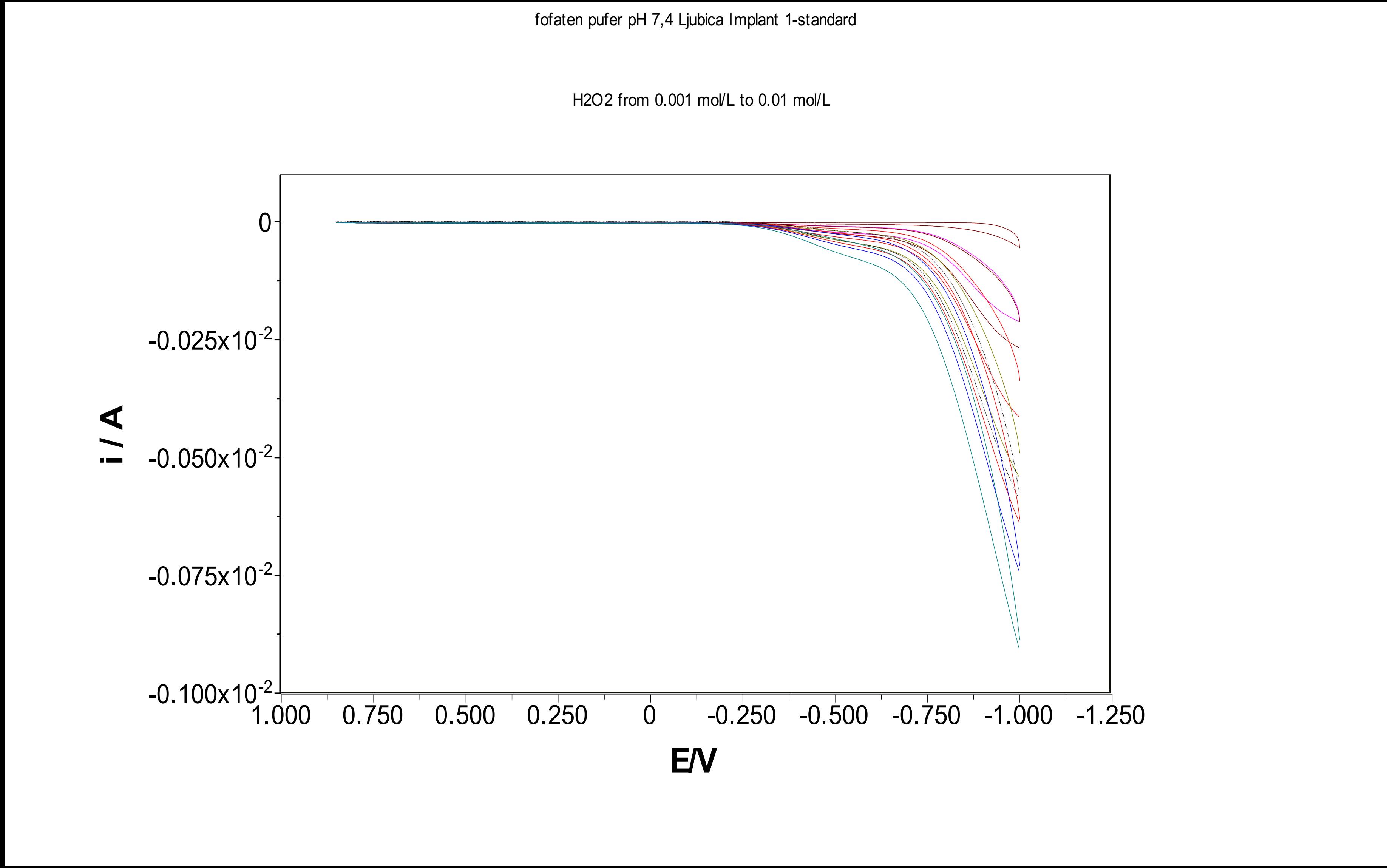
*There is no significant activity of the implant is observed
In milimolar range concentrations in neutral media.



*Small activity of the implant is observed in presence of citric acid
In milimolar range concentrations in neutral media.



*Bigger activity of the implant is observed in presence of HCL
In milimolar range concentrations in neutral media.



*Significant activity of the implant is observed in presence of H_2O_2
In milimolar range concentrations in neutral media.

