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Master Thesis
By dentistry program student
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on

„The Impact of Smoking on Periodontal Disease"

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Abbreviations

CVD – cardiovascular disease
e-cig – electronic cigarette
nACHR – nicotinic acetylcholine receptors
Bp – blood pressure
PDLF – periodontal ligament fibroblasts
TL – tooth loss
CI – confidence interval
OR– odds ration
PMT – periodontal maintenance therapy
MBLo – marginal bone loss
Ph – potential of hydrogen
OML – oral mucosal lesions
FS – former smokers
ECC – electric cigarette consumers
EVALI – e-cigarette, or vaping, product use associated lung injury
BOOP – bronchiolitis obliterans with organizing pneumonia
DAH – diffuse alveolar haemorrhage
ARDS – acute respiratory distress syndrome
DAD – diffuse alveolar damage
NLR – neutrophil lymphocyte ratio
MPV – mean platelet volume
PLR – platelet lymphocyte ratio
PPD – periodontal probing depth
BOP – bleeding on probing
APT – active periodontal treatment
SPT – supportive periodontal treatment

CAL – clinical attachment loss
PD – probing depth
TLP – tooth loss due to periodontitis
RR – risk ratio

1. Abstract

The purpose of this literature review is to point out, define and explain the negative effects of smoking in regard to periodontal disease. The topic of tobacco dependence, its destructive effects on the tissues of the body, especially the oral tissues, as well as its cells and membranes will be investigated. Furthermore, will we discuss a new upcoming trend, which is specifically dangerous for the younger generation; e-cigarettes and other smoking devices linked to flavoured smoke, mostly including some kinds of liquids which are burned/steamed and inhaled.

In addition, we will research shortly the general effects of smoking on the human body. Following, the management and treatment of smoking patients with periodontal disease which will be discussed, emphasizing the positive effects of cessation of smoking in periodontal disease.

To finish off this literature review, a questionnaire regarding smoking habits in dental students of Vilnius University will be evaluated, giving a broad understanding at dentists smoking habits during their studies at Vilnius university

Keywords : Periodontitis, smoking, tobacco

2. Introduction

Nicotiana tabacum is the name of the plant, from whose leaves, tobacco is derived.

It is suggested by archaeologic studies, that the first usage of tobacco goes all the way back to the first century before Christ, to the times when the Mayan tribes of central America smoked the leaves of the *Genus Nicotiana* to celebrate religious, as well as sacred ceremonies within the tribe.

The tobacco plant was introduced to Europe through Spanish and French sailors, which through the Sake of time spread the addictive plant all over the world, making it a popular drug, with a tremendous risk for addiction. It is also said that it was presented to the court of the French king as

a cure for Catherine de Medici´s migraine. Nevertheless, in which form tobacco is consumed, it is emphasized by many different research works from all over the world, that the consumption of tobacco has destructive effects on all systems of living beings [1].

Tobacco smoke and its consumption are still very popular, even though its negative effects are quite well known worldwide, especially in Europe, causing a tremendous amount of deaths each year, often with life compromising diseases and conditions beforehand.

Measures for prevention of tobacco addiction are more aggressively implied into society by printing discouraging images on cigarette packages, or the steady raise of tobacco prices.

In addition to the well-known tobacco smoking worldwide, a new threat is finding its way into everyday life's, e-cigarettes and other liquifying smoke devices, with inhalable smoke or vapor. Those devices bring new threats and diseases, for which there are not many long-term studies available due to its quite new appearance to the market. It cannot be emphasized enough that tobacco dependence and consumption are one of the 21st centuries, biggest threats for humanity, with a for now, not visible end due to new trends in the smoke industry, dragging especially the younger generation into this circle of death. In this literature review I will go into depth of the effects of tobacco smoking on periodontal disease to give a better understanding of the processes that happen due to the influence of tobacco smoke on the human body. Before continuing with the extent review, it is important to mention, that every time tobacco dependence is mentioned, the stimulant drug nicotine, which is found in tobacco is being addressed. During burning of tobacco and the inhalation of it, tar droplets saturated with nicotine enter the lungs, from where it is absorbed very quickly into the bloodstream and as a consequence, transported to the brain. The nicotine chemical signature is comparable with that of the neurotransmitter acetylcholine, which among other things triggers the production of dopamine. Followed by a release of dopamine the consumer experiences calmness, relaxation and alertness [2].

3. General information about tobacco usage worldwide

3.1 General information

The consumption of tobacco is only slowly decreasing with almost one billion people worldwide of the age 15 and above smoking tobacco. At the given moment and data, 847 million men smoke

tobacco, which is 46 million fewer than in 2007, and 153 million women, which is 36 million fewer than in 2007. Between 2007 and 2019, the global rates of smoking rates decreased from 22.7% to 17.5%, proving a relative reduction of 23% over 12 years [3].

The tremendous effects of tobacco smoke, are reflected in the mortality rate of nearly 6 million people per year, actively smoking, and 600 000 dying of passively inhaled smoke.

In the case of absence of measures by the WHO, the numbers are expected to reach 8 million deaths by 2030. In the public health sector, smoking is a very big issue, which is constantly discussed. Since every six seconds a person dies due to tobacco consumption, or better said one in ten deaths are a result of tobacco. Estimations state that half of all current smokers will die of a disease related to tobacco consumption. Tobacco is a slow and silent killer, causing 100 million deaths in the 20th century, with a chance of killing 1 billion people in the 21st century if the current situation of consumption continues [3,4]. When analysing studies of preventable mortality risk factors in Europe, smoking is the leading preventable cause [5]. In Europe the prevalence of smoking in adults is the highest worldwide. Shockingly but not surprisingly smoking does have a very high prevalence of all-cause mortality rate with 16% in adults aged 30 and older in Europe, compared to a 4% less mortality rate worldwide of 12% [6].

3.2 Tobacco dependence

The nicotine in tobacco is an addictive substance. When talking about Addiction or "drug dependence", it automatically has to be considered a biological need for a drug, which developed due to the bodies physiological adaptation to receiving a trigger for dopamine release. Consequently, the body stops producing dopamine itself and causes a physiological dependence: only relying on the continuous consumption of tobacco, which luckily can be reversed by withdrawal of nicotine [7/8]. A dependence to a drug can also be evaluated by the risk the person consuming, is willing to take to consume the drug. The person in dependence is willing to consume the drug, knowing it has bad influence on their health and could cause suffering in their life. An addiction can be discovered if an inability of resistance and a relief after consumption of the drug is experienced. The desire and the intensity for smoking is correlated with brain activity and neurotransmitters in addiction circuits of the brain [9]. To emphasize the urgency of being more aware of tobacco consume it is important to mention that in the diagnostic and statistical manual – 5, Tobacco is specifically mentioned; besides, alcohol, hallucinogens, caffeine, cannabis, inhalants, opioids, sedatives, hypnotics, and anxiolytics, because all those drugs consumed in excess will activate the reward circuit of the brain and have a high possibility of co-occurrence [10].

When talking about tobacco induced dependence, we must consider two types of dependence, mainly the physical dependence and additional to that the psychological dependence.

Physical dependence: This kind of dependence is triggered by tobacco and has progress stages of; wanting, craving and needing. This symptomatic withdrawal phase when not smoking, intensifies according to the amount of cigarettes or other tobacco containing drugs consumed in a specific time frame. with repeated consumption of tobacco, the latency to reach a withdrawal stage will shrink, starting from as longs as several weeks down to just several minutes [9].

Physical dependence as a term is used to indicate the aspect of addiction/dependence related to withdrawal phenomena. As a matter of proof, we need to identify withdrawal symptoms of tobacco consumption. First symptom to discuss is the reoccurrence of symptoms after each withdrawal from tobacco, second the sequence of appearance is specific as mentioned earlier. Thirdly, the appearance occurs after a characteristic latency and fourthly the craving of tobacco is immediately relieved after consumption for a specific timeframe. The typically recognizable symptoms of tobacco/nicotine withdrawal do usually not appear in a standard order, as physical dependence develops with time, but is usually associated with the needing stage in withdrawal of the drug. Symptoms recognizable are: moodiness, impatience, irritability, anxiety, restlessness, trouble sleeping and difficulty in concentrating [11,9]. Nevertheless, it is very important to be aware of the tight entanglement of physical and psychological aspects [9]. Psychological dependence: Tobacco smoking has been a socializing catalyst ever since it was discovered. In our recent society and time, it is easy to observe the consumption in different age groups. The cigarette for example is considered an icebreaker at parties or in front of clubs, a simple "do you have a cigarette" or "do you have a lighter for me", is an easy conversation starter. Another example is the newly in Europe upcoming trend of hookah or shisha bars, where people meet to smoke flavoured tobacco together and to drink alcohol in co-consumption. Nicotine is valued amongst smokers as a mood enhancer, if you have a bad mood or are stressed, smoke a cigarette, if you are happy and you want to elongate that feeling, smoke a cigarette. Another example is the "typical cigarette after sex", which is displayed in many tv-shows, giving the spectators a sense of normality in tobacco consumption. Once consumers of cigarettes, get into this "comfort zone", established by the smoke of cigarettes, a psychological dependence can also occur, the fear of not belonging to a group of people at work, or belonging to your friends who go out for a smoke can be very stressing for many people and pressure them into continuing their bad smoking habits. Those habits are mostly imposed by parents or care takers and their relationship to smoking and cigarettes; if parents are tolerate towards smoking or are smokers themselves, it is more likely for their children to experiment earlier on without having any consequences. In contrast, parents who are imposing strict dislike towards cigarettes and smoke, will pass their opinion on to their children, making them less likely to

consume tobacco. Another very interesting point to mention in this cause is, that once a relation to smoking is manifested, it will have an effect on the choosing of friends in adulthood [2].

4. The impact of tobacco smoke on the periodontal tissues

4.1 The impact on tissue oxygenation

It is out of question that tobacco consumption has a negative effect on the humans body and especially the oral cavities oxygenation rate. This can be traced back to the emergence of carbon monoxide in tobacco smoke. Carbon monoxide is a toxic gas, entering the body through the air, to be absorbed by the lungs and mainly distributed through the bloodstream, due to its haemoglobin affinity, which is 200 times greater than oxygen. This attachment of carbon monoxide to haemoglobin, prevents proper oxygenation of tissues, especially in the oral cavity with its fine blood vessels, causing limited functioning of affected tissues. Hypoxia may occur to those tissues, with possible effects of delayed therapy success or wound healing [12].

4.2 The impact on mucous membranes

Through a chronic consumption of tobacco smoke, several changes of the oral mucosa will appear. The colour of the mucous membrane will change and darken, also known as hyperpigmentation; which is called smokers melanosis, appearing due to toxic substances in tobacco smoke and the thermal exposure to the hot smoke in the oral cavity. Another non harmful change that appears most of the time is smokers palate. Both changes are nothing to be too concerned about in the first place, but can be predisposing to more severe diseases triggered by tobacco consumption and attention should be paid to those first signs. Oral leukoplakia for example is one of the most important pre-cancerous changes of the oral mucosa with a high linkage to tobacco smoke triggered development [13]. The prevalence of oral leukoplakia is determinable by the dose-work relation of consumed tobacco to the appearance of leukoplakia. Smokers are therefore six times more often suffering from it than non-smokers [13]. When considering the distribution of leukoplakia between smokers and non-smokers, it is a paradox, that the prognosis for smokers with oral leucoplakia is better than in non-smokers. This can be traced back to the fact, that some of the tobacco induced leukoplakias remain in a reversible state, with its reversible effect triggered by smoking cessation. The non-

malignant reversible type, is characterized by a whitish film, with a fingerprint riffle. Nevertheless, the risk of malignant mutation is given, causing squamous cell carcinoma, the most commonly occurring cancer in the oral cavity [13].

