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CONTENTS

Conservative Dentistry

Digital photometric analysis of mucosal wound surfaces

Kosturkov D., E. Aleksiev..... 7

Pediatric Dental Medicine

Sleep bruxism in children - symptoms, sleep features, risk factors and treatment

(Literature review)

Dimitrova M. M. Georgieva..... 13

Parents' awareness of homeopathic medicines and their influence on oral health

Pomakova A., N. Gateva, Kr. Hristov 19

Imaging and Oral Diagnostics

Latex allergy – myth or reality among professionally involved medical

staff – questionnaire survey

Istatkova, Y, M. Dencheva 26

Orthodontics

Vertical growth pattern changes during combined treatment

with fixed appliance and with functional appliance Trainer

Popova Y..... 35

Mobile photography in dental medicine /intraoral photos/

Mariyanov M..... 40

Dental Public Health

Opportunities for access to dental care

Nenov St., B. Bonev, Kr. Yaneva, Kr. Tsokov 46

Case Report

Emergence profile of porcelain veneers and gingival design in the digital workflow

Iliev G. 55

Defended PhD theses at Faculty of Dental Medicine,

Medical University-Sofia..... 63

Author Guidelines 65

Ethical standards for research and publication..... 68

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СЪДЪРЖАНИЕ

Консервативно зъблечение

Дигитален фотометричен анализ на лигавични раневи повърхности
 Костурков Д., Е. Алексиев 7

Детска дентална медицина

Нощен бруксизъм при деца – симптоми, особености на съня,
 рискови фактори и лечение
 (литературен обзор)
 Димитрова М., М. Георгиева 13

Информираност на родителите относно хомеопатичните лекарства и
 влиянието им върху оралното здраве

Помакова А., Н. Гатева, Кр. Христов 19

Образна и орална диагностика

Латексова алергия – мит или реалност сред професионално обвързаните
 медицински лица -анкетно проучване
 Истаткова, Я., М. Денчева 26

Ортодонтия

Промени във вертикалния тип растеж при приложение
 на комбинация от лечебни апарати: фиксирана техника брекети
 и миофункционален апарат Тренер
 Попова Я. 35

Мобилната фотография в денталната медицина /интраорални снимки/

Мариянов М. 40

Обществено дентално здраве

Възможности за достъп до дентална помощ
 Ненов Ст., Б. Бонев, Кр. Янева, Кр. Цоков..... 46

Клиничен случай

Профил на порцелановите фасети и оформяне на венечния контур в
 дигиталния работен процес.
 Илиев Г. 55

**Защитени дисертации за придобиване на ОНС „доктор“ във Факултет
 по дентална медицина на Медицински университет-София..... 63**

Изисквания към авторите..... 65

Етични норми за изследвания и публикуване 68

Conservative Dentistry

Digital photometric analysis of mucosal wound surfaces

Kosturkov D.¹, E. Aleksiev²

Дигитален фотометричен анализ на лигавични раневи повърхности

Костурков Д.¹, Е. Алексиев²

Summary

There are various methods for assessing mucosal wound surfaces. They require mathematical knowledge and complex calculations. Dental photography, which is entering increasingly in the everyday dental practice, can serve as an aid for accurate photometric analysis in the course of the healing process. The aim of the present study is to develop and test a digital method for determining from a photograph the metric characteristics of mucosal wound surfaces - length, width, perimeter, area. The obtained results show that the proposed methodology is suitable for analysis and evaluation of the metric characteristics of mucosal wounds in the pre- and postoperative period.

Keywords: *mucosal lesions, wounds, dental photography, photometric analysis*

Резюме

Съществуват различни методи за оценка на лигавични раневи повърхности. Те изискват математически познания и сложни изчисления. Денталната фотография, която навлиза все повече в ежедневно дентална практика, може да служи като помощно средство за прецизен фотометричен анализ в хода на лечебния процес. Целта на настоящото изследване е да се разработи и апробира дигитален метод за определяне по фотоснимка на метрични характеристики на лигавични раневи повърхности – дължина, ширина, периметър, площ. Получените резултати показват, че предложената от нас методика е подходяща за анализ и оценка на метричните характеристики на лигавични рани в пре и постоперативния период.

Ключови думи: *лигавични лезии, рани, дентална фотография, фотометричен анализ*

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Introduction

Clinical analysis and evaluation of mucosal wound surfaces in various volumes of surgical interventions is a specialized area of clinical practice, which involves doctors, nurses, therapists and professionals from other fields. The choice of treatment methods and treatment plan, assessment and monitoring of the operative and postoperative period are related to the initial documentation of the lesions and the subsequent monitoring of the development of the surgical wound surfaces. It is realized not only by registering the topographic characteristic, but also by determining the metric colorimetric characteristics, which provides valuable information for the clinician [1].

The wound healing process is associated with a sequence of reparative processes that begin after the injury occurs and end when the wound surface closes and the tissues reorganize. The first event in the cascade of reactions in the healing process is clotting. Then the vascular response, inflammation, later the formation of a scar and in parallel with it - the phase of healing of the epithelium and the phase of contraction.

Tracking these postoperative periods over time provides information about the progress of the healing process. Some of the main criteria by which the wounds described in the literature are evaluated are: location, stage, presence of necrosis, exudate and pain, color, characteristics of the edges and adjacent tissues, volume characteristics (shape, length, width, depth), induration, tunneling, undermining, odor [2].

Measuring the size of the wound and comparing them over time is one of the main ways to track and predict the period for the healing process. There are various methods for measuring wound surfaces, which are described below [3, 4, 5, 6].

Method with the greatest length and width: in this method the greatest length and

the greatest width of the wound are measured by the diameter - from one edge to the other. Due to the irregular shape of the wound, its area can be calculated by a specific complex calculation [4, 5, 6].

Clock method: in this method the face of the clock is used to direct the measurement. The reference position from 12:00 is relative to the head of the body. In this way, measurements are obtained from 12:00 to 6:00 and from 9:00 to 3:00 [4, 5, 6].

Combination method (combining the largest length and width with the clock method): in this method the maximum length and width that is perpendicular to the length are multiplied to obtain the surface area [4, 5, 6].

Photodocumentation: photos can be taken to document wound healing. However, photographs cannot accurately convey the size of the wound unless a ruler is placed on the wound. Most clinicians use photographs as an adjunct to measurement [4, 5, 6].

Wound Tracking: Use a marker or pen to trace the contour of the wound directly on a sterile clear sheet or film. Then it is simple to compare one measurement with another. However, it can be difficult to determine where the wound boundaries are, which makes this method less reliable and accurate [4, 5, 6].

The assessment of metric characteristics is important not only to determine the course of the healing process, but also supports research. At present, the methods for analysis of skin and mucosal wound surfaces are associated with manual measurement by various measuring devices and mathematical calculations. This creates preconditions for subjectivism and errors in the obtained results. It also requires valuable clinical time [7, 8].

The application of digital technologies could eliminate the problem of subjectivism and

errors in calculating the metric characteristics of wound surfaces. This can be done by creating a standardized methodology for digital photometric analysis of skin and mucosal lesions and postoperative wound surfaces. Photographs provide a visual recording that helps the clinician make decisions about operative and postoperative measures and that provides an opportunity to track and evaluate the recovery period. The standardization of the photographed wound surfaces is extremely important. It has been discussed by several organizations that have opinions on this issue - NPUAP, Wound Ostomy, Continence Society, American Professional Wound Care Association [9, 10, 11, 12].

Aim

To develop and test a digital method for determining by photograph the metric characteristics of mucosal wound surfaces - length, width, perimeter, area.

Material and methods

Material:

For the realization of the aim a highly specialized photographic technique is used:

1. DSLR: Nikon D600
2. Lenses: Nikon AF-S VR 105mm f / 2.8G IF-ED Micro lens
3. Flash: Nissin macro ring flash

Photographs of 30 cases of patients with mucosal wound surfaces were used.

Criteria for inclusion in the study:

- Area of localization - mucous membranes of the oral cavity;
- Areas without previous operative intervention;
- Wound defects obtained after removal of pathological mucosal lesions;

Methods:

Specialized photographic equipment and software were used to perform digital photographic analysis for medical purposes. Photographs are taken by following the rules of image isometry. The camera lens should be perpendicular to the captured surface. There is a measuring line in the photo. The line should be in the same plane as the wound. All photos are color-calibrated by specifically adjusting the camera's white balance to the color temperature of the light source being used (5500K when using a ring flash). Wound surfaces were analyzed manually using a line.

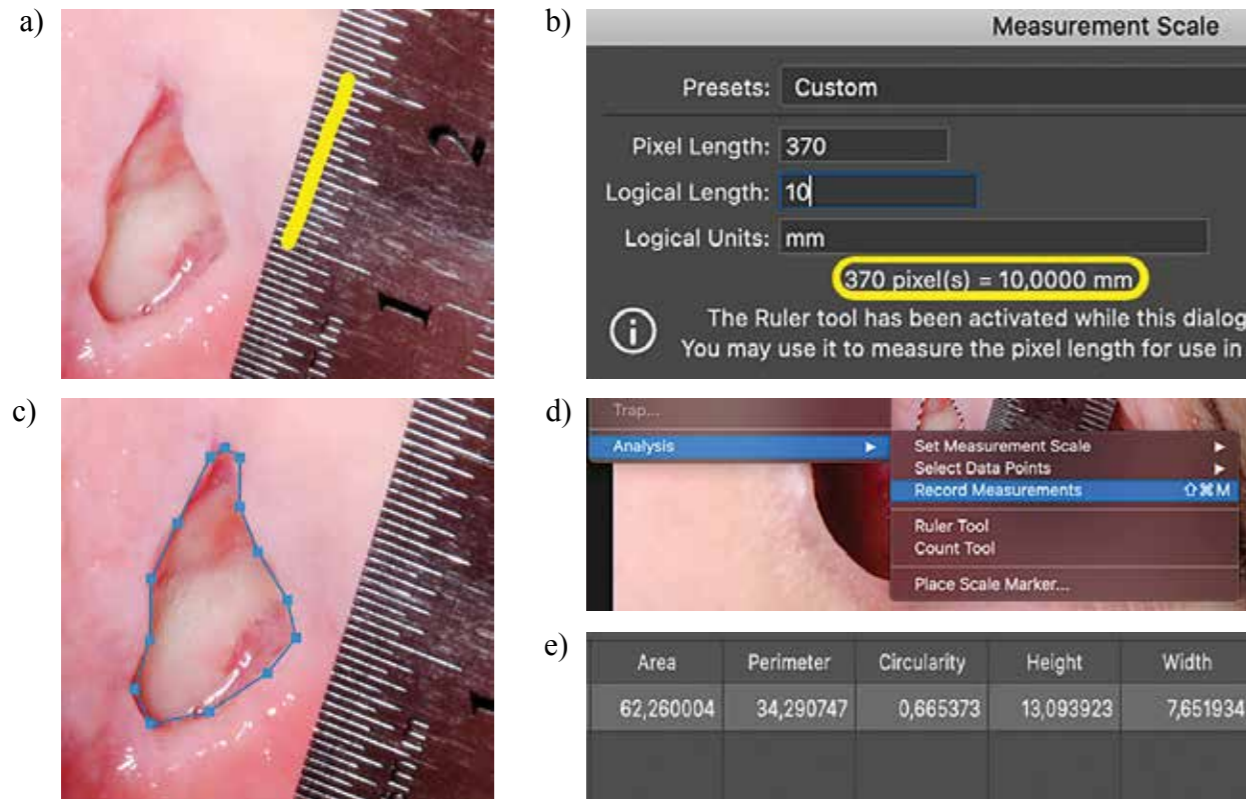
If it is not possible to follow the rule of isometricity through direct photography when photographing the mucosal wounds, then the photos are taken with special photographic mirrors. In this way, by capturing the reflected image on the wound surface, the requirement for image standardization will be met.

Photo documentation is done on the 1st day, 7th day, 21st day and 60th day. A digital photometric analysis of the wound surfaces was performed on the photographs. Manual and digital measurements were compared to verify the accuracy of the new digital methodologies.

Determining the linear characteristics of a photograph:

In the photo is marked one centimeter of the measuring line present in the frame. It is then checked by the software how many pixels are contained in one centimeter (the marked area) (Fig. 1 a). Then an individual measurement scale is set (Fig. 1 b). This is done by recording the number of pixels that correspond to 10 mm. Then the boundaries of the wound surface are marked with the pen tool (Fig. 1 c). The measurements are then recorded using the measuring instruments (Fig. 1 d). Different results are displayed on the screen. Length and width; area and perimeter are recorded (Fig. 1 e). The calculations are obtained automatically and are accurate to 0.01 mm.

Figure № 1. Method for determining the linear characteristics of mucosal wound surfaces: a) determination of the number of pixels in 1 cm; b) setting a measurement scale; c) marking the boundaries of the wound surface; d) recording the measurement; e) results obtained



The same characteristics are measured manually by the classical methods (with a measuring line - measurement of sections and calculations). The results of the two methods are compared - the tested new digital method and the classical method.

The obtained results were statistically processed using IBM Statistics SPSS v.19 software.

Results

From the conducted researches we received the following results, which are presented in two tables below.