Резултати

Загадувач	Потенцијален влез	Потенцијален позитивен ефект	Потенцијален негативен ефект
Si (силициум)	Во тек на чистење		Разорување на површина на имплант
Cl (хлор)	Се користи за чистење		Трошење на површина на имплант
Zn (цинк)	Пасти, водички за испирање		Трошење на површина на имплант

Загадувач	Потенцијален влез	Потенцијален позитивен ефект	Потенцијален негативен ефект
Ca (калциум)	Во тек на чистење	Контакт коска-имплант	Инхибира формирање на апатит
P (фосфор)	Во тек на чистење	Продуцира цитокини и матични клетки	Трошење на површина на имплантот
S (сулфур)	Плунка, во киселина за чистење		Промена на површината на имплантот – оксиден слој
Na (натриум)	Физиолошки раствор		Растварање на имплант

Лекови кои влијаат негативно на имплантниот успех

- SSRI
- Bisphoshonates
- Proton pump Inhibitors
- NSAIDs


Антихипертензиви
Остеоинтеграција
Успешна имплантација!

Review Paper

Contamination of titanium dental implants: a narrative review

Jagjit Singh Dhaliwal[1] · Sheba Rani Nakka David[1] · Nurul Ramizah Zulhilmi[1] · Sachinjeet Kaur Sodhi Dhaliwal[1] · Joe Knights[1] · Rubens Ferreira de Albuquerque Junior[2]

Received: 13 November 2019 / Accepted: 22 April 2020 / Published online: 4 May 2020

Abstract

Contamination of titanium dental implants may lead to implant failure. There are two major types of contaminants: the inorganic and organic contaminants. The inorganic contaminants mostly consist of elements such as calcium, phosphorus, chlorine, sulphur, sodium, silicon, fluorine and some organic carbons. Whereas organic contaminants consist of hydrocarbon, carboxylates, salts of organic acids, nitrogen from ammonium and bacterial cells/byproducts. Contaminants can alter the surface energy, chemical purity, thickness and composition of the oxide layer, however, we lack clinical evidence that contaminations have any effect at all. However, surface cleanliness seems to be essential for implant osseointegration.These contaminants may cause dental implants to fail in its function to restore missing teeth and also cause a financial burden to the patient and the health care services to invest in decontamination methods. Therefore, it is important to discuss the aetiology of dental implant failures. In this narrative review, we discuss two major types of contaminants: the inorganic and organic contaminants including bacterial contaminants. This review also aims to discuss the potential effect of contamination on Ti dental implants.

Keywords Dental implant · Contamination · Prognosis · Titanium

1 Introduction

Dental implants can get contaminated due to the ecological system in the oral cavity with abundant microorganisms [1]. Common elemental contamination from organic carbon and traces of elements including oxygen (O), nitrogen (N), calcium (Ca) and phosphorus (P) found on dental implant surfaces are potentially linked to failure in re-osseointegration when parts of an implant had lost its of metallic and non-metallic compounds on the surface seems to influence the success of implant osseointegration [4].

Currently, a growing amount of evidence [5, 6] suggests that the implant surface topography and chemistry has great influence on the osseointegration process by affecting protein signalling and cell migration or differentiation. Bone-implant contact area, mechanical interlocking and stress distribution are recognisably better in

Table 1 (continued)

Nature of contaminants	Contaminant	Potential entry	Potentially beneficial effect	Potentially dangerous effect	References
	Zinc	Toothpaste [40] Mouthwash [40]	Increasing the cell proliferation in osteoblasts, bone formation and biomineralization [46] Antibacterial property Pro-angiogenic [1] Good osteoinductivity [1]	Allergic reaction to metal [45]	[1, 40, 45, 46]
	Fluorine	Toothpaste [14, 47] Mouthwash [14, 47] Prophylactic gels [14, 47] Acid-etching process [47]	Prevent dental caries development [14, 47] Relieve dental sensitivity [14, 47]	Degraded the protective oxide layer of Ti and its alloys [14, 47] Discolouration of Ti implants [17]	[14, 17, 40, 47]
	Hydrogen	Acid-etching [13] Biological environment of oral cavity [50]	Delayed fractured on Ti implant [50] Improve Osteoblasts (Si–H coating) [51] Keratinocytes adhesion and viability [51]	Embrittlement of the Ti surface layer [13]	[13, 50, 51]
Organic contaminants	Hydrocarbon	Air [53] Water [53] Cleaning fluid [53]	NA	Lessen osteoblast attachment [52] Reduced hydrophilicity of Ti [52]	[52, 53]
	Caboxylates	Coating of Ti surface [54]	Osteoblast proliferation, differentiation, and matrix mineralization [54]	Increase the (super-) hydrophilicity of Ti and decreased the bonding with the oxide, N, and S atoms on protein [31] Reduced the attachment of cells [31]	[31, 54]
	Salts of organic acids	Glycolysis of bacteria [55]	NA	Reduced pH –favourable for aerobic bacteria [55] Corrosion [55] Discolouration of Ti implants [55]	[55]
	Nitrogen from ammonium residues	Bacterial plaque [2] Bolus [2] Saliva [2]	Inhibit growth of *E. coli* and act as an oxidant for the combustion reaction [56]	White residue obstructs the Ti surface [2]	[2, 56]
	Bacteria	Microbes in oral cavity [57] Bacterial contamination during surgery [58]	NA	Damaged the TiO_2 layer [57] Microbial corrosion [14, 17] Inflammation [14] Peri-implantitis [17]	[14, 17, 57, 58]