4.3 The impact on bone tissues

In the current state of research of the impact of smoking on bone tissue it is believed that it might have detrimental effects on the skeletal system of the human body [14]. Multiple studies support the recent evidence demonstrated that smoking causes a major imbalance in the turnover mechanism of bone affecting mineral density in bone and leading to a lower bone mass in general, making smokers more vulnerable to osteoporosis or fractures [14]. Bone undergoes continuous remodelling phases via formation of bone tissue or resorption of it. The two major cells responsible are osteoblasts and osteoclasts, which will be talked about more in detail later. The nicotine in tobacco smoke inhibits several complex pathways in need for the remodelling of bone tissue, and is therefore, inhibiting osteogenesis and angiogenesis, causing problems in several different regions of the body; also being correlated with periodontitis [15,16].

5.   The impact on blood circulation

The most significant risk factor for the emergence of cardiovascular illnesses is cigarette Smoking. Smokers are 2-4 times more likely to develop cardiovascular disease than non-Smokers [17]. However, research on how nicotine, the addictive substance found in all tobacco products, contributes to the emergence of CVD is still in its development.
Although the prevalence of cigarette smoking has successfully decreased as a result of increased public awareness of its negative effects, the use e-cigs or other electronic nicotine delivery systems have dramatically increased in recent years due to the perception that these products are secure [17]. The impact smoking has on blood circulation and in that regard on blood vessels and the physiology of the cardiovascular system, derives from the active form of nicotine, which has the ability to function as an agonist nAChR. These nAChR are divided into three sub categories; muscle-type, heteromeric and homomeric. Of these three categories, the heteromeric and the homomeric are the most affected by nicotine, whereas the muscle type receptors are less likely effected by nicotine. These receptors act upon post-synaptic neurons in the

noradrenergic cycle. This specific binding of active nicotine in the beginning of a neuron excitement triggers the release of noradrenaline, causing vasoconstriction and therefore higher blood pressure [17,19]. A study carried out by Oakes JM, Xu J, Morris TM, et al (2020) on mice being exposed to chronic nicotine inhalation shows a transient increase in blood pressure. In the study mice were exposed to inhaled nicotine by smoke daily for 12 hours. In week 1-3 both systolic and diastolic blood pressure elevations could be registered, which returned to baseline after 4-8 weeks of exposure. This change of blood pressure in such a short time led to the suspicion of a tolerance development or a compensatory mechanism activation. Additional to the findings it is important to mention that the Bp increase noticed during the first week of exposure to nicotine, was in correlation to a lack of a dipping systolic Bp, being a risk factor for CVD as well as end organ damage. The result of the study found that an 8- week exposure to inhaled nicotine leads to pulmonary hypertension. [18]

6.   The impact of tobacco smoke on cells

6.1 The impact on osteoblasts and osteoclasts

Smoking is known as a primary risk factor for several oral diseases, especially for periodontitis, which is primarily noticed due to alveolar bone resorption. When talking about bone resorption we must conclude the whole process of bone remodelling itself. Bone is continuously remodelled in the human body with the help of osteocytes governing the process of bone resorption complied by osteoclasts and bone formation or modelling by osteoblasts [20]. There are several factors which can affect bone homeostasis. Nicotine as mentioned before has the ability to attach to nicotinic acetylcholine receptors, which can also be found on the surface of osteoblasts, which are responsible for bone remodelling [21].The effect of nicotine is therefore mainly noticeable in this specific mechanism and rather not in bone resorption. Several studies have been done, but the detailed process of the effect of nicotine on bone remodelling has not been completely understood yet, but it is assumed that important processes working towards bone mineralization are being manipulated by nicotine consumption [21]. But most researchers agree that the extensive outcomes

of smoking such like alveolar bone resorption, periodontal ligament loss, decreased rate of bone metabolism and many more can be traced back to the most toxic component in tobacco smoke; nicotine [20,21]. Up to this date studies show divided outcomes though. With some clearly showing the inhibitory effect on bone metabolism of nicotine and with others showing more of a biphasic effect of nicotine [21].

6.2 The impact on fibroblasts

Following up to osteoblasts and osteoclasts, it is important to talk about fibroblasts; in this special occasion, about PDLF, due to their importance for the dental field. The stability and function of human teeth depends in big amounts on the health condition of the periodontal ligament surrounding these, due to its highly fibrous and vascularized tissue. In the periodontium the periodontal ligament fibroblasts are the most found cell type, responsible for periodontal tissue homeostasis as well as periodontal remodelling. Nicotine is proven to inhibit protein synthesis, cell growth as well as cell proliferation [22]. Due to the nicotinic acetylcholine receptors to whom nicotine binds during inhalation, a dysregulated repair response is produced, which causes nicotine to impair wound healing, specifically complicating periodontitis treatment, due to manipulated healing processes. In this case myofibroblasts are most affected by inhibition of differentiation and transition. Additionally, oxidative stress is triggered by inhaled nicotine, which may trigger responses of inflammatory origin in the periodontal tissues, which also slow down the healing processes [23].
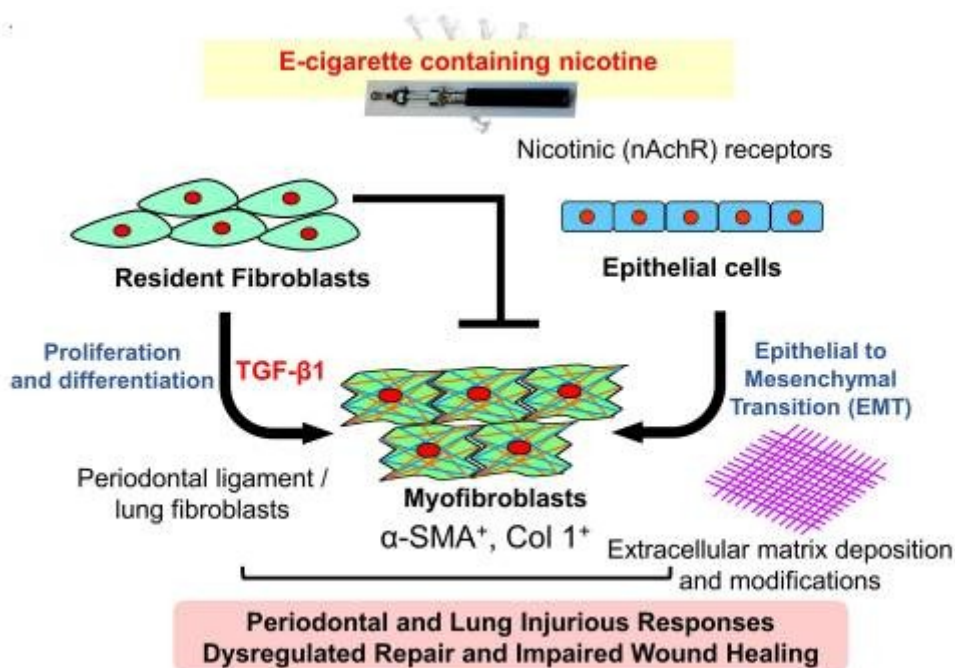
Picture 1. Possible mechanism smoke induced(e-cigarette) inflammatory and dysregulated repair responses to inhaled nicotine [23]

7. The impact of tobacco smoke on the periodontium

7.1 The impact on tooth loss

Smoking is known as one of the most important risk factors for periodontitis, thus meaning the severity of the disease, the progression, as well as TL due to it are considerably higher in smokers than in non-smoking patients. Tooth loss has been researched in several longitudinal studies among individuals going through periodontal maintenance therapy, but not a lot of papers have been published solely regarding the independent effect of smoking on tooth loss. Vieira TR, Martins CC, Cyrino RM, Azevedo AMO, Cota LOM, Costa FO, published (2018) a meta-analysis/systemic review regarding this specific topic investigating several studies regarding the relation of smoking or non-smoking during active periodontal therapy and maintenance periodontal therapy. During the research 11 papers were observed which came to the conclusion, that the odds for TL in smokers compared to non-smokers is 3-4 times higher. It has also been found that during PMT the TL occurrence in smokers was 2.5 times higher than in non-smokers. Another important thing to mention is, that irregularity of presence at PMT in smoking patients, showed

higher chances for TL in comparison to compliant patients during PMT.[24] Regarding the analysis, it is to be considered, that specific aspects, influencing the outcome of PMT in correlation with tooth loss were not considered. For example; the number of cigarettes or tobacco consumed daily, the duration of smoking, the age of the patients, the severity of periodontitis; stage/class and very important the occurrence and compliance to the PMT, which was mentioned, differed from 3-18 months between appointments. [24]

7.2 The impact on bone loss

Smoking in aspect to marginal bone loss is a general risk factor and plays a major role. The inflammatory reactions happening in the periodontal and surrounding tissues, result in a breakdown of the periodontal tissues. For a long time smoking was considered an indirect risk factor to MBLo, but recent studies established that, smoking is in fact a direct risk factor, especially when considering the huge impact smoking has on diminished vascularization to the gingiva, the inhibition of the body's immune response as well as the change in the microflora of the oral cavity, which becomes more pathogenic, due to the impact of smoking [25,26]. Even when indirect factors such as oral hygiene, gender, age and dental care were adjusted, it has been proven that smoking is directly correlated with the destruction of tissues surrounding the periodontium, causing even futher MBLo in patients with previously obtained periodontal disease [26]. A 10 years study by Bahrami G, Vaeth M, Kirkevang LL, Wenzel A, Isidor F (2017) in which participants were randomly selected from the civil registration system in Denmark, shows the impact of smoking on periodontal bone loss very well. The participants eligible for the study, which participated in the 10 years study, had a radiographic series made three times in the time window between 1997/1998 and 2017/2018 (including panoramic, periapical for every remaining tooth and two bitewings). For the study it was important that the smoking behaviours of the participants did not change, other factors mentioned earlier were already considered and did not have an impact on the study. The study included smokers and non- smokers, 301 of the participants were included in the study after completing all needed revaluations. The results of the study for marginal bone level and bone loss in smokers and non- smokers, were: the marginal bone level remained normal in 60.1% of non- smokers, whereas only in 17.4% of smokers the same result was seen. Borderline marginal bone levels could be detected in 32% of non-smokers and 34.7% of smokers. The most significant differences could be seen in the field of reduced marginal bone level, where only 7.9% of non- smokers, compared to 48% of smokers ended. Marginal bone loss of 1-2mm in non-smokers remained with only 19.2%

compared to smokers with 49%. The last column of marginal bone loss over or same to 2 mm was only presented by smoking participants with a percentage of 7.1% of all participants. (Seen in table 1 below) [26].