Table № 1 shows the measurements for length and width of mucosal wound surfaces in all periods of examination by digital and manual measurement.

Table № 1. Mean values of length and width of mucosal wound surfaces during the different examination periods, measured digitally and manually

Measured value / Way of measurement	Length (cm)				Width (cm)			
	Day 1	Day 7	Day 1	Day 7	Day 1	Day 7	Day 1	Day 7
Digitally (a)	4,52±0,68	3,12 ± 0,23	0,55±0,11	0 ± 0	2,08 ± 0,67	1,45 ± 0,23	0,25 ± 0,12	0 ± 0
Manually (b)	4,5±0,8	3,2 ± 0,3	0,6 ± 0,22	0 ± 0	2 ± 0,9	1,5 ± 0,36	0,3 ± 0,21	0 ± 0
t-test	t _(a,b) =3,76 p _(a,b) =0,15	t _(a,b) =0,05 p _(a,b) =0,98	t _(a,b) =0,12 p _(a,b) =0,95	t _(a,b) =0 p _(a,b) =0	t _(a,b) =1,01 p _(a,b) =0,76	t _(a,b) =1,21 p _(a,b) =0,79	t _(a,b) =1,52 p _(a,b) =0,66	t _(a,b) =0 p _(a,b) =0

It can be seen that there is no statistically significant difference between the results obtained for measuring the length and width of the mucosal wound surface (p> 0.05) during all periods of the examination by both

methods (digital and manual).

The following table № 2 shows the obtained values for perimeter and area of mucosal wound surfaces in all periods of examination by digital and manual measurement.

Table № 2. Mean values of perimeter and area of mucosal wound surfaces during the different periods of examination, measured digitally and manually

Measured value / Way of measurement	Perimeter (cm)				Area (cm ²)			
	Day 1	Day 7	Day 1	Day 7	Day 1	Day 7	Day 1	Day 7
Digitally (a)	13,2± 1,32	9,14±0,49	1,6±0,23	0	9,4±1,36	4,52±0,48	0,37±0,23	0
Manually (b)	13±1,63	9,4 ±0,62	1,8±0,51	0	9±1,82	4,8 ±0,72	0,18±0,41	0
t-test	t _(a,b) =0,13 p _(a,b) =0,93	t _(a,b) =0,99 p _(a,b) =0,87	t _(a,b) =1,55 p _(a,b) =0,69	t _(a,b) =0 p _(a,b) =0	t _(a,b) =1,05 p _(a,b) =0,22	t _(a,b) =1,34 p _(a,b) =0,46	t _(a,b) =1,34 p _(a,b) =0,82	t _(a,b) = p _(a,b) =

The results show that there is no statistical-significant differences between the perimeter and area of the mucosal wound surface (p> 0.05) during all study periods.

Discussion

Determining the metric characteristics of mucosal wound surfaces is realized much more accurately and objectively through digital technologies. At the moment, the photographs serve only to document the cases, which is undoubtedly extremely important. The methodology tested by us allows photographic tracking to be objectified and standardized, which is an important contribution to both clinical and research activities related to the monitoring and analysis of wound surfaces and their healing process. Digital measurements give results with much greater accuracy and lack of subjectivity. Their application is easier and will involve less than valuable clinical time [13,14].

Very often one of the main reasons for the lack of analysis of mucosal wounds is their location and the associated difficult measurement of linear characteristics. In some areas of the oral cavity, it is impossible to place a measuring line within the lesion, and in other cases, when this is possible, measurements are very difficult. All this creates a number of prerequisites for errors and lack of accuracy. In the method developed by us, the measuring line must be placed next to the wound, which is very easy. Then an analysis of all parameters is made on a

photograph, which in turn excludes the subjective factor and the possibility of incorrect measurement. The imaging of wounds in the most difficult to access areas takes place through a photographic mirror, which in practice facilitates access and visibility to the area. For this reason, in some cases, the photographic method for assessing mucosal wounds and lesions is the only option for monitoring and analysis of the postoperative process.

According to a number of authors, documentation is an extremely important component of wound assessment and must be performed very precisely, thoroughly, accurately and neatly, in accordance with certain reproducibility requirements. Consistency and accuracy in measuring wound surfaces is important for determining changes over time and for comparing the effectiveness of different treatment methods and tools. Uniformity of all measurements is possible when a single photometric analysis protocol is developed that is uniformly reproducible each time [15]. The method we developed offers exactly that.

According to some authors, clinicians need to undergo appropriate training to be able to follow protocols for assessing and analyzing lesions and wounds pre- and postoperatively. This process applies to both classical and photographic evaluation methods. Also, some authors report that using the wrong photography technique can lead to wrong results. For this reason, they have proposed a number of rules to

be followed in order to achieve maximum measurement accuracy [10, 11, 12].

We have fully complied with these rules and have even developed some additional measures to ensure the accuracy of the research (taking a mirror image in hard-to-reach areas). This guarantees the reliability and accuracy of our research.

Through our research, we confirm the benefits established by some authors related to the use of digital photography and specialized software in the evaluation of pre- and postoperative surgical interventions. According to these teams, standardized photographic protocol could use software to very accurately determine the length and width of wounds [16, 17]. They do not offer a solution to this problem. In this regard, we have developed and tested the methodology for photometric and software analysis and tracking of wounds over time.

Proper assessment of wound parameters provides clinicians with the information they need to make decisions related to specific strategies for appropriate interventions, management, and care. Technology will continue to help clinicians with documentation. Unless standardized techniques and protocols are followed, wound imaging may interfere rather than aid in treatment decisions. Digital methods are undoubtedly the future. This progress, combined with the use of photomedicine, ensures that the future of wound assessment and documentation is promising.

Conclusion

The new digital method developed by us for photometric analysis of mucosal wounds is precise with accuracy of 0,01 mm and often is the only option. It can be used to monitor the healing process of mucosal wounds and to predict the outcome of treatment. In addition, the digital method allows new scientific developments in the field, thanks to high precision and easy application.

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Sleep bruxism in children - symptoms, sleep features, risk factors and treatment (Literature review)

Dimitrova M.¹, M. Georgieva²

Нощен бруксизъм при деца – симптоми, особености на съня, рискови фактори и лечение (литературен обзор)

Димитрова М.¹, М. Георгиева²

Summary

Bruxism in children is a common condition that can lead to tooth wear, orofacial symptoms, headache, temporomandibular dysfunction and more. Its diagnosis is not always easy, and according to the way it is made, bruxism can be classified as "possible", "probable" or "certain", and according to its etiology - primary or secondary. The polysomnographic examination is the most accurate and certain way to diagnose bruxism.

Sleep bruxism is in many cases associated with other parasomnias, snoring, respiratory problems during sleep (sleep apnea), restless legs syndrome, etc., all of which are causes of poor sleep. In other cases, a link has been found between bruxism and adenotonsillar hypertrophy, allergies, gastro-oesophageal reflux. However, bruxism is largely directly related to the psycho-emotional state of the child and some psychological disorders such as attention deficit hyperactivity disorder.

Due to its multifactorial nature and unclear etiology, the treatment of bruxism may include multidisciplinary approach - drug therapy, psychological assistance, treatment of accompanying general disease and etc. As for the local oral treatment – we can use occlusal splints, myofunctional devices and the loss of teeth structures can be restored with the methods of conservative dentistry.

Key words: bruxism, psychological disorders, tooth wear, sleep apnea, myofunctional devices.

Резюме

Бруксизмът при деца е често срещано състояние, което може да доведе до зъбно изтриване, орофациални симптоми, главоболие, темпоромандибуларна дисфункция и др. Диагностиката му е невинаги лесна и според нивото, на което се прави тя, бруксизмът може да бъде „възможен“, „вероятен“ и „сигурен“, а според етиологията си – първичен или вторичен. Най-точно и сигурно е полисомнографското изследване.

Нощният бруксизъм в много случаи е свързан с други парасомнии, хъркане, дихателни

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проблеми по време на сън (сънна апнея), синдром на неспокойните крака и др., като всички тези състояния са причина за непълноценен сън. В други случаи се открива връзка между бруксизъм и адено tonsиларна хипертрофия, алергии, гастро-езофагеален рефлукс. Въпреки това бруксизмът до голяма степен има пряка връзка с психо-емоционалното състояние на детето и някои психологични смущения като хиперкинетично разстройство с нарушение на вниманието.

Поради неговата мултифакторност и неизяснена напълно етиология, лечението на бруксизма, може да включва мултидисциплинарни методи – медикаментозна терапия, психологична помощ, лечение на придружаващо общо заболяване и др. Що се отнася до локалното орофациално лечение – използват се оклузални шини, миофункционални апарати, а загубените твърди структури могат да се възстановят с методите на консервативното зъболечение.

Ключови думи: бруксизъм, психологични смущения, зъбно изтриване, сънна апнея, миофункционални апарати.

Introduction

Bruxism is a recurrent jaw-muscle activity characterized by clenching, grinding and/or pressure on the teeth, as well as pushing the lower jaw forward [1]. This condition is common in children and has its own specifics regarding the dynamics of dental development in childhood. Bruxism is divided into two different categories based on 24 hours circadian cycle, depending on when it occurs: sleep bruxism and awake bruxism [1]. Sleep bruxism or nocturnal bruxism is a common condition in children with a prevalence of up to 40%, with a predominance in boys [2, 3].

Sleep bruxism is established on the basis of the presence of regular or frequent sounds of grinding with teeth during sleep, in combination with some clinical findings, such as: non-physiological tooth wear, transient pain or fatigue in the masticatory muscles, headache, stiffness in the jaw after waking up. This condition can be diagnosed according to the above criteria, but the gold standard for diagnosing sleep bruxism is polysomnography (PSG) [4].

Bruxism is considered a multifactorial parafunction with a complex and controversial etiology. This condition is thought to be regulated primarily by the central nervous system, not the peripheral [5]. Emotional factors, high levels of anxiety and stress [6], as well as other factors such as harmful oral habits [7], genetic predisposition [8] play a role in the onset of bruxism. According to the literature, risk factors for bruxism are also snoring, mouth breathing, restless sleep, insufficient sleep [9, 10]. In addition,

bruxism in children is also associated with behavioral problems such as hyperactivity, attention deficit, drowsiness, and poor school performance [11, 12].

Classification of bruxism

Sleep bruxism can be classified according to its etiology into two different categories - primary (idiopathic) nocturnal bruxism, in which there is no specific cause associated with a socio-psychological or medical condition, and secondary nocturnal bruxism, which is associated with a socio-psychological or medical condition. These conditions may include movement or sleep disturbances, including restless leg syndrome and rhythmic movement disturbances such as head throbbing, disturbed breathing during sleep due to upper airway resistance, or apnea - hypopnea, neurological or psychiatric conditions, related to medication [13].

Another recently developed classification, result of a consensus adopted by an international group of experts, uses a new diagnostic scale for both clinical and research purposes. The authors categorize sleep and/or awake bruxism using the terms “possible”, “probable” or “definite”. Possible bruxism is based on anamnestic data from a survey and/or the anamnestic part of a clinical examination, probable bruxism is complemented by a clinical examination, and definite bruxism includes a polysomnographic recording [14].

Orofacial symptoms of bruxism

Bruxism can affect a wide range of oral and facial structures. Signs and symptoms of sleep

bruxism may include: pain in the masseters and temporal areas, temporomandibular dysfunction (TMD), thickening of the linea albuginea in the oral buccal mucosa, tooth impressions on the tongue, and tooth wear [15]. Some harmful habits, such as prolonged gum chewing, nail biting and chewing pens/pencils, are in some cases also associated with bruxism [2].

Nocturnal bruxism can be considered a probable cause of tension-type headaches when the patient wakes up with facial and/or temporal pain that decreases as the day progresses. Patients report waking up at night with pain and tension in the facial and cranial areas after prolonged episodes of bruxism [13]. Myalgia is most commonly reported on waking in the morning, but myofascial chewing pain increases as the day progresses. Orofacial symptoms associated with the TMJ such as limited opening, TMJ sounds, arthralgia may be present as concomitant with bruxism [11]. Muscle pain (myalgia) and symptoms of dysfunction associated with nocturnal bruxism may also be the result of other comorbidities that need to be differentiated [13].

The consequences of bruxism on the orofacial structures have also been studied by bulgarian authors [16]. A 2017 study found that patients with bruxism present some speech difficulties [17]. The influence of bruxism in our country has been studied most often in adult patients.

Another finding that is common in patients with bruxism is tooth wear. Tooth wear is a physiological process of loss of tooth structures result from the action of masticatory forces and time. When it is a consequence of parafunction, digestive problems, nonbacterial chemicals, etc., we refer to it as pathological tooth wear [18]. It is important to detect this problem on time and to establish its etiology, in order to prevent subsequent pathological tooth wear through appropriate prevention and treatment measures. Dimova M. examined the occlusal contacts in adult patients with bruxism and found that there is an uneven distribution of occlusal forces and articulatory blockages, which should be taken into account in the treatment of these patients [19].