NA not available

Check for updates

Accepted: 24 January 2018

DOI: 10.1111/clr.13137

REVIEW ARTICLE

WILEY CLINICAL ORAL IMPLANTS RESEARCH

Medication-related dental implant failure: Systematic review and meta-analysis

Vivianne Chappuis[1] | Gustavo Avila-Ortiz[2] | Mauricio G. Araújo[3] | Alberto Monje[1]

[1]Department of Oral Surgery and Stomatology, School of Dental Medicine, University of Bern, Bern, Switzerland

[2]Department of Periodontics, College of Dentistry, University of Iowa, Iowa City, IA, USA

[3]Department of Dentistry, State University of Maringa, Maringa, Brazil

Correspondence
Vivianne Chappuis, Department of Oral Surgery and Stomatology, School of Dental Medicine, University of Bern, Bern, Switzerland.
Email: vivianne.chappuis@zmk.unibe.ch

Abstract

Objectives: The aim of this systematic review was to investigate the association between the intake of systemic medications that may affect bone metabolism and their subsequent impact on implant failures.

Material and methods: Electronic and manual literature searches were conducted. Implant failure (IF) was the primary outcome, while biological/mechanical and the causes/timing associated with IF were set as secondary outcomes. Meta-analyses for the binary outcome IF and odds ratio were performed to investigate the association with medications.

Results: A final selection of 17 articles was screened for qualitative assessment. As such, five studies focused on evaluating the association of implant failure and non-steroidal anti-inflammatory drugs (NSAIDs), two on selective serotonin reuptake inhibitors (SSRIs), two on proton pump inhibitors (PPIs), seven on bisphosphonates

of the population odds ratio. The heterogeneity among the included studies was measured computing I^2 and a p value for the null of homogeneous studies. This p value was compared to the level of significance of 5%.

3 | RESULTS

3.1 | Study selection (Figure 1)

A total of 430 entries were identified through the electronic search, and after removal of duplicates. The initial pool was not supplemented with any further article identified through manual search or cross-reference assessments. Of these 430, forty articles were assessed for full-text evaluation, resulting in a final selection of 17 articles for qualitative assessment (Table 1) (Alissa et al., 2009; Al-Sabbagh, Robinson, Romanos & Thomas, 2015; Chrcanovic, Kisch, Albrektsson & Wennerberg, 2017a,b; Famili, Quigley & Mosher, 2011; Grant, Amenedo, Freeman & Kraut, 2008; Jeffcoat et al., 1995; Koka, Babu & Norell, 2010; Memon, Weltman & Katancik, 2012; Reddy, Jeffcoat & Richardson, 1990; Siebert, Jurkovic, Statelova & Strecha, 2015; Urdaneta, Daher, Lery, Emanuel & Chuang, 2011; Winnett, Tenenbaum, Ganss & Jokstad, 2016; Wu et al., 2014, 2016, 2017; Zahid, Wang & Cohen, 2011). A total of 23 articles did not meet the eligibility criteria and were subsequently excluded (Table 2).

The studies included for qualitative assessment were pooled ac-

failure (i.e., beta-blockers or ACE inhibitors), only one study could be identified and accordingly, no subset meta-analysis could be carried out. For NSAIDs, the analysis could not be performed, as the vast majority of studies reported no failures in any of the control or experimental groups. For PPIs, the homogeneity of the two included studies was rejected at the 5% level ($I^2 = 0.93$, $p < .01$). Hence, the results should be interpreted carefully. Both the fixed effects and the random effects model estimated a difference of implant failure (IF) rates of 4.29% and 4.53%, meaning significantly higher IF rates in the test compared to the control group ($p < .01$) (Figure 2). Likewise, for SSRIs, the homogeneity of the two studies was rejected at the level 5% ($p < .01$). Both the fixed effects and the random effects model estimated a large positive difference of 7.48% and 7.50%, rendering significantly higher IF rates in the test compared to the control group ($p < .01$) (Figure 3). With regard to IF associated with the intake of BPs, one study (Al-Sabbagh et al., 2015) was excluded from the analysis due to missing IF in the control group. Using the IF rate as the primary outcome in the analysis, studies with a 0 IF rate in either the experimental or the control group were assigned a weight of 0, because the estimated standard deviation is 0. The remaining six studies were weighted and the estimated differences were −0.13 in the fixed effects model and 0.86 in the random effects model (Figure 4). These results must be interpreted cautiously due to a high heterogeneity of $I^2 = 98\%$ ($p < .01$ for the test of homogeneity among the included studies).