	Nonsmoker N (%)	Smoker N (%)	Total N (%)
Marginal bone level (mm) [a]			
Normal (<3)	122 (60.1)	17 (17.4)	139 (46.2)
Borderline (3–4)	65 (32.0)	34 (34.7)	99 (32.9)
Reduced (≥ 4)	16 (7.9)	47 (48.0)	63 (20.9)
Marginal bone loss (mm) [a]			
≤1	164 (80.8)	43 (43.9)	207 (68.8)
1–2	39 (19.2)	48 (49.0)	87 (28.9)
≥ 2	0 (0.0)	7 (7.1)	7 (2.3)

Table. 1 Marginal bone level and marginal bone loss in mm after 10 years in smokers and non-smokers [26]

7.3 The impact on attachment loss

Smoking is associated with a two to eightfold increased risk for attachment loss as well as bone loss. But these multiples in increased chances strongly depend on the definition on nicotine dose in patients as also in the severity of periodontitis, the patients are suffering from. Attachment loss is considered a side-effect due to the systemic effects of nicotine on the periodontal tissues in summary. Smoking's detrimental impact on the bodies immune system and its inflammatory response, especially in neutrophil function alterations, the production of antibodies, fibroblast activity, inflammatory mediator production and vascular manipulation of tissues, works as an assemblage together to cause several side-effects such as attachment loss [27]. The deleterious systemic impact of smoking on the periodontium has been proven with extensive evidence in the past already, but a local impact of smoking has also been observed, when comparing smokers to non-smokers. Some studies regarding the local effect on attachment loss in smokers and non-smokers have already been performed to investigate the impact of smoking locally, but no definite answer can be given so far to establish an ensured pattern of attachment loss due to local impact. A study by M.Radvar, I Darby, A Polster et al. (2011) though, published a paper stating that a definite significantly greater amount of attachment loss could have been observed in the anterior maxillary region of smokers [27]. Another study carried out in 2017 by Javed et al. could also strengthen the objective of the earlier on carried out study, analysing periodontal

parameters in regard of the impact of smoking. In this study it has been proven that proinflammatory effects due to the stimulation of secretion of radical oxygen species and specific cytokines, were a result of smoking and that they play a major role in the destruction of periodontal tissues [28].

7.4 The impact on gingival inflammation

It was clinically investigated that smoking has a big impact on both; the gingival epithelium as well as connective tissue. The blood circulation is diminished in smokers compared to non-smokers, due to the vasoconstriction of blood vessels caused by nicotine intake. Smokers have significantly more blood vessels in the gingival tissues with a diameter of $0,5\mu$ or less in comparison to smokers [29]. the nicotine in smoke causes a stimulation for production of adrenaline and noradrenaline, which both cause the vasoconstriction of blood vessels. This side effect of nicotine has an impact on our intraoral clinical findings, causing much less bleeding in smokers than in non-smokers, which can easily be mistaken for good gingival health in patients or absence of inflammation, the decrease of capillary diameter as well as density also plays a role in inflammatory response, showing much less inflammatory signs in smokers than in non-smokers. Most often accompanied with the absence of redness in the gums, making it clinically harder to identify [29].
It has also been discovered that the nicotine in smoke, increases pro-inflammatory cytokines, manipulating the proper function of inflammatory cells during proliferation and differentiation. Neutrophils especially are the most threatened cell type, with their function of phagocytosis being suppressed and apoptosis being altered [30].

7.5 The impact on plaque accumulation

When talking about dental plaque accumulation or in other words dental biofilm formation, it has been found, that there is no difference in bacterial planktonic growth in the saliva, neither on low concentrations of 0.25 to 2mg/ml nor in higher concentrations from 2-8mg/ml of nicotine in the saliva. Surprisingly, the bacterial biofilm concentration was a lot higher in smokers than in non-Smokers, even when just a 0,5mg/ml nicotine concentration could be found in the saliva [31].
It has been researched, that in nicotine consuming patients, the composition of the dental biofilm is composed of far more bacterial cells as well as extracellular polymeric substances.

When further investigating the dental biofilm of smokers, it was found that the biofilm even changes its structure, consisting of longer bacterial chain length and a cell arrangement with more precise orientation [31]. Summarized in this specific topic it can be said, that nicotine consumption promotes the formation of a more caries suspectable environment.

7.6 The impact on oral fluids

The next point I want to emphasize is, that saliva is essential in regards of maintenance of the systemic and specifically the oral homeostasis, any hypofunction regarding salivary glands might be causing other health problems like caries, burning mouth syndrome, xerostomia or oral infectious diseases [32] It has been researched that long term effects of tobacco consumption include the desensitization of taste receptors, which ensuing has a negative impact on the salivary reflex, causing adapted taste receptors, which will finally cause a decrease in salivary flow. Saliva ph is managed by a protein, phosphate, carbonic acid, and bicarbonate system, and by the sympathetic/parasympathetic maintenance, which are responsible for the regulation of salivary flow. The consumption of tobacco, triggers salivary flow directly after contact with the oral mucosa for a short amount of time in contrary to the long-term exposure impact [32]. Furthermore, it is important to mention that it has been found, that the composition of saliva as well as its function is altered in tobacco consumers, meaning that the antioxidant systems maintained in the saliva may be insufficient to the exposure of tobacco smoke, despite their normally very efficient working conditions. It has been shown, that increased oxidative stress markers in combination with pro inflammatory markers were excessively accumulated in smokers[33]. Periodontitis in this sense is a disease, going hand in hand with an imbalanced redox homeostasis, establishing a state of inflammation together with a profuse development of more free radicals and more oxidant species, with the ability to damage cellular tissues. When saliva is in this stress state, with a decreased salivary antioxidant capacity, the restoration of the salivary redox state is very difficult, and functions collaboratively, to cause even more excessive tissue damage, together with the underlying proinflammatory state [33].

7.7 The impact on the oral flora

More than 600 different bacterial species combined with fungi and viruses colonize the oral cavity, composing the oral microbiota collectively. Balance of the oral microbiota is very important, when considering the human health. It has been observed that the oral microbiota are

influenced by tobacco consumption, especially in the form of smoke, since the oral cavity is the first part of the body to get in contact with consumed tobacco smoke.

Therefore, the oral microbiota has a significant high chance to be affected by it, through toxicants included in cigarette smoke, causing oxygen deprivation upon consumption.

An oral dysbiosis is caused by the consumption, which manipulates the needed diversity in microbiota in the oral cavity, as well as it hinders its proper functional potential.

A study carried out by Jia, Yi-Jing et al.(2021) showed the changes of microbiota in comparison to smokers with the results; when observing microbiota at the genus level were *Aptobium, Prevotella, Actinomyces, Veillonella, Bulleidia, Megasphera, Oribacterium* and *Campylobacter*, significantly enriched. Whereas a significant depletion could be detected in; *Lautropia, Peptococcus, Eikenella, Kingella, Haemophilus, Neisseria, Cardiobacterium, Aggregatibacter and Moxarella. Moryella, Moxarella* and *Bulleidia* in these genera, were able to be observed to be significantly dependant on smoking status. The changes were very significant with other bacteria included as well (see in table 2). Important to mention is, that the bacteria primarily enriched in smokers belongs to the *Phyla* of *Bacteriodetes, Actinobacteria and Firmicutes*. In contrary, belonged the bacteria, that primarily decreased in smokers, to the phylum of *Proteobacteria*, showing that the diversity of the oral microbiome in smokers is less than in non-smokers, and dominated by bacteria which are damaging to the oral health.[34]
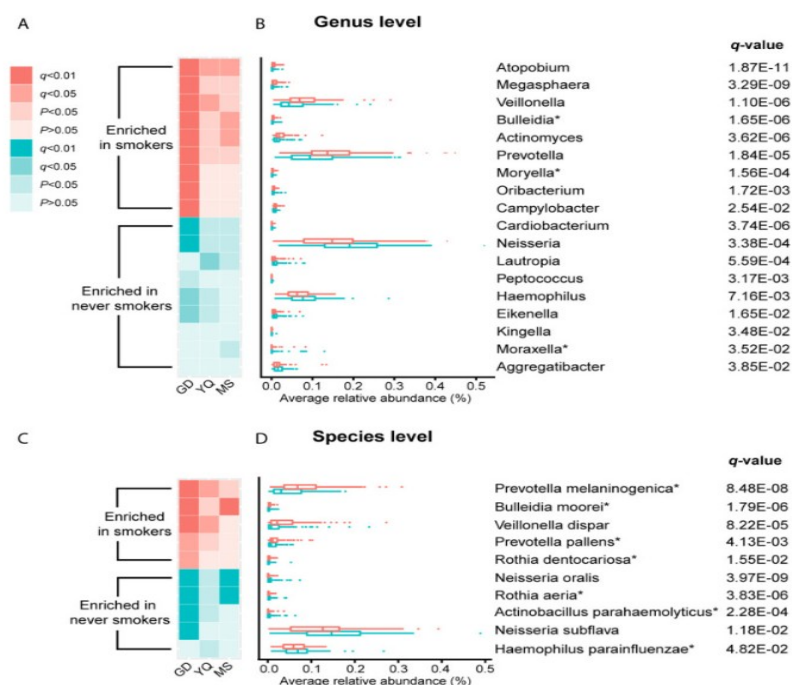

Table 2. The results of comparison of bacterial abundance at the genus level and species level [34]

Another study also found that the oral microbiome differs significantly from current smokers to never or former smokers. The findings of this study also correlate with the findings of the study

mentioned earlier, observing significant depletion of *Proteobacteria* as well as a reasonable enrichment of *Actinobacteria and Firmicutes* in a comparison of current to never smokers.

A finalising comment of the study was, that they observed, that there was no difference in the composition of the oral microbiome between never or former smokers, which is promising information, when considering periodontal treatment including smoking cessation, meaning that changes in the oral microbiome are reversible and not permanent [35].

Both studies showed, that smoking will manipulate the oral microbiome count and cause a harmful imbalance of pathogenic bacteria and beneficial bacteria.

8. E-Cigarette smoke, a new dangerous trend

8.1 Local effects of e-cigarette smoke

Over the past ten years, e-cigarettes have become much more popular, particularly among teens. Although while research on the impact of e-cigarettes in the oral cavity has just recently begun, not a lot is known about how they might affect the oral microbiota, oral health, and even the risk of diseases. A recent study, published in 2022 observed, that in the oral cavity, an essential aspect of bacterial colonization is the attachment to epithelial cells. They found, that in e-cigarette smokers during "vaping", the bacteria *St. Mutans*, shows a higher capability of attachment to the mucosal membrane, which might lead to inflammation of mucosal tissues or other systemic diseases. Microbial adhesion, followed by an excessive aggregation, further biofilm formation and great risk for excessive local damage in the oral cavity. Additionally, it has been observed, that e-cigarette smoking, similar to tobacco smoking has many disadvantageous effects through the induction of the release of inflammatory-cytokines and oxidative stress causing further damage to the surrounding tissues [36]. In another study Bardellini et al. (2018) observed nine distinct lesions of the oral mucosa, during the research of impact of e-cigarette smoke on the oral mucosa, which were nicotine stomatitis, melanose, hairy tongue, median rhomboid glossitis, lichen planus, hyperplastic candidiasis, leukoplakia (hyperkeratosis and dysplasia) as well as squamous cell carcinoma. The research revealed that 9 OML were detected in 55 participants out of 90 (45 FS and 45 ECC in those 55 participants OML were found in 19 FS (34,6%) and 36 ECC (65,4%). The study found a prevalence of hairy tongue, angular cheilitis and nicotinic stomatitis in ECC [37]

Authors	Parameters evaluated	Type (follow-up)	Inclusion criteria	Sample	Main results (mean levels)
Bardellini et al., 2017[25]	OML	Case-control prospective (2 years)	>18 years Dental treatments>6 months No chronic alcoholism No occupational exposure to carcinogens No history of malignancy	ECC (n=45) FS (n=45)	OMLs were detected in 55 cases FS: 34.6% (n=19/55) ECC: 65.4% (n=36/55) 9 different OMLs detected ECC: > Prevalence of nicotinic stomatitis, hairy tongue, and angular cheilitis.