Sleeping and sleep bruxism in children

Sleep is essential for the development of the child. Sleep disorders often accompany brux-

ism in childhood. They include parasomnias like sleep walking and talking, nocturnal enuresis, restless leg syndrome, breathing disorders during sleep [10, 13, 20]. Some studies have found a link between snoring and sleep bruxism, as well as a correlation between nightmares and sleep bruxism [11]. Often sleep disorders and snoring are due to sleep apnea, which accompanies bruxism in most of the cases [21]. Ohayon et al. found that among sleep-related symptoms and disorders, obstructive sleep apnea is the greatest risk factor for teeth grinding [22]. On the other hand adenotonsillar hypertrophy is the most common cause of obstructive sleep apnea syndrome in children [23].

Some clinical observations and studies provide us with indirect evidence of an association between nocturnal bruxism and sleep-disordered breathing [24, 25]. Bruxism has been found to be significantly more prevalent in children with tonsillar hypertrophy and there is a significant reduction in bruxism after adenotonsillectomy [25].

Psychosomatic risk factors for bruxism in children

The exact pathophysiology of bruxism is unclear. Two groups of etiological factors can be identified - peripheral (morphological) factors and central (pathophysiological and psychological) factors. Of the emotional characteristics, anxiety is often associated with bruxism [2, 6]. Peripheral morphological factors, such as occlusal discrepancies, are thought to play a negligible role. It has been suggested that hyper- and hypodopaminergic conditions may be important risk factors for bruxism [26]. Attention deficit hyperkinetic disorder (ADHD) in children is the most common disorder in the development of the nervous system in children and is characterized by distraction, hyperactivity and impulsivity. Deficiencies in the function of the frontal lobe, dysfunction of the frontosubcortical pathways and imbalance in the dopaminergic and noradrenergic systems contribute to the pathophysiology of ADHD [27]. A number of studies have shown a link between ADHD and the presence of awake and/or sleep bruxism [28, 29]. A study by Ghanizadeh demonstrated a link between oppositional defiant disorder in children, ADHD and bruxism, and maternal de-

pression [30].

Other studies have shown that children and adults who report grinding of teeth on their own are more anxious, aggressive and hyperactive [22]. It has been found that the electromyographic activity of the masseters increases during sleep after days of emotional or physical stress, but these results are contradictory. There is evidence that patients with sleep bruxism have increased jaw motor activity in response to life stressors. [13]

Other risk factors associated with bruxism

Nocturnal bruxism is more common in children with allergies. This fact can be proved not only by the anamnesis, but also by the ulcerations and grooves of the buccal mucosa in the retro molar area, which are often observed in these children, bilaterally. In addition, the surfaces of molars, canines, and even incisors often show signs of occlusal wear [31].

A study found three times higher incidence of bruxism in allergic children than in non-allergic children. Allergies can certainly play a role in sleep bruxism and this can be demonstrated during exacerbations of perennial allergic rhinitis, asthma attacks, upper respiratory tract infections, and excessive exposure to pollen, mold, dust, and animals, which cause more frequent teeth grinding [31]. Children with asthma were found to be 20% more likely to have bruxism than the control group [32]. Some parents associate exacerbation of bruxism with ingestion of certain foods with high allergenic potential. With proper treatment of allergies, bruxism is significantly reduced or completely disappears [31].

Treatment of bruxism in children

The treatment of bruxism in children should be consistent to childhood, which is characterized by periods of growth and development of the jaws, changing from temporary to permanent dentition. In the literature, several different therapies are offered for the treatment of bruxism - monotherapy or in combination. We could group them as local, systemic and additional psychological methods of treatment. Local methods are through obturation, orthodontic treatment and prevention of bad habits, occlusal articulation and occlusal splints [33].

Methods of systemic treatment are also used

[34], as well as psychological techniques with counseling and/or psychotherapy to influence emotional factors that have been shown to be a risk for developing bruxism. Additional treatments include physical therapy and acupuncture [33]. Studies have shown that homeopathic remedies have been used successfully for sleep bruxism [35].

Occlusal acrylic or silicone splints are most commonly used in the treatment of bruxism, as they are removable and easy to handle and do not impede the growth of teeth and jaws in children [10]. The silicone occlusal splint has been shown to be effective in controlling bruxism and can be used in children as a controlled treatment method [33].

Recently, myofunctional devices have been used in dentistry to treat sleep disorders (obstructive sleep apnea, sleep-disordered breathing, bruxism, snoring, temporomandibular disorders, etc.) [36]. The devices are pre-made, especially for children, quick and easy to use, have a soft texture, which makes them comfortable for children and allow growth and development without restricting the jaw. They act in a complex way on the orofacial structures and according to the individual case, we can choose the most suitable device [37]. In a study by Karakis et. al it has been found that treatment with such a soft pre-made splint, for a period of 6 weeks, leads to a decrease in the clenching force of the jaws, compared to the initial force as well as a prophylactic effect on tooth wear [38].

This series of functional intraoral devices are designed to treat with a myofunctional approach rather than a mechanical one. This is done by correcting the position of the lower jaw, correcting the position of the tongue and providing better breathing, as well as preventing subsequent wear of the tooth surfaces by means of an occlusal surface of the splint itself, which protects the teeth [37].

The treatment of tooth wear due to bruxism should begin with the treatment of the cause, and then continue with conservative restorative therapy if necessary.

Conclusion:

Bruxism is considered a multifactorial parafunction with a complex and controversial

etiology. This condition is regulated mainly by the central nervous system, not the peripheral, and is associated with emotional factors, high levels of anxiety and stress. Some harmful oral habits, malocclusions and improper occlusal relationships and genetic predisposition also play a role in the onset of bruxism. In addition, bruxism in children is also associated with behavioral problems such as hyperactivity, attention deficit, drowsiness, and poor school performance.

As a result of bruxism, there is an irreversible loss of tooth surface, also called tooth wear. This process can also be the result of the influence of other factors, related to non-bacterial chemicals or mechanical processes on the hard tooth structures.

There are different approaches to the treatment of bruxism with different success rates - through psychological and behavioral techniques, conservative restoration of tooth surfaces, drug therapy, therapy with individual or universal dental splints.

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Parents' awareness of homeopathic medicines and their influence on oral health

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Информираност на родителите относно хомеопатичните лекарства и влиянието им върху оралното здраве

Помакова А¹, Гатева Н², Христов Кр³

Introduction. Homeopathy is one of the most popular forms of complementary and alternative medicine in modern times. The trend of increasing the use of both prescription and over-the-counter medication tends to put children at risk of drug-related caries and should be considered a public dental problem.

Objectives. To assess parents' awareness of the negative effect of homeopathic medicines (HM) on the dental health of children, which result from the simple sugars contained in HM and the frequent intake during childhood.

Materials and methods. The study included 396 parents after a survey among 600 participants. A questionnaire with 41 questions was handed out to parents personally. It was a part of the medical history taken during the clinical study of the children of these parents. **Results.** More than half of the parents are not aware of the presence of sugars in HM. In many cases their children also do not apply oral hygiene procedures after intake of such medicines. 27,3% of parents are not informed that frequently used medicines actually belong to homeopathy.

Conclusions: Many parents prefer homeopathic medicines for treatment of their children but are not aware of the negative effects these medicines could have on their dental health. This identifies the need for more education among them.

Key words: homeopathy, dental health, homeopathic medicines, sugar content

Introduction

Homeopathy is one of the most popular forms of complementary and alternative medicine (CAM) in modern times [1, 2]. It is a holistic method of treatment based on a broader view of human health, causes of the disease, and its individual manifestations [3].

Homeopathy is well perceived by parents and children as medications are widely avail-

able as over the counter medications, they are cheap and prescribed for acute and chronic conditions [4]. Homeopathic medicines (HM) are easily accepted by children. The reasons are: 1) they are usually in the form of sweet-tasting pellets, powders or liquids [4]; 2) they are dissolved in the mouth without chewing [1, 2]; 3) are made from natural extracts, are not toxic and have no potential side effects [4].

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In the literature, however, the assessment of the effect of the use of HM includes only the effect on general health, with no assessment of their local effect on the oral cavity structures [5]. Homeopathic medicines contain sugars [4]. For this reason, their sugar content, similar to that in conventional medications (CM), can also affect dental health. Unlike sugar in pediatric drugs, according to some authors, sugar in HM cannot be defined exactly as "hidden sugar." It is rather "ignored," "missed," which is particularly risky by children who are chronically ill. They have a higher sugar load and may be at a higher risk of developing caries from an early age. Five pellets, taken 4 times a day, contain a total of 1 gram of sugar [6].

Homeopathic medicines also have specific rules for administration [1, 4]. They are prescribed with frequent intake - usually 3-4 times a day, and sometimes once every two hours, at bedtime and usually, especially in children, left to dissolve in the mouth [4]. Their intake is desirable to be at least 15 minutes before or couple of hours after meals. When homeopathic treatment is being applied, it is forbidden to use certain substances such as peppermint, camphor, perfume, etc., and toothpastes should not contain fluorides [1].

Children are more susceptible to recurring colds and therefore many parents prefer HM to conventional medications due to the absence of side effects [4]. In many families homeopathy is a treatment choice in case of recurrent illnesses and / or chronic ones (colds, runny nose, diarrhea, asthma, nausea and vomiting, headache, mucosal inflammation, colic in babies, etc.). Although some parents are aware of the sweetness and taste of homeopathic medicines, they do not pay attention to the possible effects these sweet HM can have on the dental health of their children [4].

The trend of increasing the use of both prescription and over-the-counter medication tends to put children at risk of drug-related caries and should be considered a public dental problem [4].

This also determined the purpose of our research - to assess parents' knowledge of HM and their role in dental health related to sugars in them.

Material and methods

The study included 396 parents after a survey among 600 participants. All participants were randomly selected, and the final selection was based on the treatment used by their children. The answers of the participants with frequently and infrequently ill children who are using homeopathic treatment (alone or mixed - in combination with conventional) were analyzed. Defined as often ill, according to modern medical standards, are children who are ill more than 4 times a year. A questionnaire was created for the purposes of the survey. It contained 41 questions, with a choice among several answers. The questionnaire was a part of the medical history taken during the clinical study of the children of these parents. Questionnaires are handed out to parents personally with instructions for filling in.

Questions from the questionnaire are intended to identify: parents' preference for the type of treatment applied to their children - homeopathic or mixed; type of homeopathy - classic or symptomatic; type of preparation - drops, tablets, syrup; the intake scheme of HM; the initial age and the reason for choosing homeopathic treatment; their awareness of the content of sugars in medications (conventional and homeopathic). The questionnaire also includes questions that allow the assessment of other additional behavioral factors relevant to the assessment of the risk of developing a carious process in the child. These are related to the frequency, type and means of oral hygiene, frequency and reason for dental visits, diet, and more. Before taking the questionnaire, each parent signed an informed consent about the use of answers for the purposes of this survey.

The results were subjected to a descriptive statistical analysis (SPSS 2017) and summarized in order to show the percentage ratios of the answers for each question.

Results:

Among all 396 respondents 170 parents (28.3%) use only HM and 226 (37.7%) use mixed treatment - conventional and homeopathic. The results are presented in Diagram 1.

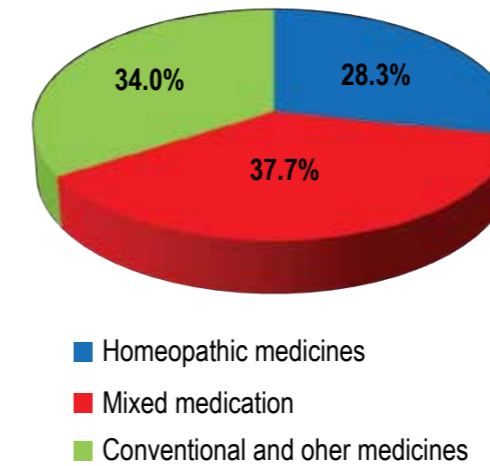


Diagram 1. Distribution of the children depending on the medication used, according to the respondents' answers.

Of all 396 children using HM, 254 (64.1%) use symptomatic ("Boiron") homeopathy, 53 (13.4%) use classical and 89 (22.5%) combine classic with symptomatic homeopathy.

Of all 396 patients using HM, 284 take single doses between the main meals and only 1 of the patients at bedtime (Diagram 2).

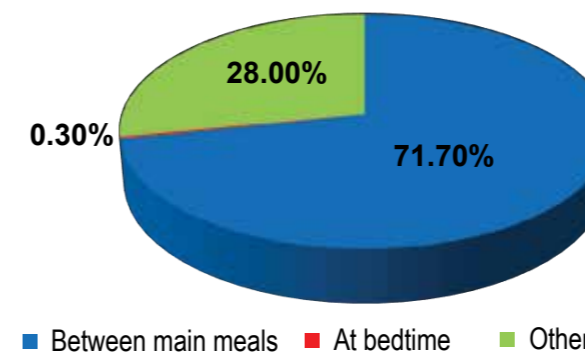


Diagram 2. Distribution of the intake scheme of HM by children.

Of all the 396 children taking HM, 98 (24.7%) use an anti-viral homeopathic drug to increase immunity; 81 (20.5%) - homeopathic cough syrup; 87 (22.0%) - a homeopathic an-

ti-inflammatory drug that is also commonly used for tooth eruption. The remaining 130 children use a variety of homeopathic medicines belonging to classical and/or "Boiron" homeopathy.

Out of a total of 396 parents who use HM in their children, 216 (54.5%) do not know about the presence of sugars in HM.