No analysis was conducted for secondary outcomes. Implant

IMPLANT SURFACE ANALYSIS AND MICROBIOLOGIC EVALUATION OF FAILED IMPLANTS RETRIEVED FROM SMOKERS

Jamil Awad Shibli, DDS, MS, PhD; Thales Rodrigo Colombo Vitussi, DDS, MS; Ricardo Vieira Garcia, DDS, MS, PhD; Elton Gonçalves Zenóbio, DDS, MS, PhD; Claudia Ota-Tsuzuki, DDS, MS, PhD; Alessandra Cassoni, DDS, MS, PhD; Adriano Piattelli, MD, DDS; Susana d'Avila, DDS, MS, PhD

The aim of this study was to evaluate the microbiota and surface of failed titanium dental implants from 4 manufacturers. Twelve mobile dental implants were retrieved from 10 smokers after 3 to 10 years of functional loading. Before implant removal, microbial samples were taken and evaluated using polymerase chain reaction. After implant removal, analyses of the failed implant surfaces were performed using scanning electron microscopy and energy-dispersive spectrometer x-ray. Periodontal pathogens such as *Aggregactibacter actinomycetemcomitans, Campylobacter rectus, Eikenella corrodens, Fusobacterium nucleatum, Porphyromonas gingivalis, Prevotella intermedia, Tannerella forsythia,* and *Treponema denticola* were detected in all implants in different proportions. Surface analysis showed varying degrees of surface roughness between the samples and the [redacted]

[redacted]

current, as previously reported.[21,22] Thereafter, the implant surfaces were observed by means SEM and submitted to an element analysis. The regions of interest[22] and the element detection were done simultaneously by verification of electron beam–induced x-ray radiation. An energy-dispersive spectrometer x-ray (EDX) equipped with a Si(Li) detector (EDS, Noran Instruments, Inc, Middleton, WI) was coupled to the JEOL JSM-T330A SEM. The spectral resolution of the detector was 138 eV at 5.7 kV (MnKα1). The microprobe used to acquire the spectra was set at 20kV high tension, 250 pA probe current, and a working distance of 80mm.

Data analysis

Fisher's exact test was used to calculate the different detected proportions of target bacteria around failed implants ($P < .05$). The EDX analysis showing the element detected was present only as descriptive data.

RESULTS

Microbiological evaluation

Figure 2 shows the prevalence of all target periodontal pathogens. *A actinomycetemcomitans* was detected in 16.67% of the implants. *P gingivalis* was most frequently detected in peri-implant pockets ($P = .030$) and was detected in 66.60% of samples. *P intermedia* and *T forsythia* were detected in 33.30% of peri-implant samples. *E corrodens*, *T denticola*, and *C rectus* were detected in 41.66% of the failed implants.

FIGURE 2. Mean prevalence (%) of periodontal pathogens. Fisher's exact test (*$P < .05$).

from smokers. Microbiological analysis revealed a periopathogenic microbiota around failed implants. The detection of *P gingivalis*, *P intermedia*, and *F nucleatun* agree with previous studies.[30–33] These microorganisms are commonly associated with progressive periodontal diseases and virulence factors that could be important to peri-implantitis progression and treatment.

A actinomycetemconitans and *T forsythia* were detected in peri-implant sites in agreement with other reports.[34,35] Previous studies have demonstrated that dental biofilm can be an important source of bacteria colonizing dental implant surfaces.[8,12,17] However, the presence of putative periodontal pathogens around oral implants does not necessarily mean disease.[14,15] These studies[14,15] evaluated diseased implants in nonsmokers, suggesting that the microbial composition between smokers and nonsmokers might be similar. Earlier studies that evaluated periodontal

Electrochemical behavior and surface characterization of dental materials in artificial salivary