TABLE 3. Effects of electronic cigarette in the oral cavity [37]

A systematic review including the research paper mentioned earlier, suggests due to results of the analysis of several studies regarding the effect of electronic cigarettes on oral cavity, that e-cigarettes are less harmful than their conventional competitor tobacco in cigarette form, nevertheless do e-cigarette users, have a higher chance of upcoming alterations compared to ex and non-smokers in the biological oral tissues. Also, important to mention is, that in the systematic review conducted, only participants that had one smoking type were included [38]. Another study conducted that focused on the assessment of e-cigarettes possible potential role in preventing cancer, where non-smokers, cigarette smokers and e-cigarette smokers were included, found out by micronucleus test through cytologic examination with an oral mucosa scrape, that e-cigarette smokers had a decrease in micronuclei extent, which was already worth noting. Through the study, it was concluded, that e-cigarette consumption, might be a good alternative in smoking cessation, as a supportive step for current smokers, to quit and therefore to eventually exfiltrate the elevated risk of developing oral cancer to bridge some time until complete smoking cessation takes place [39]. Another study carried out in 2020, about the local and systemic toxicity caused by inhalation of e-liquids, which contain ingredients of the flavour group representatives, only had minimal toxic effects in the study. The study found, that if there is an impact on the local membranes, it must be due to the nicotine effect, included in most e-liquids,

meaning that the dosage of included nicotine in e-liquids, also carries a big responsibility in regards to the toxic local impact [40].

8.2 General effects of e-cigarette smoke

E-cigarette consumption possesses several dangers, comparable to tobacco in normal cigarettes, but needs more thorough long term-studies to be carried out in that matter to be finalized. Generally speaking, have some acute impacts been noted in the pulmonary, immune and cardiovascular system, also do e-cigarettes hold the risk of dependence, nicotine exposure as well as an uptake of normal combustion cigarette devices later on. Additionally do e-cigarettes carry favourable chemical constituents, whose general impact is still not researched very well. Unfortunately do the newer versions of e-cigarettes deliver nicotine and toxicants in higher dosages, making the consumption even more dangerous. A study regarding the cardiac cytotoxicity of vapor e-cigarette smoke and cigarette smoke found, that the e-cigarette power voltage is a very important factor in cardiac cytotoxicity when comparing 3.7 and 4.5V power units, it was found, that the 4.5V power unit of the e-cigarette caused more cell death. [41] The chances for cardiopulmonary changes in chronic use of e-cigarettes is at higher risk according to a review published in 2020, taking a statement to the physiological changes in the cardiovascular as well as the pulmonary system caused by vaping. When considering the cardiac physiology, e-cigarette aerosols increased the blood pressure and the heart rate, similar to normal cigarettes upon acute exposure. Chronic exposure was imitated by animal models, where the researchers observed increased angiogenesis, arterial stiffness, vascular endothelial changes, increased atherosclerotic plaque accumulation and cardiorenal fibrosis. The impact on the physiology of the pulmonary system due to inhalation of e-cigarette smoke was also notable, causing airway obstruction, increased airway reactivity, higher risk for inflammation and for emphysema. Thus far research shows, that several physiological changes are caused by the consumption of e-cigarettes, much contrary to the believed health benefits in comparison to normal cigarettes. Those assumptions of the "healthier" option of e-cigarettes are unfortunately spread by marketing firms to enhance business and are not based on evidence, as explained earlier. Despite the already found changes, it is inevitable, that further long-term studies have to be carried out to define the impact of e-cigarette aerosol more thoroughly [42].
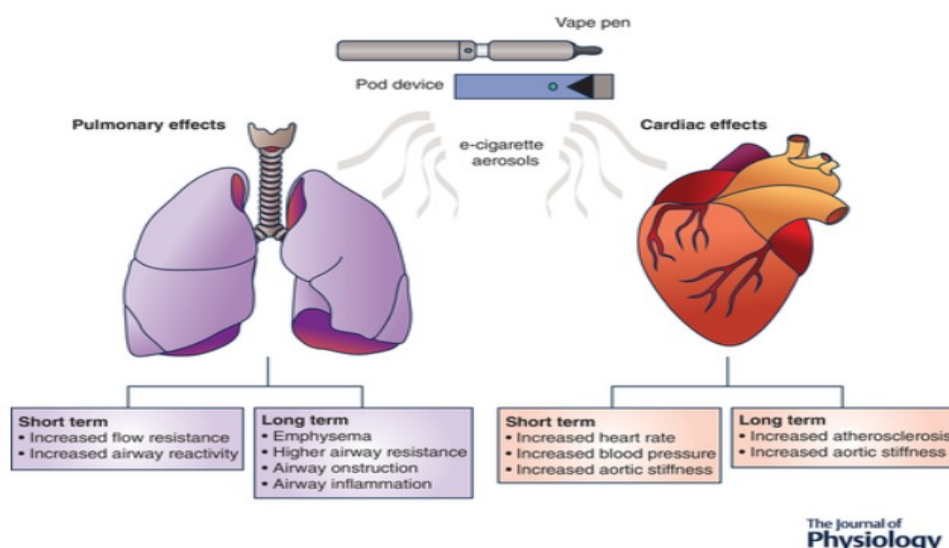
Picture 2. Cardiopulmonary changes due e-cigarette aerosol inhalation [42]

A systematic literature review published in 2020, including 58 respiratory cases in 41 research papers, observed that the most common diagnosis due to e-cigarette consumption was EVALI (n=15) or EVALI with an additional finding (n=1), strongly followed by the second most diagnosed diseases (n=12), which was (BOOP), followed by lipoid pneumonia (n=9). Vaping also triggered pneumothorax in 4 cases (n=4) and caused the exacerbation of pre-existing asthma in 2 cases (n=2). Eosinophilic pneumonia was diagnosed in 4 cases (n=4), 3 cases were found of organizing and lipid pneumonia (n=3) and also 3 (n=3) in hypersensitivity pneumonitis. Other diagnosis, each with 1 finding in the review (n=1), were DAH, epiglottis, ARDS, a combination of ARDS, organizing pneumonia and diffuse alveolar damage (DAD), as well as possible EVALI due to asthma [43]. E-cigarette or vaping product use-associated lung injury (EVOLI), is a newly coming up diagnosis, due to e-cigarette consumption. EVALI´s symptomatic signs include coughing, shortness of breath, chest pain, haemoptysis, nausea, vomiting, with sometimes fever and malaise. Respiratory failure can be monitored in up to one third of diagnosed and requires intubation as well as mechanical ventilation. Important to mention is, that up to 86% of EVALI cases are associated with THC products in combination of a vaping device [44]. With that said, is it more than important to do more research on the topic of dangers of e-cigarette devices and the upcoming dangers coming with it.

## 9. The impact of tobacco smoke on the human immune system

It has been backed by long-term studies that the immune and inflammatory responses caused by chronic tobacco exposure alter, therefore causing changes in the immune responses.

However, is the impact of tobacco on the immune system two sided, on one hand it is immunosuppressive and on the other hand pro-inflammatory. The inhaled smoke promotes production of pro-inflammatory cytokines, such as TNF- α, IL-1,6 and 8 as well as it promotes an increased accumulation of immune cell gathering in the lungs. E-cigarette consumption possesses several dangers, comparable to tobacco in normal cigarettes, but needs more thorough long term-studies to be carried out in that matter to be finalized [41].

Additionally do e-cigarettes carry favourable chemical constituents, whose general impact is still not researched very well. Unfortunately do the newer versions of e-cigarettes deliver nicotine and toxicants in higher dosages, Making the consumption even more dangerous [41]. The chances for cardiopulmonary changes in chronic use of e-cigarettes is at higher risk according to a review published in 2020, taking a statement to the physiological changes in the cardiovascular as well as the pulmonary system caused by vaping. When considering the cardiac physiology, e-cigarette aerosols increased the blood pressure and the heart rate, similar to normal cigarettes upon acute exposure [42].The impact on the physiology of the pulmonary system due to inhalation of e- cigarette smoke was also notable, causing airway obstruction, increased airway reactivity, higher risk for inflammation and for emphysema. Thus far research shows, that several physiological changes are caused by the consumption of e-cigarettes, much contrary to the believed health benefits in comparison to normal cigarettes [42].

Contrary does tobacco have inhibitory effects, due to nicotine, decreasing IL-6,8 and 10 production. One possible immunosuppressive pathway which is nicotine induced is linked to the nACHRs, which have an impact on T-cells, B-cells and macrophages [45].

Other preclinical studies also noted that the immune function is also altering lymphocytes by acting on the nACHRs induced by nicotine [46]. The effects on the adaptive and the innate immunity of the human body on inhaled cigarette smoke have been researched in detail by Qiu F, Liang CL, Liu H, Zeng YQ, et al. (2017) which is shown in the picture below.
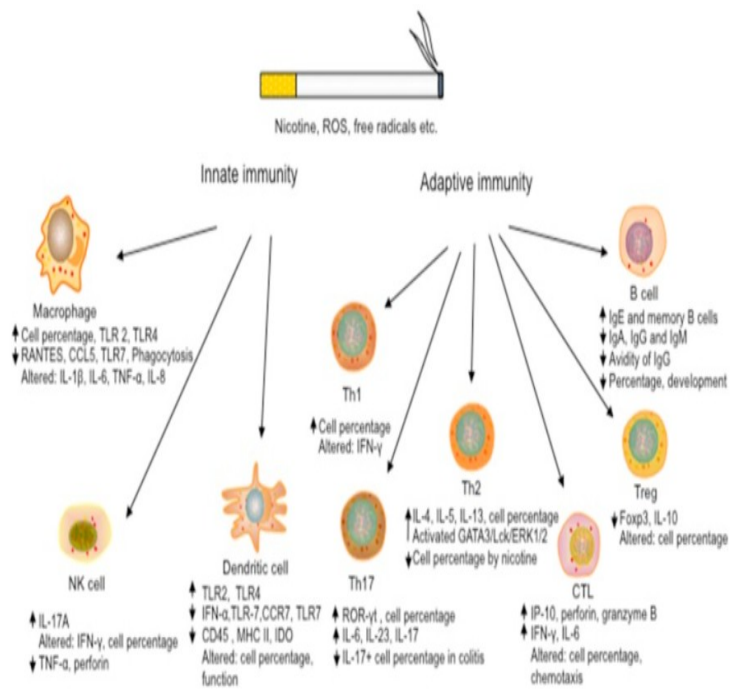
Picture 3. Effects of cigarette smoking on development and function of both innate and adaptive immune cells [47]

In this figure it is visible that the development in both the adaptive and innate immunity is being altered by cigarette smoking. In this context "altered" contradictory refers to the both, up and down regulation as a result of cigarette smoking [47]. A clinical study by Gumus F, Solak I, and Eryilmaz MA (2018) on the effects of smoking on neutrophil/lymphocyte, platelet/ /lymphocyte ratios, found that in the peripheral blood, the count of leukocytes, eosinophils as well as the platelet count were increased due to acute smoke exposure. Various other studies mentioned in the clinical study have also shown impairment of thrombocyte activity, leukocyte percentage, as well as decreased white cell count. The results of the study where smokers and non-smokers were compared came out to be, that smokers had an increase in NLR, which is a marker for systemic inflammation, as well as an increase in MPV/ platelet ratio and a decrease in PLR [48].