The results of assessing parents' knowledge of the presence of sugars in the HM and the application of some kind of hygiene procedures after their use are presented in Table 1.

Table 1. Parents' knowledge of the presence of sugars in HM and application of oral hygiene after their use.

Oral hygiene	Sugars in HM		Total
	Yes	No	
Yes	32 (8,0%)	29 (7,3%)	61 (15,4%)
No	148 (37,4%)	187 (47,2%)	335 (84,6%)
Total	180 (45,4%)	216 (54,5%)	396 (100%)

Out of all the parents who took part in the survey, 148 (37.4%) are aware of the presence of sugars in HM but do not require their children to apply some kind of oral hygiene after the intake. Nearly half of the respondents who apply HM by their children - 47.2%, do not know about the presence of sugars in HM, and their children also do not apply oral hygiene procedures after their intake (Table 1).

Table 2. Restriction of the use of fluoride toothpastes in children using only HM.

Restriction of the use of fluoride toothpaste	Frequently ill child		Total
	Yes	No	
Yes	34 (8,6%)	10 (2,5%)	44 (11,1%)
No	265 (67,0%)	85 (21,5%)	350 (88,4%)
No answer	1 (0,3%)	1 (0,3%)	2 (0,5%)
Total	300 (75,8%)	96 (24,2%)	396 (100,0%)

When analyzing the questionnaire responses, we found that out of a total of 396 children using homeopathy, 44 (11.1%) have a restriction to use fluoride toothpaste, 350 (88.4%) have no such

prohibition, 2 (0,5%) do not answer this question. Table 2 presents the results depending on whether the child is frequently or infrequently ill.

When evaluating the daily intake of HM among children using this type of medication, we found that 239 (60.4%) of the 396 patients received the medication up to 3 times a day and 157 (39.6%) - more than 3 times a day (Diagram 3).

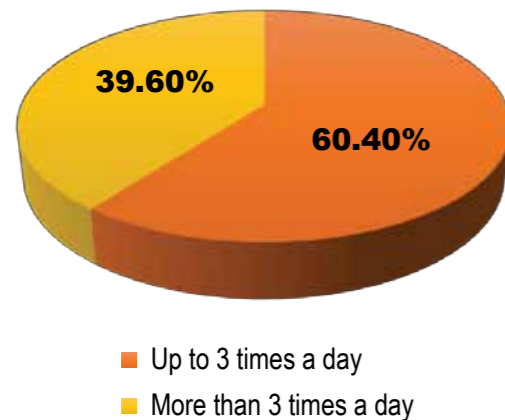


Diagram 3. Frequency of HM intake by children on homeopathic treatment.

Children treated with homeopathy, alone or in combination with conventional medications, first took HM for the first time as follows: up to the first year - 108 children, between 1-3 years - 176 children, over 3 years - 112 children. Children treated with CM: up to the first year are 123, between 1-3 years are 226, over 3 years are 81. The answers are presented in Diagram 4.

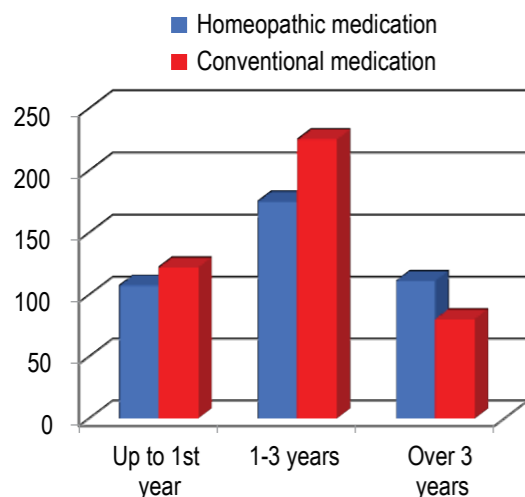


Diagram 4. Starting age for intake of homeopathic or conventional medications.

We also surveyed how many of the parents did not know that some of the commonly advertised and used drugs were actually homeopathic.

Out of all the 396 parents interviewed, 108 (27.3%) did not know that medications such as Shusler salts, Oscillococcinum, Influcid, Stodal, Homeovox are homeopathic.

Discussion

In recent years consumer requirements for 100% natural and harmless products have risen significantly. This is one of the reasons why more patients use homeopathy for their treatment, as one of the most popular forms of CAM nowadays [7]. The current study aims to assess parents' awareness concerning the use of HM by their children.

Many studies draw attention to the sugar content of conventional pediatric drugs and identify it as a potential risk for the initiation and development of a carious process in children who are suffering from recurrent infections or are chronically ill [8-12]. Likewise, homeopathic medicines also contain sugars [4]. Therefore, it is a logical conclusion that they can also have a negative effect on dental health. Other physico-chemical parameters of pharmaceutical products (conventional and homeopathic) such as endogenous pH, titratable acidity, soluble contents and viscosity also influence their cariogenic and erosive potential [10, 13-16].

It is known that children usually refuse to take medicines because of their taste and the fact that they need to be swallowed, especially when they are not in a liquid form [4, 17]. Homeopathic medicines are usually in the form of sweet tasting pellets, powders or liquids. They are left to dissolve in the mouth and are not chewed. This makes them well accepted by children [1, 4]. Furthermore, they are made of natural extracts, are not toxic and have no potential side effects [4]. Probably these are the reasons why homeopathic medicines are preferred and

often prescribed in childhood.

When it comes to the effectiveness of oral prophylaxis in childhood an important factor, besides the child and the dentist, are the parents. They are the ones that motivate children to conduct personal oral hygiene, who are responsible for their treatment at home, who make important decisions about health and who are involved in building the habits of children. This is the reason to thoroughly interview parents about their awareness of the specifics of homeopathic treatment and its risky nature with regard to the dental health of their children because of the content of simple sugars in HM.

Usually, parents are aware that sugar causes tooth decay, but in most cases, they only associate it with the consumption of sweets and biscuits [8]. Although many are aware of the sweetness and flavor of homeopathic remedies, they often ignore their possible negative effects on dental health of children, precisely because of their sugar content and/or other physico-chemical parameters.

The literature lacks information on parents' awareness of the content of sugars in homeopathic medicines, but there is the same lack of knowledge about conventional pediatric medications [8, 18, 19]. In our study of a total of 396 parents applying homeopathic remedies to their children, more than half - 216 (54.5% of those applying the HM) are unaware of the presence of sugar in them (Table 1). In a similar study among 100 parents about CM, it is clear that only 32.3% are aware of the presence of sugar in them. The authors conclude that parents are unaware of the harmful effects of drugs on the oral health due to their carbohydrate content [18]. The result of our study gives us reason to draw the same conclusion.

Another feature of our study's findings is that only 15.4% of the children taking homeopathic medicines perform some kind of oral hygiene after taking the dose. Half of their parents know

about the presence of sugars in the medication, but that does not influence the habits of their children. Similar studies have found that only 6% of the 100 parents interviewed brush their children's teeth after receiving a conventional drug [20] and 17.6% out of a total of 45 interviewed parents applied hygiene procedures to their children after taking a drug in another study [18]. The results in an extended university study showed that 84.9% of parents are not trained professionally (by doctors/dentists) to apply an appropriate oral hygiene after taking a medication [21]. It becomes clear that the lack of targeted prophylaxis, motivation and remotivation by medical professionals leads also to an inevitable lack of control among parents. They either do not know about the potential negative effects of taking medication by children or do not understand the seriousness of this factor.

Authors note that oral hygiene practices should include a fluoride toothpaste to prevent or control dental caries [22-24]. It is considered that even frequent intake of sucrose, there will be no particular loss of hard dental tissues (demineralization) if the patient's oral hygiene includes a toothpaste with fluoride twice a day [23]. If fluoride toothpaste is not used, massive demineralization will occur in individuals exposed to carbohydrate intake three times a day. In this connection, several authors advise that children and their parents should be aware of the need to brush teeth after taking each dose of the medicine, take medication during main meals rather than between them, avoid taking medication before bedtime and also the need of fluoride application [11, 25, 26]. Many of these recommendations, however, cannot be met when taking homeopathic medicines. For example, we found through a survey among parents that 11.1% of children are forbidden to use fluorides by their homeopaths - in toothpastes or otherwise (Table 2). Homeopathic medicines cannot be taken during meals, but only between meals. According

to our data, 60.4% of children using homeopathy take these medicines 3 times a day, the rest of them – more than 3 times (Diagram 3). These facts create a risk of starting enamel demineralization processes. Authors find a drop in saliva pH below the critical 5.5 in children after taking some homeopathic remedies, and consider this to be a potential threat to dentition, especially in the case of frequent intake [4]. It is known that the speed, frequency and duration of pH drop in dental plaque create a cariogenic situation [27, 28]. There are three major drops in plaque acid values below the critical pH of 5.5 that are associated with the three main meals. If there are also drops between the main ones, this will increase the time that saliva buffering is limited, and it could not normalize the pH of dental biofilm. Long periods of acidic environment and short recovery periods are created. In these cases, the pH never returns to normal. Thus, teeth cannot remineralize or recover the lost minerals after the initial demineralization. There is a higher risk of developing a carious process [29]. The authors state that, depending on the composition of the homeopathic medicine, frequency of administration and duration of therapy, the oral health of children undergoing regular treatment is at risk and should be monitored. The results of the survey found that the intake of drugs (homeopathic and / or conventional) starts during the first year after birth (Diagram 4). This creates conditions for an increased and neglected risk of developing a carious process from an early age, especially in children who are often ill and take medicines containing simple sugars. Authors' advice to also give instructions for proper oral hygiene when prescribing a sweetened medicine [17].

Also interesting was the result which found that 108 (27.3%) of parents did not know that some of the often advertised and used drugs were in fact homeopathic.

Conclusion

Our findings have identified the need for more education among parents and their preparation for a preventive behavior in case of frequent intake of medications by their children, including homeopathic ones. They should not be considered as completely harmless, but attention should be paid to their additional ingredients - sugars and acids and chemical characteristics, which could be a prerequisite for the initiation and progression of a carious process, especially among children with frequent and prolonged intake. It is necessary to focus the attention of parents on specific and yet simple to implement preventive measures that would reduce this risk to a minimum. It is imperative to set up a scheme for the prevention of children, especially those who are ill and who are applying HM (alone or combined), to the maximum extent possible, without interfering with their general drug effects.

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Latex allergy – myth or reality among professionally involved medical staff – questionnaire survey

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Латексова алергия – мит или реалност сред професионално обвързаните медицински лица -анкетно проучване

Истаткова, Я.¹, М. Денчева²

Summary

Introduction: Latex allergy is considered an extremely acute problem in dental medicine, it is of great significance and in relation with diseases like AIDS/HIV, viral hepatitis, Covid-19. Various studies have been conducted many times among patients and medical staff which, however, have contradictory results. There is no definite data on the frequency of this allergy. It is still debated in medical circles whether or not there is latex allergy, exactly by what mechanism it proceeds and what are the main clinical manifestations.

Aim: To be investigated which are the most common complaints among professionally involved medical staff when using various protective equipment, including latex products.

Material and methods: The information was obtained by analyzing the data from indirect anonymous survey containing 14 questions. The questionnaire has been filled out by 338 people (92 men – 27.2%, 246 women – 72.8%), on average age 33 years old, for the period of 2 months.

Results: More than half of the participants did not report any complaints from the skin of the hands or from the upper respiratory tract when working with latex gloves, nor for intolerance to foods that cross-react with latex; they don't have allergy to latex condoms or other latex products. In those who report complaints, predominate the symptoms from the skin of the hands, related to the longevity of wearing protective gloves (itching, dryness and redness/erythema).

Conclusion: The low frequency of symptoms of contact with latex products found by us among medical staff is not a reason for reassurance. The different ways of manifestation of latex allergy (from fast or delayed type allergic reaction) require detailed examination of the patients with different methods, informing about the ways of possible sensitization of the organism, the means to control a potentially rapid occurred allergic reaction and the use of alternative latex-free materials and consumables.

Key words: food intolerance, latex allergy, occupational diseases, skin complaints

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Резюме

Въведение: Латексовата алергия се счита за изключително наболял проблем в денталната медицина, с голяма значимост, във връзка със заболявания като СПИН/ХИВ, вирусните хепатити, Covid-19. Провеждани са многократно различни изследвания сред пациентите и медицинския персонал, които обаче са с противоречиви резултати. Липсват категорични данни относно честотата на проявление на тази алергия. Все още в медицинските среди се спори относно това дали има или няма латексова алергия, точно по какъв механизъм протича тя и какви са основните клинични проявления.

Цел: Да се проучи какви са най-честите оплаквания от професионално ангажираните медицински лица при използването на различни предпазни средства, включително латексови продукти.

Материал и методи: Информацията е получена чрез анализ на данните от непряка анонимна анкета, съдържаща 14 въпроса. Анкетата е попълнена от 338 души (92 мъже – 27.2%, 246 жени – 72.8%), на средна възраст 33 години, за период от 2 месеца.

Резултати: Повече от половината от участниците не съобщават за оплаквания от страна кожата на ръцете или от горни дихателни пътища при работа с латексови ръкавици, нито пък за непоносимост към храни, реагиращи кръстосано с латекса; нямат алергия към латексови презервативи или други латексови продукти. При тези, които съобщават за оплаквания, преобладават симптомите от страна на кожата, свързани с дълготрайността на носене на предпазни ръкавици (сърбеж, сухота и зачервяване).