S. Lakhloufi [a], H. Labjar [b], Y. El Hamdouni [b], I. Bouhouche [a], A. Dahrouch [c], M. Serghini-Idriissi [b], El.M. Lotfi [a], M. El Mahi [a], A. El Yamani [d], S. El Hajjaji [b], N. Labjar [a]

Show more

+ Add to Mendeley   Share   Cite

https://doi.org/10.1016/j.matpr.2020.06.483   Get rights and content

Abstract

Research concerning the applications of ceramic biomaterials as dental restorative materials is of particular interest for the study of the physico-chemical, mechanical and microstructural behavior with a multitude of techniques. Nevertheless, the wealth of scientific articles in this field remains vast and poor in terms of all-ceramic restorative materials, their ageing and electrochemical degradation behavior utilizing the electrochemical impedance spectroscopy, in contact with an electrolytic solution which can cause and exhibit a very remarkable variation in the surface state and variation in the stability of the electrochemical behavior of these dental materials, which can be influenced by pH, temperature and the medium variations. Ringer's solution as artificial saliva has been used as a degradation medium to evaluate the effect of saliva on the microstructure, surface condition, chemical composition and degradation behavior of dental materials. This is done using X-ray diffraction, SEM-coupled energy dispersive spectrometry (EDX) and electrochemical impedance spectroscopy as a technique to

Conclusion

Dental ceramics are known for their good resistance to the aggressiveness of the saliva environment. During this work, we were able to evaluate and compare the electrochemical behavior of the two ceramics with respect to the Ringer saliva medium as a function of immersion time at a temperature of 37â€¯Â°C, this technique was reinforced by surface condition and microstructure analyses. The loss of mass obtained by the gravimetric study shows that its variation (loss or gain of mass) variesâ€¦

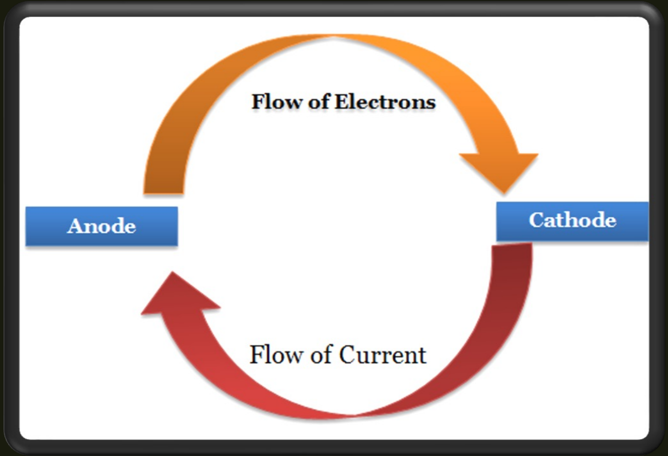
CRediT authorship contribution statement

S. Lakhloufi: Conceptualization, Methodology, Software. **H. Labjar:** Methodology, Software. **Y. El Hamdouni:** Methodology, Software. **I. Bouhouche:** Methodology, Software. **A. Dahrouch:** Resources. **M. Serghini-Idriissi:** Validation. **El.M. Lotfi:** Resources. **M. El Mahi:** Resources. **A. El Yamani:** Resources. **S. El Hajjaji:** Writing - review & editing. **N. Labjar:** Supervision, Project administration, Writing - review & editing.â€¦

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.â€¦

ПРЕДНОСТИ од употреба на Волтаметрија



- Погодна за студирање на дентални био-материјали
- Брза техника
- Лесна за изведување и ЕФТИНА
- Работи со употреба на хемикалии што ги има во секоја лабораторија
- Дава широг опсег на информации
- Кинетичка и термодинамичка природа

Заклучок

- Контаминациите на денталните импланти - неуспесите на имплантацијата. Сумирано, можеме да заклучиме дека загадувачите, лековите може да бидат корисни и/или да предизвикаат негативни ефекти врз денталните импланти.
- Сеопфатна проценка и разбирање на медицинската историја на пациентот и лековите е важна за имплантниот успех.

- Овој преглед е наменет и за производителите и за лекарите.
- Постои разлика во имплантите од различни производители
- Сите импланти се различно чистени
- Различни цени на импланти
- Нерамнини, односно вдлабнувања, испакнувања
- Медицински статус и терапија

Отфрлање на имплант, инфекција, периимплантитис!

Благодарност

- Проф. д-р Софија Царчева Шаља
- Проф. д-р Даниела Велеска-Стевковска
- Проф. д-р Рубин Гулабоски
- Проф. д-р Киро Папакоча

Ви благодарам на вниманието!

11.11.2023

ljupka.arsovski@ugd.edu.mk