10. The management of smoking patients in periodontology

10.1 The impact of smoking on therapeutic success

An analysis published in 2020 in the Journal of clinical medicine, which was carried out under the goal to research the impact of smoking with a duration of 10 years, for implant loss in smoking and

non -smoking patients found, that there is a significant difference in implant loss between the two tested groups. It was found that in smoking patients the incidence of implant loss was 5.64 times higher than in non-smokers. In this correlation it is important to mention that in non-smokers the risk of implant loss in the mandible was 2.92 times bigger than implant loss in the maxilla The research also found that the smoking group lost significantly more bone, but only in the maxilla. When considering the chance of developing peri-implantitis the smoking group was at a 2.6 times higher risk in the maxilla and the mandible compared to the non-smoking patients [49]. Another research paper which investigated the periodontal stability during supportive periodontal therapy in 993 patients, found that smoking indeed has a negative effect on the severity, progression as well as the prevalence of periodontitis. Seen in the attached table below, considering the success of the treatment as defined by PPD ≤5 mm and BOP <10% in addition to PPD ≤5 mm.

	At evaluation of APT (T0)		At evaluation of SPT (T1)	
	Success for PPD (%)	Success for PPD with BOP <10% (%)	Success for PPD (%)	Success for PPD with BOP <10% (%)
Total population ($n = 993$)	36	16	33	10
Male ($n = 444$)	32	13	29	9
Female ($n = 549$)	39	18	36	11
Non-smoker ($n = 760$)	39	17	37	11
Smoker ($n = 233$)	27	12	20	5
Age at intake ≤50 ($n = 502$)	37	15	34	10
Age at intake >50 ($n = 491$)	35	16	32	10
SPT 1–5 years ($n = 500$)	34	17	30	9
SPT 6–10 years ($n = 287$)	41	16	37	10
SPT 11–15 years ($n = 182$)	32	12	32	10

Table 4. Success of treatment defined in PPD and BOP [50]

Work published earlier by the same periodontal clinic also claimed and proved, that the number of pockets exceeding PPD of 5 mm and TL is higher in smoking patients in general during APT and SPT. Finally it is very important to mention, that the maintenance of the achieved success during SPT, was better in non-smokers than in smokers, which was to be expected according to the data analysed [50]. A bigger review/meta-analyses, where several factors were considered such as PD following non-surgical periodontal treatment and CAL gain showed that PD had less reduction after non-surgical treatment, as well as a reduced CAL gain in smokers in comparison to non-smokers. The differences found were statistically significant. From a clinical point of view, it might be that the mean difference in the tested groups appears quite modest, with an intermediate of 0.33 mm difference of PD and a 0.20 mm CAL gain in the groups, making the impact of smoking on non-surgical treatment quite insignificant. Nevertheless, it has to be considered, when looking at the carried out research, that during the probing, there was no differentiation between localized or generalized periodontitis, therefore all sites were measured, which has an impact on the perceiving

of the results [51].

10.2 The impact of cessation of smoking when periodontal disease is present

When considering the impact of smoking cessation during periodontal treatment, some studies reported that former smokers are an intermediate of non-smokers and active smokers.
In this context it is also mandatory to mention, that even short-term former smokers have an improved response to treatment and disease progression, quite similar to non-smokers, which means, that positive effects of smoking cessation can be monitored after a short duration of time. The comparison of periodontitis in former or current smokers, showed a lower chance of periodontitis to emerge in the ones, which quit tobacco consume [52].
Clinical attachment level loss has been found to be greatest in current smokers and showed a proportional decrease according to years of abstinence in tobacco consumption in former smokers According to a long-term study of active, former and non-smokers, the rate of disease development as measured by PD, CAL, or alveolar bone level is almost identical in former smokers and non-smokers. Both groups mentioned before are also much lower in the mentioned disease development parameters than active smokers [52], Additional findings were published when a rodent model of cigarette smoking was observed in two similar studies, which were both supported by human studies, clearly showing the benefits of smoking cessation during periodontal treatment and its significant outcomes. The two rodent studies have reported, that smoking cessation increases the alveolar bone density around non-ligated teeth as well as decreased bone loss and improved bone density in ligature-induced periodontitis. Additionally, to the mentioned information above, a 12-month prospective longitudinal study showed that smoking cessation is very favourable in APT, having a big impact on probing depth reduction in patients after non-surgical therapy.
The existing evidence on the topic of the beneficial impact of smoking cessation, shows quite well implementation of smoking cessation therapies in periodontitis patients could increase the successful treatment of periodontitis [53].

10.3 The impact of temporary smoking abstinence

A study published in 2020, revealed that there is a dose response pattern, according to tobacco consume in regard to TLP[54]. Finding that heavy smokers in comparison to light smokers had more TLP. Most importantly did they find out, that it takes about 15 years of smoking cessation in

former smokers, to reach the risk of TLP of a never smoker. In the study, light smokers were considered patients not exceeding 10 cigarettes per day and heavy smokers were exceeding 10 cigarettes per day. Meaning that the study shows, that similar TLP results are only achieved after about 15 years, implicating that there are only minor effects in temporary smoke cessation in this matter. Additionally, another study assessing the impact of smoking cessation on the incidence as well as the progression of periodontitis researched in a meta-analysis, in 3 groups the risk ratio for the earlier mentioned fields of interest. They found that the RR in the first group of quitters vs never-smokers had a RR of 0.97(CI = 0.87-1.08), the next group were continuing smokers were compared to quitters had an RR of 1.79(CI =1.36-2.35), the last group of continuing smokers to never smokers had an RR of 1.82(CI =1.43-2.31). It is important to mention that an RR of 1 is an indication of no difference in compared groups. RR greater than 1 is an indicator for a higher risk, on contrary a RR below 1 is an indication of a lower risk group. Defined as risk groups in the comparisons, were in the first group the quitters, in the second group as well as in the thirds group the continuing-smokers. The CI, were measured according to the found data during the study [55].

10.4 Clinical treatment approach of smoking patients in periodontology

In the dental working field, not only general practitioners or periodontologist will encounter Smoking patients, but those two have the possibility to encounter them on a more "regular" basis, with recall appointments or half yearly visits. This gives them the best opportunity for frequent and repeated interaction with the general smoking patient, giving a better chance of disease management. A very special burden, that those practitioners carry is the unique chance to motivate the patients repeatedly about occurring subsequential damage due to the habit of cigarette smoking. Therefore, the cessation program should be started by the practitioner, when periodontal disease is present in combination with a smoking patient. The duty of the dentist or periodontologist in this case is, to properly, repeatedly educate the patient about the impact of tobacco consumption, as well as to demonstrate the disadvantageous effects on the destructive behaviour, on the patient's own dental condition, by showing changes during treatment, and by explaining possible outcomes and diagnosis for the medical situation [56]. Here it is important to state, that smoking cessation will have positive effects on the treatment. Instructions, feedback as well as reinforced behavioural management for the tobacco cessation must be performed. Possible steps to follow are as followed; Try to keep patients from initiating tobacco consumption e.g. by substitutes for oral fixation such as gum. Another way practitioners can help is to initiate a tobacco cessation program in the clinical setting. A different way is to address the damage caused to the periodontal support and to explain

that cessation has an advantageous impact in the outcome of the treatment.

It has been found in another study, that smoking-cessation counselling is more preferably received by a health professional, compared to support groups, telephone counselling or other option[56]. Treatment success is most likely to occur when a combination of counselling and pharmacological approaches are used in combination, such as the integration of nicotine-replacement therapy, induced by the health professional [57]. As a start the five A´s are a good way to start the journey of tobacco cessation. The five A´s include ask, advice, asses, assist and arrange.

In the asking stage, patients are asked about their former and current tobacco consume, which is than documented in their patient's card. Possible conversational phrases could be: "Do you ever smoke or use any other type of tobacco, including smokeless tobacco and cigars?" & "I take the time to ask all of our patients about tobacco use, because it is important." The asking stage is followed by the advising stage, where the dentist has to be very clear, though non-judgmental and has to give strong advice for quitting, the following phrase would be adequate: "There have been some tissue changes in your mouth and gums since your last visit. Tobacco use is affecting your health.", here it is important to connect the findings to a suggestion, such as:" The best thing that I can do for your current and future health is to advise you to stop smoking." The next stage is the assessment stage, in this stage the practitioner finds out if the patient is willing to quit or not [57]. Phrases like this could be used:" Would you like to try to quit tobacco in the next month (or year)? If so, we can help." In a positive feedback, for smoking cessation a treatment plan is being made, together with the patient. In a negative feedback regarding the smoking cessation, the motivation has to be enhanced by the practitioner. The next stage is the assisting stage, where a quitting date is set within 2 weeks, past attempts have to be reviewed. Patient will be motivated to avoid other tobacco users as best as possible, family members and friends should be contacted by the patient to be aware of the change and to be supportive, tobacco has also to be removed from the house, car, and workplace. In this stage pharmacotherapy can be prescribed with a compliant patient.

For incompliant patients the practitioner should provide a brief intervention and have a motivational interview repeatedly. The last stage is the arrangement stage, where incompliant patients can sensibly be remined of the needed treatment:" If it is okay with you, I'd like to check in with you at your next appointment to see where you are in your decision making." The compliant patients can be assisted in referring to tobacco counsellors, or tobacco-cessation programs, nevertheless follow-ups have to be scheduled to ensure the cessation success and the progress made, easy sentences like:" If it's okay with you, I'd like to schedule a follow-up appointment or phone call to discuss your progress", can help make the patient feel comfortable and assured of the cessation plan [57]. The combination of the cessation treatment with pharmacologic medication is usually used with Personalized cessation counselling. Medication availability is prescription duty is differently

managed from country to country. Most and foremost are nicotine replacement therapies the most common first treatment modality, they are available in chewing gum, nasal spray, transdermal patch, inhaler and many other forms. It is also possible to prescribe drugs, which have a nicotine agonist like activity, such as Varenicline. Sometimes more than one replacement therapy is used, and can be combined in specific cases, with Bupropin SR(Zyban), a sustained released antidepressant. In usage of the antidepressant Bupropin, potential psychological effects have to be considered beforehand prescription [56]. For incompliant or uninterested in quitting smoking patients, the health professional has the chance to introduce the five R´s, which are relevance, risks, rewards, roadblocks and repetition. Whereas relevance has to be identified in a personalized manner, the many risks, such as impotency, cancer, infertility and many more have to be explained properly, rewards such as improved health, physical performance and saved money have to be pointed out. Roadblocks can be argued with the patient through proper counselling, to bypass problems like weight-gain, depression. Lack of motivation. And least repetition, the practitioner should be persuasive in the repeating appointments. Nevertheless, is it important to keep in mind, that every patient will need a personalized treatment approach, and that there is no common treatment for everyone, therefore sensibility of the practitioner is mandatory [58].