Заключение: Установената от нас ниска честота на симптоми от контакт с латексови продукти сред медицинския персонал не е повод за успокоение. Различните начини на проявление на латексовата алергия (от бърз или забавен тип) налагат подробно изследване на пациентите с различни методи, информиране относно начините за сенсibiliзиране на организма, средствата за овладяване на потенциална бързо настъпила алергична реакция и използването на алтернативни безлатексови материали и консумативи.

Ключови думи: кожни оплаквания, латексова алергия, професионални болести, хранителна непоносимост

Introduction

Latex allergy is considered an extremely acute problem in dental medicine, it is of great significance and in relation with diseases like AIDS/HIV, viral hepatitis, Covid-19. Various studies have been conducted many times among patients and medical staff which, however, have contradictory results. There is no definite data on the frequency of this allergy. It is still debated in medical circles whether or not there is latex allergy, exactly by what mechanism it proceeds and what are the main clinical manifestations.

Different authors have studied the problem among professionally attached individuals – both among students, and among doctors and dentists with many years of work experience [2, 4].

Aim

To be investigated which are the most common complaints among professionally involved

medical staff when using various protective equipment including latex products.

Material and methods

The information was obtained by filling out an indirect anonymous questionnaire containing 14 questions. It was distributed online (by a link in Facebook, Viber, e-mail), through the official pages of the Regional brotherhoods of the Bulgarian Dental Union in Sofia, Plovdiv, Sliven, Varna and Burgas, as well as through the online platform “Medical News”

Within 2 months in the questionnaire survey have participated 31 medical doctors (8.3%), 145 doctors of dental medicine (38.8%), 13 dental technicians (3.5%), 21 nurses (5.6%), 29 dental assistants (7.8%), 1 sanitary worker (0.3%), 119 students (31.8%), as well as 15 others (4.0%), non-professional persons, who use latex products in their daily routine – Attachment 1.

The information from the inquiry was transformed to a database file – an “Excell” table. Statistical analysis was carried out with **IBM SPSS Statistics 21**. Descriptive statistics were used to evaluate the individual variables and relationships between them. The level of significance was set at $p < 0.05$.

Multiple logistic regression analysis was conducted in order to investigate the connection between the use of latex gloves and manifested reactions from the skin of the hands, reactions from the upper respiratory tract, intolerance to certain foods, allergy to latex condoms and other latex products.

Results:

The questionnaire has been filled out by 338 people (92 men – 27.2%, 246 women – 72.8%), on average age 33 years old. It is clear from the data analysis that 195 people (57.7%) have been working with gloves from 1 to 5 years, 57 people (16.9%) have been working with gloves between 5 to 10 years and 86 from the inquired people (25.4%) have been using gloves more than 10 years.

The distribution of answers to the question “How many days per week you have been working with gloves?”, is as follows Fig.1:

Days/week work with gloves

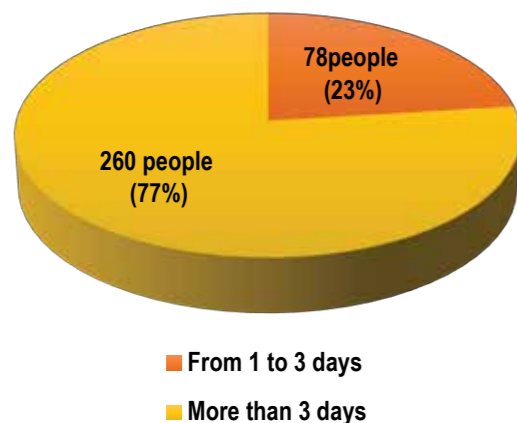


Fig.1. Diagram showing how many days/week the inquired people use gloves

The majority of the respondents 77% (n=260) use gloves more than 3 days per week.

The hourly distribution of wearing of pro-

TECTIVE gloves shows that more than half of the participants in the survey - **187 people (55.3%) work more than 5 hours/daily with gloves Fig.2**

How many hours/day do you work with gloves?

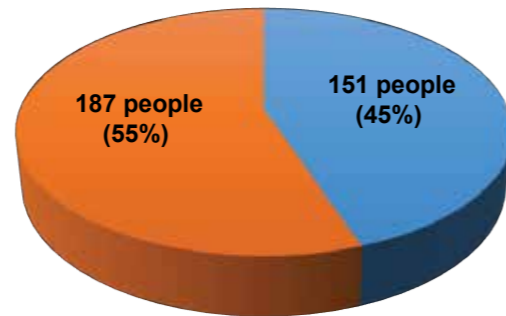


Fig.2. Hourly distribution of wearing protective gloves.

Concerning the distribution of the used types of gloves, the percent correlation is as follows Fig.3:

Types of used gloves

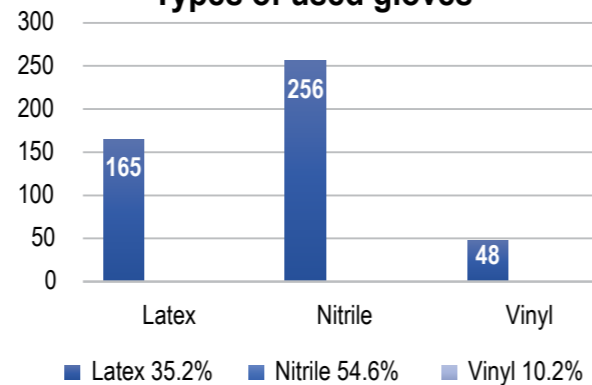


Fig.3. Distribution of the used types of gloves

What makes an impression is that the inquired people do not use only one type of gloves, but the prevalence is for the **nitrile** gloves - 54.6% (n=256), on the second place is the use of latex gloves– 35,2% (n=165).

Data from the analysis of the answers to the questions concerning the connection between the use of latex gloves and manifested reactions from the skin of the hands, from the upper respiratory tract and latex condoms, as well as relationship between the use of gloves and the intolerance to some foods that cross-react with latex

or other latex products, is evident that **no statistical significance is established**. More than half of the respondents– 217 people (64.2%) **do not** report about skin complaints when they work with latex gloves.

Among those, who have reported about the presence of any symptoms, the most common answers with statistical significance are about **itching, dryness and redness/erythema**, irritation, cracking/fissures and small itchy rash ($p < 0.001$) Fig.4

SKIN COMPLAINTS DURING TO THE USE OF LATEX GLOVES

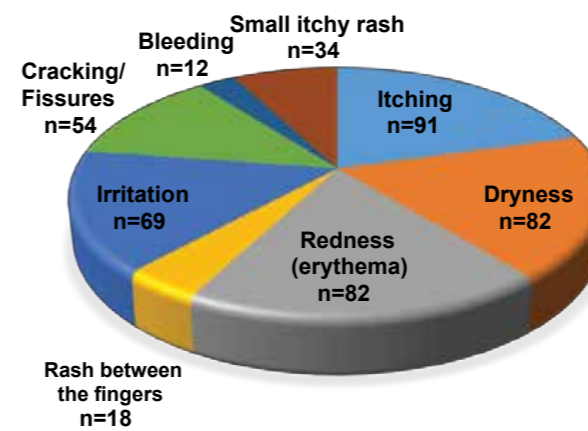


Fig.4. Quantitative distribution of skin complaints during to the use of latex gloves; n – number of the people who have answered (+) for the certain symptom.

The statistical analysis shows that the majority of the respondents– **324 people (95.9%)** report that they **do not** have complaints from the

upper respiratory tract while using latex gloves or other products containing latex proteins.

Among the others, who have reported any complaints, the distribution is as follows:

REACTIONS FROM THE UPPER RESPIRATORY TRACT

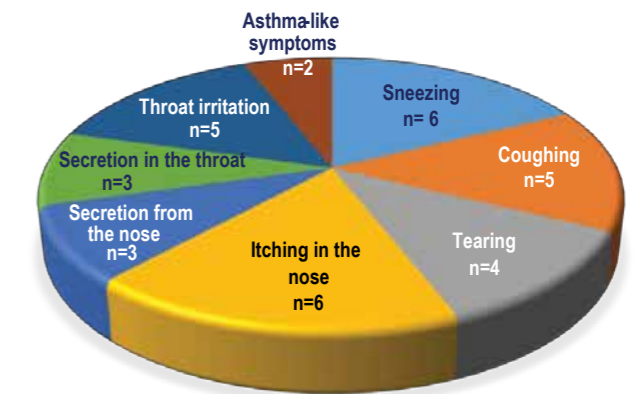


Fig.5. Reactions from the upper respiratory tract while using latex gloves; n – number of the people who have answered (+) for the certain symptom.

The most common complaints (although slightly dependent on the wearing of latex gloves) are about **sneezing, itching in the nose, coughing and throat irritation ($p < 0.05$)**. **None** of the respondents have declared about **shortness of breath** during the work with latex gloves. About the intolerance to certain foods which are associated with latex allergy, **308 people (91.1%)** reported that they **do not** have **any complaints** when consuming the listed foods. The positive answers are distributed as follows Fig.6:

Intolerance to certain foods

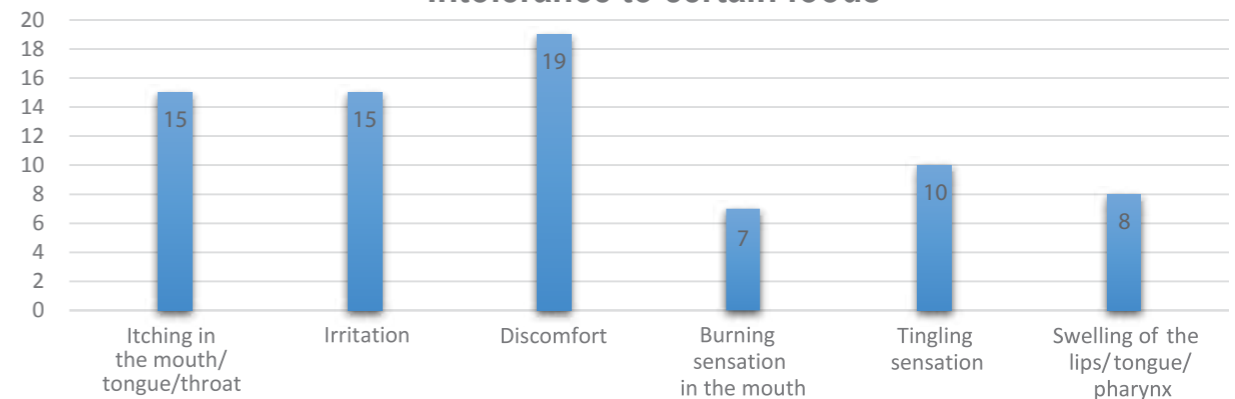


Fig.6. Complaints from the consumption of certain foods, associated with latex allergy.

Most often the respondents indicate **discomfort, irritation and itching in the mouth/tongue/throat** – a statistically weak dependence is found between the use of latex gloves and the consumption of **peaches, plums, bananas, kiwi, mango, melon, papaya, avocado, tomatoes, peanuts, chestnuts** ($p < 0.05$).

Answering the question whether they are allergic to latex condoms or not, **315 people (93.2%)** give a **negative answer**. Among those who have reported about the presence of any complaints, the distribution is as follows Fig. 7:

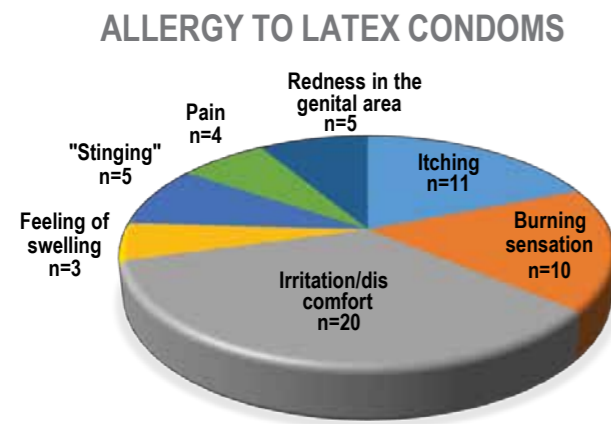


Fig. 7. Distribution of the complaints in allergy to latex condoms; n – number of the people who have answered (+) for the certain symptom.

It is noteworthy that most respondents who gave a positive answer for presence of any complaints (23 people, 6.8%), reported about **discomfort/irritation, itching and burning sensation in the genital area** ($p < 0.05$) while using latex condoms.