The general treatment approach in smokers is the same as in non-smokers, but with the twist of trying to encourage the patient to quit smoking. The APT is started with non-surgical approaches and is repeated, after 6 weeks if no or only small differences are visible. In the case of repeatedly failed non-surgical treatment surgical treatment in the form of a wide variety of treatment modalities are performed, such as open flap debridement, if deep pockets are involved, other treatments such periodontal plastic surgery, for the treatment of gingival recession or regeneration surgery for bone defects can be integrated into the treatment plan. Implant treatment can also be considered in this stage. For the surgical treatment approach, the patients gingival tissues must be free of inflammation. Once a stable state of the disease is achieved, supportive periodontal treatment can be carried out, aiming at the maintenance of the periodontal status [59].

11. Treatment of the smoking addiction

The treatment approach of the general smoking addiction and its cessation varies from person to person individually. When as a health professional the encouragement for cessation due to different reasons is obligatory, the previously mentioned approach of the five A´s should be applied.

A vast number of health care providers complain about not enough time for an adequate consultation about the need of a smoking cessation, in this case a substitute intervention in a brief

manner can be implemented. Consisting of three major points; ask, advise and help, in this scenario the patient is quickly asked about his smoking behaviour, and the current status, the advisory stage is a general approach of transmitting general information about cessation methods, showcasing which are the most effective and advise specific treatment approaches due to patient knowledge of the practitioner. The last stage is the helping stage, where the practitioner offers referrals to professionals in the field of smoking cessation, with the chance of introducing behavioural interventions. As said before, is a combined treatment approach more effective, therefore pharmacotherapy is also advised, with many effective therapy modalities on the market.

Nicotine replacement therapy used in combination of behavioural treatment or combination treatment with varenicline are the most effective forms of therapy [60].

Almost exclusively are psychotherapeutic therapy in combination with pharmacological support advised for successful smoking cessation.

Included in this treatment modality, should be behavioural counselling or personal advice conversations, for instance, possible options are as well group therapy sittings, individual therapy sittings or phone counselling, which is not available in all countries. This approach should be used in the one hand, on the other hand supportive pharmacotherapeutic treatment should be started, with drugs such as Bupropin. Other possibilities as also mentioned earlier, could be chewing gum, nicotine patches, oral sprays, or varenicline. Additionally, there are several different treatment approaches, which have no clinically proven effectiveness yet, but are still available on the market, such as acupuncture, hypnosis services or app based counselling [61]. Hypnotherapy is widely mentioned in the research of smoking cessation, therefore a more detailed investigation on this treatment modality was needed for the review. The hypnotherapeutic treatment is supposed to weaken the desire to consume tobacco and to smoke by acting on underlying, subconscious impulses. It is said to either strengthen the will to stop or weaken the desire to consume. A systemic review was carried out by Joanne Barnes, Hayden McRobbie et al. (2019) giving more insight in the effectivity of this specific treatment option. The carried out review came to the conclusion, that there was no clear evidence of hypnotherapy having a better or equal outcome to other approaches for smoking cessation. If at all a benefit is noticeable, it is small at most, clarified by current evidence. An assumption was made, that the benefit of hypnotherapy might lay in the continuous counselling with a therapist, but to make a precise statement about its efficacy, more and specifically, stricter researches on this treatment approach have to be done [62]. Another possibility for treatment of the smoking addiction is an incentives and rewards approach. This theory suggests, that the possible positive outcomes of smoking cessation might be triggered due to the process of behavioural operant conditioning by rewarding them for reaching specific "check-points". and therefore leading to the desired behaviour of smoking cessation. Incentives are being handed out

for. Participation in the program, program compliance, days of absolved cessation etc.

In a systemic review carried out by Caitlin Notley, Sarah Gentry et al. (2019), different researches were included, reaching from cash payment bonuses, exchangeable vouchers, bonuses in salary to promotional articles. The results of the review came out to be, that incentive therapy, has a high certainty of long-term cessation boosting (six months and more), in a mixed population study. Nevertheless, is the outcome towards the end of the therapy not always ensured, due to the learning theory based explanation, that the effect of the incentive therapy is only given, when rewards are received by the participants, therefore there is a legitimate concern, that this type of treatment is only time-limited [63].

12.   Conclusion

Smoking is somehow known to be dangerous and harmful to the human body by most of the worlds population. Nevertheless, are a tremendous amount of people consuming tobacco products, which some individual countries and states try to regulate by adding high prices to tobacco goods or to put warning signs on packages. The tobacco industry though always finds new ways to reinvent itself and to successfully advertise new tobacco products, to stay relevant, also in the younger upcoming generations, such as with the new trend of e-cigarettes. In the carried out literature review, it was shown, that tobacco consumption in any form, has very harmful effects on our bodies, including the periodontium specifically. It was shown, that through nicotine, several cells needed to maintain a non diseased status were strongly impacted, causing together with many other synchronous processes, such as inhibited blood circulation due to vasoconstriction, or changes in the microbiome in the oral cavity, that already diseased patients, diagnosed with periodontitis, have a strongly disadvantageous addiction to achieve complete recovery of their disease.

We also looked at the impacts of smoking on periodontal treatment (active, supportive), compared it to non, or former smokers, and found a clear tendency. The periodontal status of smokers in comparison to non-smokers during periodontal treatment, is not promising compared to non-smokers. Tooth loss, attachment, periodontal probing depth results, during periodontal treatment were significantly worse in smokers throughout all reviewed research papers in this study. Smoking tobacco and therefore intaking nicotine also has crucial effects on the body's immune system, leading to several fatal diseases. Unfortunately, the common knowledge about the impact of nicotine on the human body and specifically the oral cavity not very recessed and widespread. More education in this field, specifically in high schools about the impact of

smoking and nicotine have to be introduced, to safe later generations from the worst and longest pandemic the world has witnessed.

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14. Smoking habits of dental students at Vilnius university

15. Abstract

The intention of the carried out research in regards to smoking behaviours in dental students at Vilnius university, was to evaluate certain habits, experiences as well as behaviours of mentioned students. The importance of this research is given due to the high responsibility as future dentists for being role-models for patients and other members of society. The hypothesis of "dental students at Vilnius university are not aware of health dangers smoking possesses", was investigated through an adapted questionnaire, which aims for mentioned topics earlier. In comparison to students from dental studies in other countries, Vilnius university students had the worst results in regards of consumption of smoking as well as tobacco consumption in general.

Keywords: Dental-students, smoking habits, questionnaire

16. Introduction

The upcoming generations are going to face new challenges in the handling of tobacco consumption, due to the always adapting tobacco industry. Dentists, due to their profession, have a high duty in the prevention and or management of results of tobacco consumption and addiction. As new dentists are raised up in the next generations, it is important to educate them excellent in this field and make them aware of the dangers smoking can cause to themselves and their patients, whom they are responsible for. The general objective of this research was to evaluate the personal relationship to smoking, the relationship of family members and friends, as well as general information that correlates with tobacco consumption. The hypothesis of "Dental students of Vilnius

university are not aware of health dangers smoking possess" is to be investigated.

Significance and novelty of the research

The significance and novelty of the research is given, due to the lack of knowledge of smoking behaviours of Vilnius university dental students, including internationals, as well as the importance to evaluate the smoking habits of future dentist being educated at Vilnius university, Lithuania.

Rationale for the literature review

The literature review about the impact of smoking on periodontal disease intends to give a compacted overview about the effects of tobacco consumption in general as well as in detail when focused on periodontal disease.

Rationale for the research on smoking habits of dental students at Vilnius university

The research intends to give insight on the smoking behaviours of national and international dental students at Vilnius university, which will be part of the next generation of dentists. The questionnaire was adjusted to the needs of the research. Different fields of interest such as smoking relationship of family members, friends as well as general questions were submitted.

17. Subjects and methods

Dental students from years 1-5 between the ages of 17-30 from the international as well as the national groups from Vilnius university were asked to fill in a 26-question questionnaire, limited to once per person. Out of approximately 200 students 85 students participated (42.5%), from which 41 belonged to the international group and 43 belonged to the national group, 1 participant did not answer the question to which group he belonged.

For the questionnaire Microsoft forms was used with an adjusted questionnaire derived from the Global youth tobacco survey (GYTS) : https://cdn.who.int/media/docs/default-source/ncds/ncd-surveillance/1-gyts-corequestionnairewithoptionalquestions-v1-2-nov2014.pdf?sfvrsn=f763ac85_5

The general objective of the research was: Evaluation of smoking habits of dental students at

Vilnius university.

Statistical methods:

Microsoft forms automatically filling in statistical questionnaire was used, creating graphs and numbers automatically.

Main objectives of the research:

1.Evaluation of smoking experience of dental students at Vilnius university Q: 2,3,4,9,11,13,23

2.Evaluation of external influences and their impact on smoking habits of dental students at Vilnius university Q: 5,8,17,18,20

3.Evaluation of influence of family members on smoking habits of dental students at VU Q: 6,21,26

4.Evaluation of influence of friends on smoking habits of dental students at VU Q: 10,22

5.Evaluation of general smoking habits of dental students at VU Q: 1,7,12,14,15,16,19,24,25

18.   Research

Smoking and dental student

Out of 85 participants 37,5% consider themselves smokers and 62,5% do not considers themselves smokers [Graph 1]. To question 2, 76.5% stated that they had tried cigarettes or other smoking devices asked for in the question, and 23.5% stated they never smoked [Graph 2]. When observing the results of the third question, leaving the "not smoking" answer possibility out, the most prominent group is "a few times a month" 17,65%, followed by "Once a month or less" 14,12%, with a descending amount in the third major answer "6-9 times a day" 10,59%, giving also an insight, that in this group of participants 2,35% smokes more than 20 times a day. [Graph 3]. In the fourth question of the questionnaire, the main answers are "tried it once" 21,18%, "1 to 3 years" 20% and "3 to 10 years" 15,29%, "never smoked" participants were 20%. [Graph 4]. In the next

question external factors influencing tobacco consumption were evaluated. Resulting in "parties" 61.18%, alcohol consumption 54.12% and stressful events 30.59% [Graph 5]. Question six was chosen for evaluation of family relations to smoking. "nobody in my family smokes" 55.29% was the most prominent answer and "yes all of them "was represented by 3.53%. [Graph 6]. In question 7, participants were asked about the feeling they associate with smoking. "indifferent to me" 38.82% and "relief" 36.47%, were the most selected answers. [Graph 7]. 52.49% of participants answered with yes, to the question , if they were more prone to smoking, if the smoke has a taste.[Graph 8]. Question 9 evaluated the source of usage and showed that 56,74% of all participants used e-cigarettes in the last 12 months. [Graph 9] When asked about who introduced the participants to smoking 72.94% answered "friends". [Graph 10]. The next question asked was about the first trying of smoking and showed that 72.94% tries smoking between 14-20 years of age [Graph 11]. Question 12 evaluated the age of participants and the result was, that the majority 81.18% is between the age of 19-24 years old. [Graph 12]. The question, when was the last time you smoked, had a prominent answer "in the past 24 hours" 35.29%. [Graph 13]. When participants were asked if they think they could quit smoking if they wanted to 72.94% answered with yes. [Graph 14]. When asked when the last time was they tried quitting smoking, not evaluating the non-smokers, the prominent answer was "5 or more months ago" 24.71%. [Graph 15]. When asked about if the participants have tried quitting in the past 40% answered "yes" and 60% answered "no". [Graph 16]. In question number 17 participants were asked to describe their physical activity. 55.29% answered they are physically active 2-7 times a week and 21.18% answered they had low activity levels [Graph 17]. Question 18 asked if participants think, that their physical activity decreased due to smoking, the result was that 36.75% answered with no. [Graph 18]. Participants were asked if they live or lived with smokers in the past in question 19, 54,12% answered with "no never", and 16.47% answered with "I do at the moment" [Graph 19]. Question 20 asked if it is bothering the participants, if someone is smoking around them, 42.35% answered "yes" and 27.06% answered with "no" [Graph 20]. When asked about their parents knowledge on smoking habits in question 21, 47.06% answered with "no" and 40% answered with "yes" [Graph 21]. Question 22 asked if the participants consider smoking a social bonding catalyst, 56.47% answered with "yes" and 14.12% answered with "no" [Graph 22]. In question 23, where patients had to evaluate their feelings towards smoking on a scale from 1-10, the most picked number was "8" with 12,94%. [Graph 23]. Question 24 asked about the group, if national or international, 48.23% answered "international" and 50.58% answered "national" [Graph 24] In question 25 participants were asked if they are aware of health risk smoking is causing. 95.29% answered with "yes" [Graph 25] The last question, number 26, asked if the participants parents were active in the medical field, 42.35% answered with "yes" [Graph 26].

GRAPH 1

1. Do you smoke ?

Weitere Details   Einblicke

🔵	yes	32
🟠	no	53

GRAPH 2

2. Have you ever smoked cigarettes or used smoking devices like vapes or e-cigarettes ?

Weitere Details

🔵	Yes	65
🟠	No	20

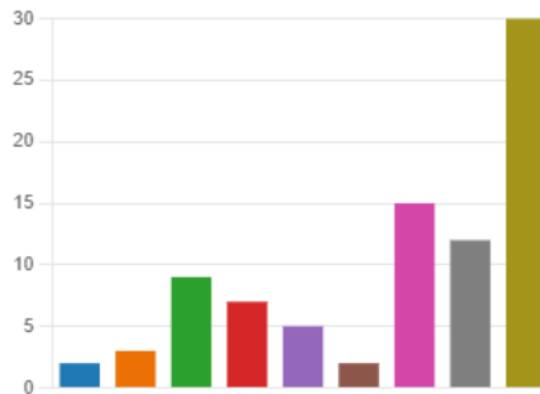## GRAPH 3

3. Regardless of the type of smoking or tobacco product used, which best describes your average use frequency?

🔆 Einblicke

🔵 20 or more times a day	2	
🟠 10-19 times a day	3	
🟢 6-9 times a day	9	
🔴 1-5 times a day	7	
🟣 4-6 times a week	5	
🟤 1-3 times a week	2	
🔴 A few times a month	15	
⚪ Once a month or less	12	
🟡 not smoking	30	

GRAPH 4

4. For how long have you smoked?

🔵 6 months or less	8
🟠 6 to 12 months	9
🟢 1 to 3 years	17
🔴 3 to 10 years	13
🟣 10 years or more	3
🟤 tried it once	18
🔴 never smoked	17
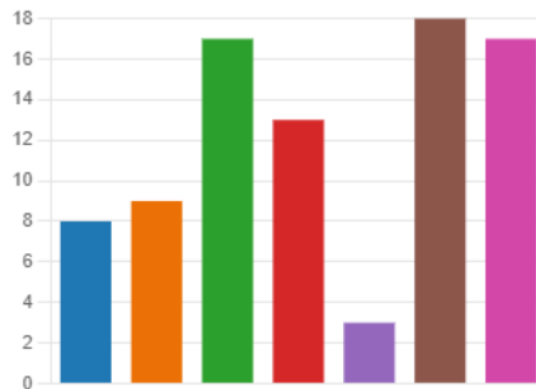
GRAPH 5

5. Do external factors influence your smoking behavior, if so ; which ?

● Alcohol consumption	46	
● smoking breaks at work	13	
● parties	52	
● stressfull events	26	
● hunger	7	
● Sonstiges	9	
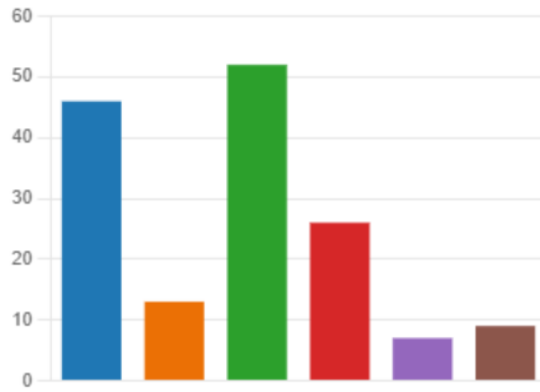
GRAPH 6

6. Do your family members smoke (mother, father,siblings) ? please specify !

● yes all of them	3	
● nobody in my family smokes	47	
● only mother	6	
● only father	15	
● only siblings	12	
● Sonstiges	8	
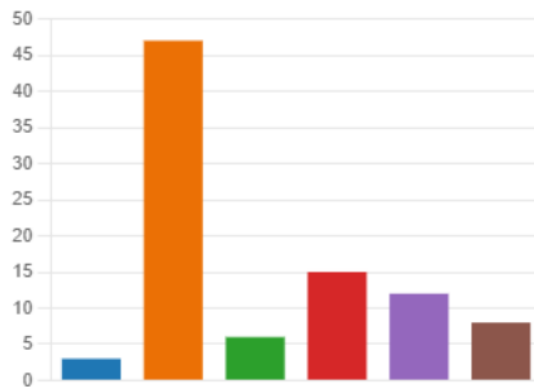
GRAPH 7

7. What kind of feeling do you associate with smoking ?

● happiness	13	
● sadness	4	
● anger	8	
● indifferent to me	33	
● relief	31	

GRAPH 8

42

8. Are you more proned to smoking, if the smoke has a taste of choice ?

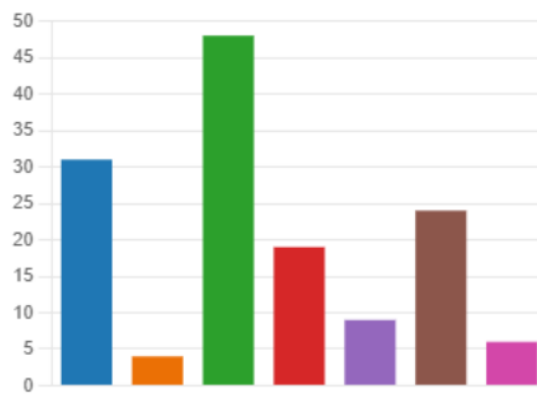Weitere Details   🔆 Einblicke

● Yes   45
● No   34

GRAPH 9

9. In which of the following have you partaken in the past 12 months?

Weitere Details

● Smoking cigarettes   31
● Smoking cigars   4
● Vaping/e-cigarettes   48
● Smoking hooka/shisha/water pi...   19
● smoking joints   9
● none   24
● Sonstiges   6

GRAPH 10

10. Who introduced you to smoking ?

Weitere Details   Einblicke

- Parents — 3
- Friends — 62
- Tv-shows, movies — 3
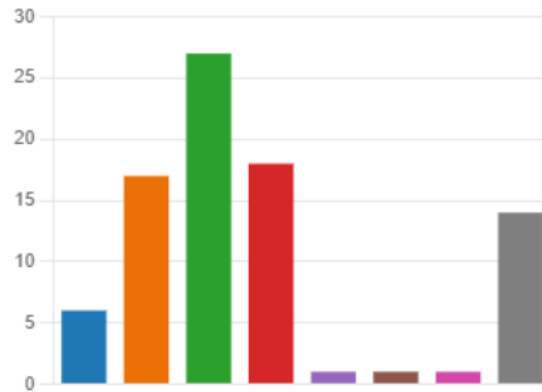- acquaintences — 0
- Sonstiges — 6

GRAPH 11

11. How old were you when you first smoked ?

Weitere Details   Einblicke

- 0-12 — 6
- 12-16 — 17
- 16-18 — 27
- 18-20 — 18
- 20-22 — 1
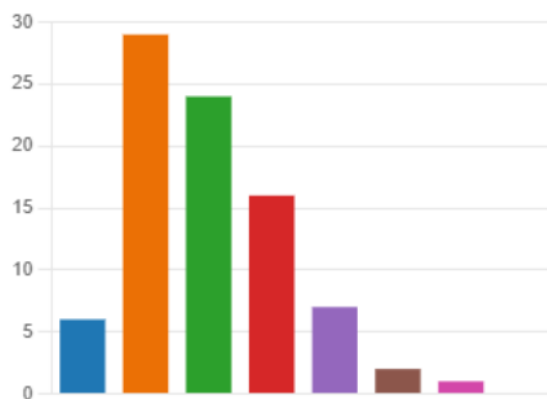- 22-25 — 1
- 25 + — 1
- never smoked — 14

GRAPH 12

12. How old are you now ?

Weitere Details   Einblicke

- 17-18 — 6
- 19-20 — 29
- 21-22 — 24
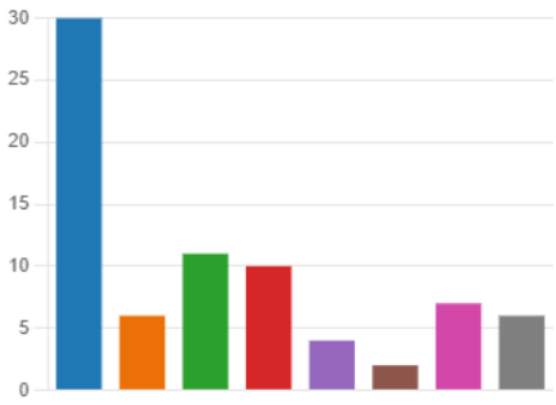- 23-24 — 16
- 25-26 — 7
- 27-28 — 2
- 29-30 — 1
- 30+ — 0

GRAPH 13

13. When was the last time you smoked ?

Weitere Details   Einblicke

🔵 In the past 24 hours	30
🟠 In the past week	6
🟢 In the past month	11
🔴 In the past 3 months	10
🟣 In the past 6 months	4
🟤 In the past year	2
🩷 more than 1 year ago	7
⚫ Sonstiges	6

GRAPH 14

14. Would you say you could stop smoking if you wanted to ?

Weitere Details

🔵 Yes	62
🟠 no	3
🟢 Maybe	9

GRAPH 15

15. How long ago did you last quit smoking?

Weitere Details   Einblicke

🔵 1 month or less	7
🟠 1 to 2 months	8
🟢 2 to 5 months	9
🔴 5 months or more	21
🟣 never smoked	35

GRAPH 16

16. Have you tried quitting smoking in the past ?

- ● Yes   25
- ● No   51

GRAPH 17

17. How would you descibe your physical activity?

- ● low physical activity level   18
- ● approximately once a week   20
- ● 2-3 times a week   19
- ● 4-5 times a week   14
- ● daily   14

GRAPH 18

18. Would you say smoking decreases your physical performance ?

   💡 Einblicke

- ● Yes   21
- ● No   32
- ● Maybe   21

GRAPH 19

19. Do you, or have you lived with smokers ?

- ● I do at the moment   14
- ● I used to   25
- ● No never   46
- ● Sonstiges   0