Statistical analysis of the data shows that **307**

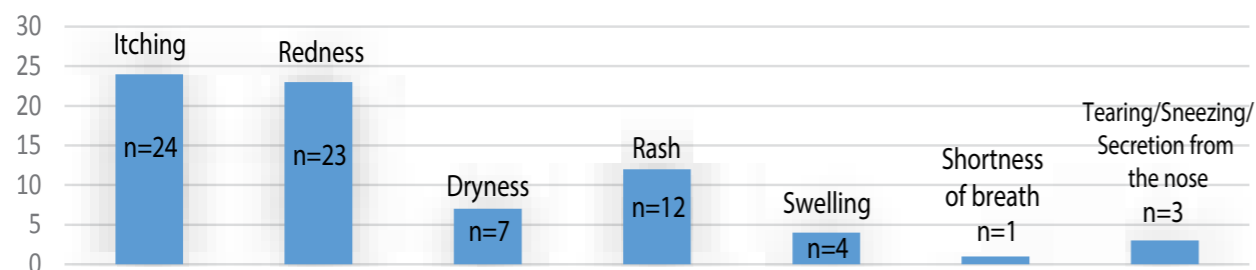


Fig. 8. Complaints in allergy to latex products; n – number of the people who have answered (+) for the certain symptom.

from the respondents (90.8%) do not declare about allergy to other products containing latex proteins (cofferdam, sleeves for blood pressure monitors, wound dressings/adhesive bandages, balloons, household/work gloves, goggles and other sports equipment, underwear, enema irrigators, hoses, marking wrist bracelets, tires, etc.). The presence of complaints is represented in Fig. 8:

Most often is declared about **itching, redness and rash** while using the mentioned latex products – a statistically weak dependence is found ($p < 0.05$) between the use of latex gloves and unwanted side effects/reactions when using other latex products.

The respondents were asked to indicate what type of latex materials they had contact with at their workplace. The distribution of answers is schematically presented in the Fig. 9:

DENTAL MATERIALS CONTAINING LATEX PROTEINS

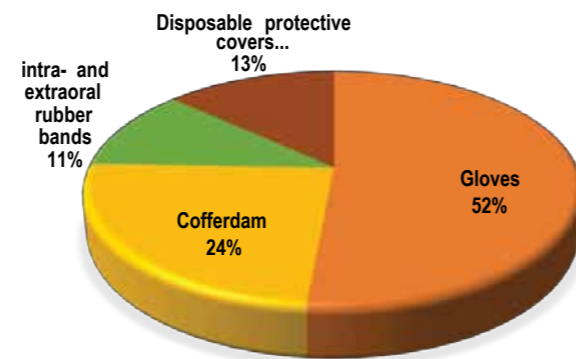


Fig. 9. Percentage distribution of the materials used in dental practices, containing latex proteins.

Most often the colleagues have been in contact with **latex gloves and cofferdam**.

Discussion

Latex allergy is a serious, sometimes life-threatening problem among professionally-attached individuals which could be developed during the student training [1,3]. Jean Bousquet et al. found in their studies that health care workers have an increased risk of sensitization and developing allergic symptoms to latex [4].

Also through a survey among health care professionals is established that factors like the quantity of glove use, history of atopy, and allergy to fruits cross-reacting with latex are risk factors for the occurrence of glove-related non-cutaneous symptoms [5]. But in our survey the majority of the respondents do not report about food intolerance to certain foods, that cross-react with latex.

The significance of latex allergy as occupational disease among health care workers has been studied in the works of Sükran Köse et al. According to them, latex allergy is rather an occupational disease of healthcare workers. It is considered to be the leading source of occupational health problems (contact dermatitis, allergic rhinitis, allergic conjunctivitis, asthma) [6]. But the results from our questionnaire do not confirm those of the colleagues – the majority of our respondents do not report about complaints from the skin of the hands, from the upper respiratory tract, neither for allergy to latex condoms, nor other latex products.

The prevalence of latex allergy and data from different countries vary widely. In Russia, for example, H Nolte et al. declare about low prevalence of latex allergy. They suggest that the lessened exposure to natural latex powdered gloves may diminish the prevalence of latex sensitization in professionally involved individuals. The most frequently reported symptom, related to latex exposure, was contact urticaria [7]. In our survey the respondents declare that they work predominantly with nitrile gloves (54.6%) and

perhaps this is part of the explanation for the low rate of the complaints from the skin of the hands – the most common are itching, dryness and redness (erythema).

In the same preventive direction is a recent announcement in the scientific literature from Emma Critchley et al. that the majority of general dental practitioners in Great Britain routinely use non-latex containing gloves and dental dam in their clinical dentistry. They use predominantly nitrile gloves. And this is the reason that the sales of latex containing gloves are continuing to decrease [8].

Similar data for relatively low prevalence (3.56%) of occupational dermatoses, partially and latex allergy, is observed also among health care workers in Portugal (predominantly among women) by Diana França et al. [9]. The main complaints of the examined patients were allergic and irritant contact dermatitis, as well as latex allergy. The main triggers were skin disinfectants, latex and nitrile gloves, also prolonged contact with water. The low prevalence of occupational dermatosis - 3.56%, they explained with previously implemented preventive measures in the workplace.

Another interesting investigation by Iva Japundžić et al. shows that only a small number of the investigated people were allergic to latex (7%) or rubber additives (4.8%). The self-reported contact dermatoses (including the use of latex products) in dental professionals and students were not commonly caused by allergies to latex and rubber additives, as is often assumed, but by other factors (i.e. years of work experience, type of the used gloves – latex with/without talc, pairs of gloves used throughout the working day, anamnestic data for atopic allergic diseases) [10].

Conclusion

The complaints of medical professionals from the skin of the hands and the upper respiratory tract in contact with latex products, as well as the data for Latex-fruit syndrome food intolerance must not be neglected or underes-

estimated although the low frequency of people who declare about such symptomatology in our investigation. Due to the possibility of development both anaphylactic reactions and delayed type allergic reactions, it is imperative for people at risk to be trained to administer medication and take measures to quickly address a possible life-threatening situation [11]. Their complaints must be carefully analyzed and evaluated, followed by in-depth examination with specific clinical and laboratory tests and to provide guidelines for discontinuing the use of certain products and replacing them with appropriate latex-free ones.

Informing the professionally involved individuals about the potential ways to sensitize the organism to latex, as well as for the different mechanisms of manifestation of latex allergy should begin in the initial courses of training; to carry out in-depth testing of those with specific complaints, providing appropriate latex-free protective equipment in the work- and study environment. Complaints such as intolerance to certain foods, latex condoms and other latex products should not be ignored – and this requires detailed information about the problem and good collaboration with colleagues from other medical disciplines.

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QUESTIONNAIRE

„LATEX ALLERGY IN DENTAL PRACTICE“

- You are:
 - Male
 - Female
- Age:
- What is your profession (more than 1 answer is possible)?
 - Doctor
 - Doctor of Dental Medicine
 - Dental technician
 - Nurse
 - Dental assistant
 - Sanitary worker
 - Student
 - Other, but I use latex products in my daily routine
- Years of work experience (How many years have you been working with patients):
- Indicate what type of gloves you have worked with (more than 1 answer is possible):
 - Latex
 - Nitrile
 - Vinyl
- How **many years** have you been working with gloves?
 - 1 - 5 y.
 - 5 -10 y.
 - > 10y.
- Write how **many days per week** you work with gloves:
 - 1 - 3 days/week
 - > 3 days/week
- Indicate how many **hours per day** you work with gloves:
 - < 5 h.
 - > 5 h.
- Do you have any **skin reactions** when working with latex gloves?
 - No
 - Yes (list what/more than 1 answer is possible):
 - Itching
 - Dryness
 - Redness (Erythema)
 - Rash between the fingers
 - Irritation
 - Cracking/Fissures
 - Bleeding
 - Small itchy rash
- Do you have any **reactions from the upper respiratory tract** when working with latex gloves?
 - No

- b) Yes (list your complaints/ more than 1 answer is possible):
- Sneezing
 - Coughing
 - Tearing
 - Itching in the nose
 - Secretion from the nose
 - Secretion in the throat („post nasal drip“)
 - Throat irritation
 - Shortness of breath
 - Asthma-like symptoms
11. Do you have an intolerance to any of the following foods?
- **peaches, plums, bananas, kiwi, mango, melon, papaya, avocado, tomatoes, peanuts, sweet chestnut/ Allergy to grass/ cereals, mugwort, ragweed**
- a) No
- b) Yes (list your complaints/ more than 1 answer is possible):
- Itching in the mouth/tongue/throat
 - Irritation
 - Discomfort
 - Burning sensation in the mouth
 - Tingling sensation
 - Swelling of the lips/tongue/pharynx
12. Are you allergic to **latex condoms**?
- a) No
- b) Yes (list your complaints/more than 1 answer is possible):
- Itching
 - Burning sensation
 - Irritation/Discomfort
 - Feeling of swelling
 - “Stinging”
 - Pain
 - Redness in the genital area
13. Are you allergic to any of the following latex products?
- **cofferdam, sleeves for blood pressure monitors, wound dressings/bandages, balloons, household/work gloves, goggles and other sports equipment, underwear, enema irrigators, hoses, marking wrist bracelets, tires, etc.:**
- a) No
- b) Yes (list your complaints/more than 1 answer is possible):
- Itching
 - Redness
 - Dryness
 - Rash
 - Swelling
 - Shortness of breath
 - Tearing/Sneezing/Secretion from the nose
14. Indicate which of the following *latex materials* you **have worked with** (more than 1 answer is possible):
- a) Gloves
 - b) Cofferdam
 - c) Orthodontic intra- and extraoral rubber bands
 - d) Disposable protective covers for intraoral X-ray machines, diodes for light-curing lamps, etc.

Vertical growth pattern changes during combined treatment with fixed appliance and with functional appliance Trainer

Yana Popova¹

Промени във вертикалния тип растеж при приложение на комбинация от лечебни апарати: фиксирана техника брекети и миофункционален апарат Тренер

Яна Попова¹

Summary

The topic for functional appliance treatment effects has been controversial since the last century. The combination of mechanical acting appliances braces and functional orthodontic appliances trainers can combine the advantages of both treatment approaches. The treatment with braces allows optimal alignment of the teeth in the dental arches, and the trainers improve the occlusal contacts and the muscle balance, thus creating good conditions for long term stability of the treatment results.

***Aim:** The purpose of the present study was to estimate the changes in the vertical growth pattern during combined with mechanically acting braces and functionally acting trainers.*

***Materials and methods:** Twenty patients diagnosed with skeletal and dental Class II underwent combined treatment with braces and trainers (T4B). In the end of the treatment we achieved class I sagittal occlusal relationship in the area of the molars. Cephalometric analysis on profile X-rays were made for the beginning and the end of the treatment with the software AudaxCeph®. The data was evaluated statistically*

***Results:** Changes in the mean values of the six vertical skeletal parameters were small and in most of the cases not significant. Statistically significant changes in the mean values were observed for two parameters, including angles SN-M° and Go°.*

***Conclusion:** From the obtained results, it cannot be concluded that the combined treatment with the observed appliances affect substantially the vertical growth pattern.*

***Key words:** functional appliance, Class II treatment, vertical growth pattern*

Резюме

Темата за лечебните ефектите на функционалните апарати е противоречива от миналия век насам. Комбинацията от механични действащи апарати - брекети и функционалните ортодонтически апарати тренери може да съчетае предимствата на двата лечебни подхода. Лечението с брекети дава възможност за оптимално подреждане на зъбите в зъбните дъги, а тренерите подобряват оклузалните контакти и мускулния баланс, като по този начин създава предпоставка за стабилност на лечебния резултат.

***Цел:** Целта на представеното изследване е да се оценят промените във вертикалния тип растеж по време на лечението с комбинация от механично действащи брекети и*

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функционално действащи тренери.

Материали и методи: Двадесет пациенти, диагностицирани със скелет и зъбен клас II, са подложени на комбинирано лечение с брекети и тренери (T4B). В края на лечението пациентите са с клас I клас оклузални съотношения при моларите. Всички пациенти имат начални профилни телерентгенографи преди началото на лечението и крайни направени след края на активното лечение. За цефалометричен анализ на направените телерентгенографи е използван софтуер AudaxCeph®. Данните бяха оценени статистически

Резултати: Промените в средните стойности на шестте вертикални скелетни параметъра са малки и в повечето случаи не са статистически значими. Наблюдават се статистически значими промени в средните стойности на два параметъра: ъглите SN-M° и Go°.

Заклучение: Въз основа на наличните доказателства не може да се заключи, че лечението с описаната комбинация от ортодонтични апарати повлиява съществено вертикалния тип растеж.

Ключови думи: функционални ортодонтични апарати, лечение на клас II малоклузии, вертикален тип растеж

Introduction

Functional orthodontic appliances are a proven treatment choice for Class II growing patients [1]. The frequency of class II deformations in the Caucasian race is significantly high 30-40% according to various literature sources [2, 3]. Petrunov found a frequency of 32.1% in children from 7 to 14 years in Bulgaria [3]. This is the most common malocclusion, which determines the importance of this orthodontic problem [4]. Skeletal Class II may result from a distal position of the mandible, medial position of the maxilla, or a combination between them. McNamara examined 277 profile X-rays of children with Class II molar occlusal relationships to study the morphology of the skull in adolescents with class II malocclusion and found that the highest percentage of individuals are with retro position of the mandible 60% [5]. The mandibular retrognathism could result from a distal position of the mandible with proportionally normal size relative to the facial skull or a mandible with a distal position resulting from a proportionately smaller size relative to the structures of the skull.

The treatment approach for mild to moderate forms of mandibular retrognathism in growing patients aims to change the position and size of the mandible by increasing its growth potential [6]. Prepubertal and pubertal growth of the mandible in the sagittal and vertical directions are controlled by the condyle growth center [7]. The advancement of the mandible is performed mainly by the muscle pterygoideus lateralis, which inserts onto the neck of the mandibular

condylar process. The change in the muscle tone of this muscle increases the traction in the area of the growth center, which favorably affects the growth potential of the mandible.

The medial positioning of the mandible under the action of functional appliance is achieved not only in sagittal (anterior-posterior), but in vertical direction, to [8, 9]. In some cases, this vertical component is a desired effect within certain limits, whereas in other cases it isn't. To what extent the vertical component of functional appliance treatment effect influence over the vertical growth pattern is a subject of the present study.

Numerous studies have proven the effectiveness of functional appliances in the treatment of Class II malocclusions, but one of their main drawbacks is the inability to align the teeth in the dental arches. Braces, as mechanically acting fixed appliances, provide optimal leveling and alignment of teeth in dental arches. Thus, it has been a trend to combine a two-phase system to obtain the best of functional and fixed appliance treatment modalities. The simultaneous application of the two treatment appliances in single-phase treatment aims optimal alignment of the teeth, achieving balanced occlusal contacts, Class I occlusal molar relationship and last but not least - balance of the muscles in the maxillofacial area, providing stability of the treatment result [10].

Aim

The aim of the present study is to observe the treatment changes in the vertical growth pattern of, when using combination between two

biomechanical treatment philosophies: the mechanically acting fixed appliances - braces and the removable functional appliances.

Materials and methods

The study involved twenty dental and skeletal Class II orthodontic patients with ANB angle values greater than 40 and Class II occlusal molar relationship, who underwent combined treatment with combination of braces and functional appliance, presented by the trainer T4B (Myobrace®, Myofunctional Research Co, Australia) (Fig. 1).

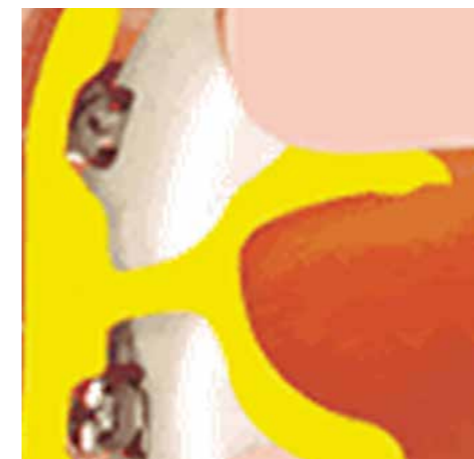


Fig. 1. Trainer T4B combine with braces

Among them, 9 were male (45%) and 11 (55%) female, with no significant difference in the proportional representation of both sexes ($p = 0.752$). The patients' age ranged between 10 and 20 years, with a mean age of 13.80 ± 2.98 years. Patients complete treatment with molar occlusal relationship. Cephalometric analysis on profile X-rays were made for the beginning and the end of the treatment with the software AudaxCeph®. (Fig. 2). We observed 6 parameters of cephalometric analysis before and after to evaluate the vertical growth pattern: SN-M°; SN-FH°; SN-SpP°; SpP-M°; Go°; PFH/AFH. The data was evaluated statistically.

Statistical Analysis

The data was analyzed with the statistical software IBM SPSS version 26 (2018) and Minitab version 19 (2019). Continuously measured and normally distributed variables were

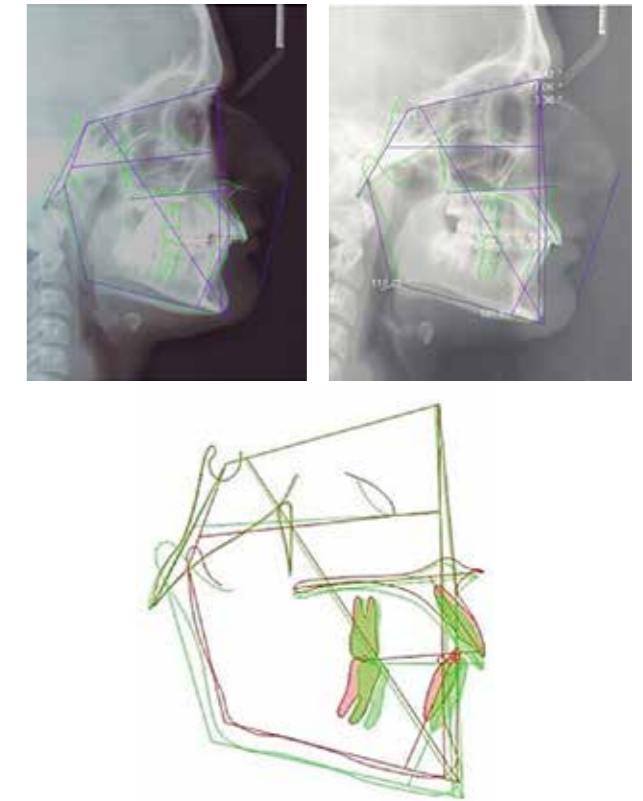


Fig. 2. Cephalometric analysis of the initial and final profile X-rays, and the superimposition between both analyses

described through the mean values and standard deviations ($\pm SD$). Categorical data were processed in frequencies and percentages. A paired-samples t-test was used to compare the cephalometric data before and after the treatment.

Results

Vertical skeletal changes were assessed through paired t-test comparisons of the cephalometric data before and after the treatment (Table 1). Significant changes in the mean values were observed in two of the parameters, including SN-M° ($p = 0.010$) and Go° ($p = 0.019$).

The individual and mean vertical skeletal differences are illustrated on Fig. 3. The mean SN-M° value decreased by $0.60 \pm 0.76^\circ$ after the treatment, from $31.70 \pm 5.01^\circ$ to $31.10 \pm 5.03^\circ$ with significant difference ($p = 0.010$). The plot

Table 1. Paired comparisons of vertical skeletal parameters before and after the treatment

Measurement	Mean±SD	Difference		
		Mean ±SD	Minimum-Maximum	p
SN-M° before	31.70±5.01			
SN-M° after	31.10±5.03	-0.60±0.94	-2.00 to 1.00	0.010
SN-FH° before	8.20±1.88			
SN-FH° after	8.60±2.23	0.40±0.99	-2.00 to 3.00	0.088
SN-SpP° before	10.05±3.05			
SN-SpP° after	10.55±3.20	0.50±1.14	-1.00 to 3.00	0.066
SpP-M° before	21.45±4.61			
SpP-M° after	21.20±4.96	-0.25±2.91	-3.00 to 11.00	0.706
Go° before	121.45±5.38			
Go° after	121.10±4.75	-0.35±2.70	-5.00 to 5.00	0.019
PFH/AFH before	66.70±3.85			
PFH/AFH after	67.50±4.03	0.80±1.39	-1.00 to 4.00	0.569

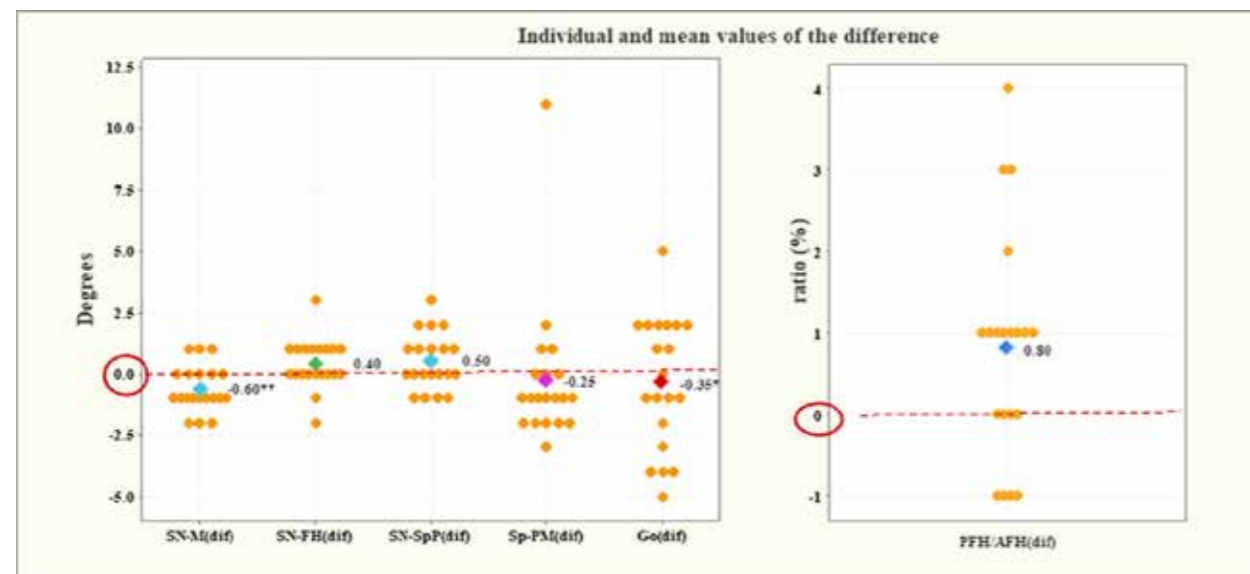
of the individual values of the difference in SN-M° shows a decrease by 1 or 2° in 12 patients (60%), an increase by 1° in 3 patients (15%) and no change in 5 patients (25%).

The mean SN-FH° value increased from 8.20±1.88° to 8.60±2.23°, but the mean difference of 0.40±0.99° was not significant (p = 0.088). Nine patients (45%) had no change in SN-FH°, 9 patients (45%) had an increase and 2 patients (10%) had a decrease in SN-FH° after the treatment.

The mean SN-SpP° value was increased by

0.50±1.14°, from 10.05±3.05° to 10.55±3.20°, but the observed change was not significant (p = 0.066). The individual values of the difference didn't change in 7 patients (35%), an increase of 1° to 3° in 9 patients (45%) and a decrease by 1° in 4 patients (20%).

A slight decrease of -0.25±2.91° was observed in the mean SpP-M° value, from 21.45±4.61° to 21.20±4.96°, but the change was not significant (p = 0.706). In 13 patients (65%) the SpP-M° value decreased by 1°, 2° or 3°. An increase of 1°, 2° or 11° was observed in 4 pa-



* - Significant at p < 0.05; ** - Significant at p ≤ 0.01

Fig. 3. Individual and mean values of the difference in SN-M°, SN-FH°, SN-SpP°, SpP-M°, Go° and PFH/AFH between the measurements taken before and after the treatment

tients (20%) and no change in 3 patients (15%).

The mean Go° value decreased from 121.45±5.38° to 121.10±4.75°, with a significant difference of 0.35±2.70°, p = 0.019. The individual values of the difference showed a decrease from 1° to 5° in 10 patients (50%), an increase of 1° to 5° in 9 patients (45%) and no change in 1 patient (1%).

PFH/AFH ratio had a mean value of 66.70±3.85 before the treatment which increased to 67.50±4.05 after the treatment, with a small difference of 0.80±1.39 with no statistical significance (p = 0.569). The individual changes in PFH/AFH ratio varied from -1 to 4 with the following distribution: 12 patients (60%) had an increase in their baseline PFH/AFH ratio, 4 patients (20%) had a decrease, and in 4 patients (20%) there was no change in the value of the PFH/AFH ratio.

Discussions

The treatment results of removable functional appliances showed statistically significant incensement in some of the vertical skeletal parameters in most of the clinical studies [9, 11, 12]. Most of them showed changes mainly in metrical measurement of the facial height [9, 11, 12] or mandibular angle [9]. Thus, could be explained with allows of vertical development of the mandibular molars.

Other study didn't show evidence for statistically significant vertical skeletal changes during treatment with removable functional appliances [13].

The slight but statistically significant decrease in SN-M° value and Go° value in the present study could be explained by vertical control of the mandibular molars and incisors. Fixed appliances combined with prefabricated myofunctional appliances T4B in one treatment phase, provides vertical control over mandibular molar vertical development and intruded incisors if they were in superimposition by using fixed braces and the horizontal occlusal pad of the T4B [14]. This effect is known as leveling of Spee curve during fixed appliance treatment [15].

Conclusion

From the obtained results, it cannot be concluded that the combined treatment with the observed appliances combination affect substantially the vertical growth pattern. After the treatment, statistically significant changes had occurred in the mean values of only two of the six vertical skeletal parameters, including a significant decrease in SN-M° value and in Go°.

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Mobile photography in dental medicine /intraoral photos/

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Мобилната фотография в денталната медицина /интраорални снимки/

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Summary

Introduction: With the constant improvement of technology in recent years, mobile dental photography is gaining more and more popularity. Mobile phones have almost completely replaced compact cameras in everyday life. The small size of the lens built into the phones is the reason why the image is distorted when shooting close-ups.

Aim: The aim is to determine whether a mobile phone can be used to take standard pictures of patients in everyday dental practice.

Material and methods: A total of 165 intraoral photographs were taken of 33 patients. 5 photos were taken of each of them: one with a DSLR camera and four with a mobile phone with different magnification x2, x3, x4 and x5 and respectively from different distances. In each photo, six linear indicators were measured - three in the vertical direction and three in the horizontal.

Results: In the photos taken with a mobile phone at all magnifications there is a deformation of the image compared to the photos taken with a DSLR camera. The largest deformation is at twice the magnification, and the smallest at five times.