GRAPH 20

20. Is ot bothering you if someone around you is smoking ?

● Yes	36
● No	23
● I don't care about it	26

GRAPH 21

21. Do your family members know about your smoking habits?

● Yes	34
● No	40

GRAPH 22

22. Would you consider smoking a social bonding catalyst ?

● Yes	48
● No	12
● Maybe	20

GRAPH 23

23. From a scale from 1-10, where a 10 is ecstatic joy , how much do you enjoy smoking ?

Weitere Details   Einblicke

● 1	1
● 2	3
● 3	4
● 4	7
● 5	8
● 6	8
● 7	8
● 8	11
● 9	2
● 10	5
● not smoking	27
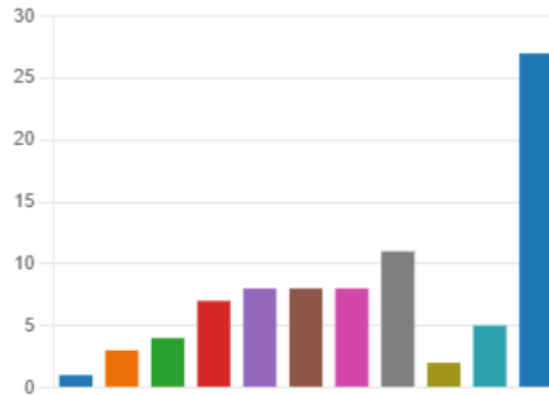
GRAPH 24

24. Are you part of the international or lithuanian study group ?

Weitere Details   Einblicke

● International group	41
● Lithuanian group	43

GRAPH 25

25. Are you aware of the health risks smoking is causing ?

Weitere Details

● yes	81
● no	1
● a view	2

GRAPH 26

26. Are your parents active in the medical field?

Weitere Details   Einblicke

●	Yes	36
●	No	48

19.   Discussion

In the research conducted, it was found that 37,65% of participants of the questionnaire, belong to current smokers, but that 76,5% had already tried some kind of smoking device in the past, such as e-cigarettes or water pipe smoking; in the field of dentistry students at Vilnius university years 1-5, national and international (mostly german students). In comparison to this a study was published by Alhajj MN, Al-Maweri SA, Folayan MO, et al. (2022), which included 5676 dental students from 11countries (Iraq, Kuwait, Lebanon, Malaysia, Nigeria, Turkey, Yemen, Croatia, Jordan, Saudi Arabia and south Africa). In the above mentioned study the percentage of current smokers was 19,6%, which is almost half of the percentage that students at Vilnius university represent. The biggest difference was the percentage of never smokers between participants in the research at Vilnius university and the international study of 23,6% to 80.04%. In the matter of e-cigarette usage, the international study found that 23,6% of participants have tried them before, whereas in the study done at Vilnius university 56.47% have tried or consumed e-cigarettes in the past 12 months [1].This big difference in numbers might be evident due to different cultural believes, socioeconomic status, and educational systems. Another point to be aware of is the geographic location of the countries assessed. Europe, asia, arabia. Another study carried out by Riad A, Põld A, Olak J, Howaldt HP, Klugar M, Krsek M, Attia S. (2022) on Oral Health-Related Knowledge, Attitudes and behaviours in Estonian dental students showed closer related percentages to the international study, than to the study carried out at Vilnius university. The study carried out in Estonia included 124 students of which 79% were female. In this study 11.3% were smoking tobacco at least once a week, whereas in the study that was done at Vilnius university the students consumed tobacco at least once a week up to 20 times a day at 32,94%.[2] Another study by Rodakowska et al (2020), showed the tobacco smoking behaviour of at least once every 30 days and

was found to be 42% in Italian dental students and 28% in polish dental students. [3] this change of time duration might be the reason of the higher numbers. If comparing dental students of Vilnius university to polish and Italian students in the consumption of tobacco in the last 30 days (1month) we get a percentage of 50.58% when adding all the data from question 3 up to a few times a month. Thomas J, Kumar RV, Akhil S. et al (2019), also published a study regarding the prevalence of smoking in dental students. 370 students participated in the study, which was carried out in India. Out of the 370 participants, 17% stated they smoked tobacco in the last 30 days [4]. Another very big study was conducted in China by Song, X. Yang, W. Yang, Y. Dai, K. Duan et al. (2023), in which 9361 students were asked about their smoking behaviours. The results were, that 29,8% were smokers or e-cigarette smokers. From these remaining smoking participants 16,7% were electric cigarette only users. 35% of the smoking participants were cigarette only users and 48,3% were combined users [5], which is in comparison to Vilnius university almost an 8% difference of smokers in general. A study conducted in turkey amongst medical students carried out by G. Cosgun, S. Cilekar, A. Balci, et al.(2023), showed that, out of 392 participating students only 18.9% are active tobacco users, and that 68.1% have never used tobacco products in any kind [6], additionally showing, that tobacco consume at Vilnius university in comparison to other countries is increased. A study including 700 medical students from Brazil, published by R. Martins, A. J. Araujo, F. C. Wehrmeister et al. (2023), came to the conclusion, that only 7.9% of the 700 asked participants were current smokers, whereas 39.1% had experimental contact with tobacco products. Surprisingly were only 2.3% consuming e-cigarettes [7], which shows a very clear difference to dental students in Lithuania, especially in the percentage of current smokers, as well as e-cigarette consumers.

Therefore, I partly agree with the hypothesis, that dental students are not aware of the health dangers of smoking, due to their high consume, but I recommend more divided research in Vilnius universities dental students research, as in questioning the national and international groups separately, since that might change the overall percentage of the research done. Nevertheless should it be mandatory to integrate the teaching of the impact of smoking on the humans health more in detail, due to an increased number of smokers at Vilnius university, when compared to other academic faculties. Awareness should be raised throughout the council of future dentists. To lead in good example, for future generations.

20. Conclusion

1. It was found that participants, that stated to be smokers, start smoking in the years between 13 to 20 years of age. E-cigarette usage came out to be very popular amongst dental students of Vilnius university. 38% of participants state to be smokers and the majority of all students participating has tried some kind of smoking habit, at least once.

2. alcohol consumption, parties and stressful events came out to be triggers for tobacco consumption. Flavoured smoke also has an negative impact on smoking behaviour, increasing the likelihood to participate.

3. In most participants families nobody is smoking, if there are smokers, the prevalence is higher in males (fathers) and siblings. In more than 50% of the cases, do family members do not know about tobacco consume habits of participants. Slightly less than half of the parents of participants are active in the medical field.

4. The majority of participants were introduced to smoking by friends. Smoking came out to be seen as a social bonding catalyst by more than 50% of participants.

5. 62% of participants do not consider themselves as smokers. The mean age of participants was between 19-24 years of age. The majority of participants feel indifferent when smoking.
81% of questioned participants stated to be aware of the health risk dangers smoking can cause.
The questionnaire was answered to almost similar parts national and international students.

Practical recommendations :

Further research in the field of smoking habits in dental students at Vilnius university as well as medical students should be carried out, with a special focus on the difference of behaviours of international and national students, and the question, if studying abroad is a risk factor for increased stress as well as increased tobacco consumption as a result.
Furthermore should more precautions be taken to educate specifically dental students early on in their studies about the impact of smoking on themselves as well as their patients more in depth.

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QUESTIONNAIRE :

Smoking habits in dentistry students

1. Do you smoke ?

   ○ yes

   ○ no

2. Have you ever smoked cigarettes or used smoking devices like vapes or e-cigarettes ?

   ○ Yes

   ○ No

3. Regardless of the type of smoking or tobacco product used, which best describes your average use frequency?

   ○ 20 or more times a day

   ○ 10-19 times a day

   ○ 6-9 times a day

   ○ 1-5 times a day

   ○ 4-6 times a week

   ○ 1-3 times a week

   ○ A few times a month

   ○ Once a month or less

   ○ not smoking

4. For how long have you smoked?

- ◯ 6 months or less
- ◯ 6 to 12 months
- ◯ 1 to 3 years
- ◯ 3 to 10 years
- ◯ 10 years or more
- ◯ tried it once
- ◯ never smoked

5. Do external factors influence your smoking behavior, if so ; which ?

- ☐ Alcohol consumption
- ☐ smoking breaks at work
- ☐ parties
- ☐ stressfull events
- ☐ hunger
- ☐ Sonstiges

6. Do your family members smoke (mother, father,siblings) ? please specify !

- ☐ yes all of them
- ☐ nobody in my family smokes
- ☐ only mother
- ☐ only father
- ☐ only siblings
- ☐ Sonstiges

- ◯ 10 years or more

7. What kind of feeling do you associate with smoking ?

- [ ] happiness

- [ ] sadness

- [ ] anger

- [ ] indifferent to me

- [ ] relief

8. Are you more proned to smoking, if the smoke has a taste of choice ?

- ( ) Yes

- ( ) No

9. In which of the following have you partaken in the past 12 months?

- [ ] Smoking cigarettes

- [ ] Smoking cigars

- [ ] Vaping/e-cigarettes

- [ ] Smoking hooka/shisha/water pipe

- [ ] smoking joints

- [ ] none

- [ ] Sonstiges

10. Who introduced you to smoking ?

  ○ Parents

  ○ Friends

  ○ Tv-shows, movies

  ○ acquaintences

  ○ Sonstiges

11. How old were you when you first smoked ?

  ○ 0-12

  ○ 12-16

  ○ 16-18

  ○ 18-20

  ○ 20-22

  ○ 22-25

  ○ 25 +

  ○ never smoked

12. How old are you now ?

○ 17-18

○ 19-20

○ 21-22

○ 23-24

○ 25-26

○ 27-28

○ 29-30

○ 30+

13. When was the last time you smoked ?

○ In the past 24 hours

○ In the past week

○ In the past month

○ In the past 3 months

○ In the past 6 months

○ In the past year

○ more than 1 year ago

○ Sonstiges

14. Would you say you could stop smoking if you wanted to ?

○ Yes

○ no

○ Maybe

15. How long ago did you last quit smoking?

○ 1 month or less

○ 1 to 2 months

○ 2 to 5 months

○ 5 months or more

○ never smoked

16. Have you tried quitting smoking in the past ?

○ Yes

○ No

17. How would you descibe your physical activity?

○ low physical activity level

○ approximately once a week

○ 2-3 times a week

○ 4-5 times a week

○ daily

18. Would you say smoking decreases your physical performance ?

○ Yes

○ No

○ Maybe

19. Do you, or have you lived with smokers ?

○ I do at the moment

○ I used to

○ No never

○ Sonstiges

20. Is ot bothering you if someone around you is smoking ?

○ Yes

○ No

○ I don't care about it

21. Do your family members know about your smoking habits?

○ Yes

○ No

22. Would you consider smoking a social bonding catalyst ?

○ Yes

○ No

○ Maybe

23. From a scale from 1-10, where a 10 is ecstatic joy , how much do you enjoy smoking ?

○ 1

○ 2

○ 3

○ 4

○ 5

○ 6

○ 7

○ 8

○ 9

○ 10

○ not smoking

24. Are you part of the international or lithuanian study group ?

○ International group

○ Lithuanian group

25. Are you aware of the health risks smoking is causing ?

○ yes

○ no

○ a view

26. Are your parents active in the medical field?

○ Yes

○ No