Conclusion: The mobile phone is applicable in cases when the photos will be used for documentation and tracking the course of treatment, but when shooting with five times digital magnification. If you are looking for an image with the correct and as close as possible to the actual proportions of the teeth, the first choice is the DSLR camera.

Keywords: Mobile dental photography; intraoral photos

Резюме

Въведение: С непрестанното усъвършенстване на технологиите в последните години все по-голяма популярност набира мобилната дентална фотография. Мобилните телефони замества почти изцяло компактните фотоапарати в ежедневието. Малкият размер на вградения в телефоните обектив е причината, при заснемането на обекти от близко разстояние образът да е деформиран.

Цел: Целта е да се установи дали може да се използва мобилен телефон за направата на стандартни снимки на пациенти в ежедневието дентална практика.

Материал и методи: Направени бяха общо 165 интраорални снимки на 33-ма пациенти. На всеки от тях бяха направени по 5 снимки: една с огледално-рефлексен фотоапарат и четири с мобилен телефон с различно дигитално увеличение x2, x3, x4 и x5 и съответно от различно разстояние. На всяка снимка бяха измерени 6 линейни показателя – три във вертикална посока и три в хоризонтална.

Резултати: При снимките направени с мобилен телефон при всички увеличения се наблюдава деформация на образа спрямо снимките, направени с огледално-рефлексен фотоапарат. Най-голяма е деформацията при двукратно увеличение, а най-малка при петкратно.

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Заклучение: Мобилният телефон е приложим в случаите когато снимките ще се използват за документация и проследяване на хода на лечението, но при заснемане с петкратно дигитално увеличение. Ако при заснемането се търси образ с правилни и максимално близки до реалните пропорции на зъбите, първи избор е огледално-рефлексният фотоапарат.

Ключови думи: Мобилна дентална фотография; интраорални снимки

Introduction

Dental photography is an increasingly important part of clinical practice in Dental Medicine. In some disciplines, such as Orthodontics, quality photographs are a mandatory part [1]. In other specialties, they are an integral part of the work protocol of dentists who publish scientific articles and/or present their cases to colleagues. In the field of "Aesthetic Dentistry" photographs are a tool for analysis and treatment plan in the preparation of the so-called DSD (digital smile design)

It is still believed that taking quality photos, that can be used not only for documentation but also for participation in scientific forums and publications in magazines and journals, requires a DSLR camera or the most contemporary mirrorless full-format cameras. In recent years, compact cameras with removable lenses, which are smaller and more comfortable to work with, as well as smartphones, have become very popular. With the advancement of technology, the mobile phone is replacing more and more devices, replacing traditional devices such as dictaphones, calculators, cameras, video cameras and more. In recent years, there has been increasing talk of mobile dental photography or how the mobile phone can replace the "irreplaceable" DSLR camera.

The main disadvantage of mobile phones is that when shooting with them, image distortion occurs [2]. The reason is that the lenses that integrate into them have very little focal length. The optimal focal length of a lens for dental photography is 100 mm [3,4], and in phones the focal length is from 2 mm to a maximum of 5 mm. The software in the phones solves this problem to some extent.

Aim

The aim is to determine whether a mobile phone can be used to take standard photos of

patients in everyday dental practice.

To achieve the formulated goal, the following tasks were set:

To compare the intraoral photos of patients taken with a DSLR camera and a mobile phone;

To give recommendations for the optimal distance from the photographed subject when shooting with a mobile phone in order to create quality photos.

Materials and methods

A total of 165 intraoral images were taken of 33 patients, 11 (33.3%) men and 22 (66.7%) women, with mobile phone images taken at magnification x2, x3, x4 and x5 (fig. 1), respectively from different distances: 10 cm, 20 cm, 30 cm and 40 cm. The purpose of zoom shooting was to increase the distance from the lens to the subject to reduce image distortion.

The photos were taken according to the established rules and requirements for dental photography[5] for capturing the upper and lower dentition in a central occlusion:

- The patient bites in a central occlusion
- The camera should be positioned at the level and parallel to the occlusal plane
- Teeth from molar to molar should be visible
- The focus is on the maxillary canines

The measurements were made with IC Measure software. To set the actual dimensions, the photos were taken with a ruler with millimeter lines and subsequently calibrated with the software. We used the Normando method [6], in which the ruler is attached to the cheek retractor.

The photos were taken with a Samsung Galaxy 9 Plus phone, using a telephoto camera, which gives twice the optical magnification of the image. The settings of the camera of the phone when shooting are: professional mode; aperture-2.4, ISO 100, speed 1/50s. The matrix of the phone is 12MP Back-lit CMOS. The

Smile Lite MDP device by Smile Line (fig. 2) with only side lights on was used for lighting.

Reference points were set for the analysis of the photographs. The distances between these points were measured and compared to the photos taken with a DSLR camera with those taken with a mobile phone with different magnification and from different distances. The measured linear indicators are in vertical and horizontal direction, and a total of 990 measurements were made.



Fig. 1. Intraoral photographs taken with: a) a DSLR camera; b) mobile phone with magnification x2; c) mobile phone with magnification x3; mobile phone with magnification x4; mobile phone with magnification x5



Fig. 2. Smile Lite MDP

The following distances were measured in the analysis of intraoral images(Figure 3):

- Inc width - the mesiodistal width of the tooth 11
- 3-3 - the distance between the incisal edges of the upper canines
- 6-6 - the distance between the tips of the mesiobuccal cusps of the upper first molars
- Inc height - the distance from the most apical point of the gingival margin to the incisal edge of tooth 11
- Canine height - the distance from the most apical point of the gingival margin to the incisal edge of the tooth 13
- Molar height - the distance from the most apical point of the gingival margin to the tip of the mesiobuccal cusp of tooth 16



Fig. 3. Parameters used in the analysis of intraoral photos: (1) Inc width; (2) 3-3; (3) 6-6; (4) Inc height; (5) Canine height; (6) Molar height

The data was processed with the IBM SPSS Statistics 25.0 statistical package. A 95% confidence interval ($p < 0.05$) was chosen for a significance level at which the null hypothesis was rejected. Descriptive, variational, and graphical analysis, Mauchly test for multivariate normality, Shapiro-Wilk test for normality distributions,

nonparametric Friedman test for hypothesis for difference between several dependent samples and nonparametric Wilcoxon test for two dependent samples were applied.

Results

In the analysis of the measurements of the intraoral images the following results were obtained (Table 1):

- At Inc height and Canine height, the average values of the measurements in the photos taken with mobile phone with magnification x2, x3 and x4 are significantly lower than that of the photos taken with a DSLR camera, and at magnification x5 - statistically identical to its average value;
- At Molar height, Inc width, 3-3 and 6-6 significantly lower mean values compared to the values measured in photos taken with DSLR camera were observed in all other measurements.

From Table 2 it is clear that in all six param-

Table 1. Dynamics of the studied parameters

Parameter	n	Type of the photos									
		DSLR camera		Mob. phone x2		Mob. phone x3		Mob. phone x4		Mob. phone x5	
		\bar{X}	SD	\bar{X}	SD	\bar{X}	SD	\bar{X}	SD	\bar{X}	SD
Inc height	33	8,96 ^a	1,02	8,25 ^b	1,03	8,61 ^b	1,07	8,80 ^b	1,03	8,99 ^a	1,07
Canine height	33	7,44 ^a	1,56	6,69 ^b	1,44	7,05 ^b	1,52	7,25 ^b	1,55	7,46 ^a	1,60
Molar height	33	4,98 ^a	1,14	3,90 ^b	1,03	4,39 ^b	1,05	4,61 ^b	1,06	4,87 ^b	1,14
Inc width	33	8,43 ^a	0,58	7,77 ^b	0,60	8,06 ^b	0,60	8,24 ^b	0,58	8,38 ^b	0,59
3-3	33	33,35 ^a	2,08	29,77 ^b	1,89	31,27 ^b	2,05	32,16 ^b	2,07	32,85 ^b	2,08
6-6	33	47,54 ^a	1,99	40,12 ^b	1,98	43,38 ^b	2,14	45,32 ^b	2,23	46,60 ^b	2,14

*- the same letters horizontally mean no significant difference from the first dimension, and different - the presence of such ($p < 0,05$)

Table 2. Comparative analysis of the differences in the studied parameters compared to the values of the photos taken with a DSLR camera

Parameter	n	Differences from the measurements of the values from the photos taken with a DSLR camera (1)							
		2-1		3-1		4-1		5-1	
		\bar{X}	SD	\bar{X}	SD	\bar{X}	SD	\bar{X}	SD
Inc height	33	-0,71	0,25	-0,35	0,20	-0,16	0,17	0,03	0,18
Canine height	33	-0,74	0,25	-0,38	0,23	-0,19	0,18	0,02	0,20
Molar height	33	-1,08	0,43	-0,59	0,27	-0,37	0,25	-0,11	0,25
Inc width	33	-0,66	0,21	-0,37	0,15	-0,19	0,14	-0,05	0,14
3-3	33	-3,58	0,70	-2,08	0,63	-1,19	0,61	-0,50	0,56
6-6	33	-7,42	1,23	-4,16	1,11	-2,22	0,99	-0,94	0,99

ters the largest in absolute value difference compared to the measurements of the photographs taken with a DSLR is observed in the photographs taken with a mobile phone with magnification x2, and the smallest - at magnification x5.

Following the dynamics of the parameters inc height (Fig. 4) and canine height (Fig. 5), the largest difference compared to the values when shooting with a DSLR camera is observed at twice the magnification. At three and four times magnification there is a permanent increase in the values and at five times they are statistically the same.

For the parameters molar height (fig. 6), inc width (fig. 7), 3-3 (fig. 8) and 6-6 (fig. 9) the following changes are observed:

- At twice the magnification, there is the biggest difference from the values when shooting with a DSLR camera.
- At each subsequent magnification (x3, x4 and x5) there is a permanent increase in the values, as the difference in the five times magnification compared to the values when shooting with a DSLR camera is the smallest

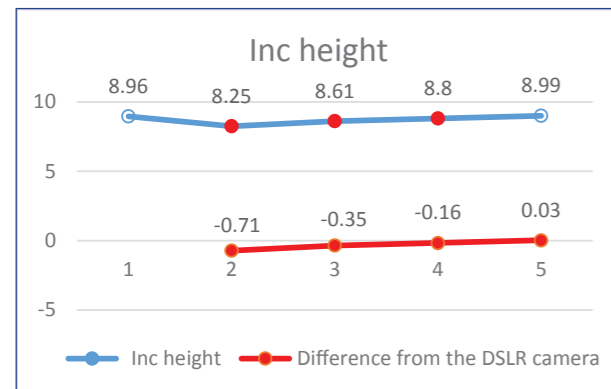


Fig. 4. Dynamics of the Inc height parameter

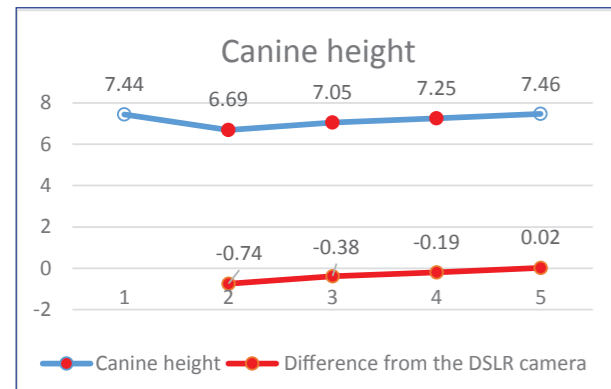


Fig. 5. Dynamics of the Canine height parameter

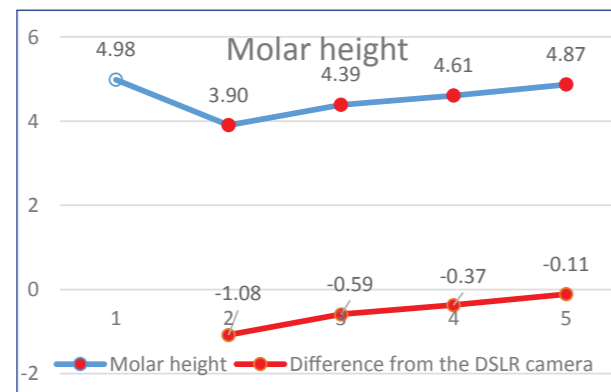


Fig. 6. Dynamics of the Molar height parameter

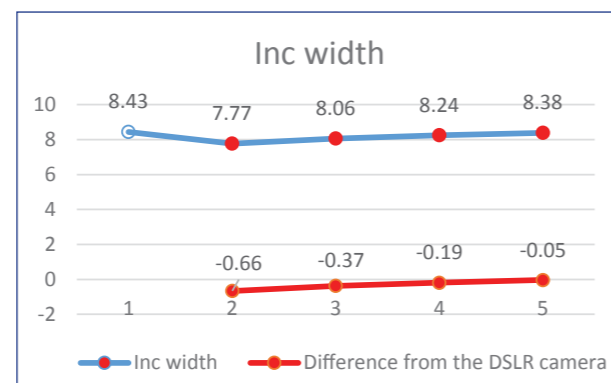


Fig. 7. Dynamics of the Inc width parameter

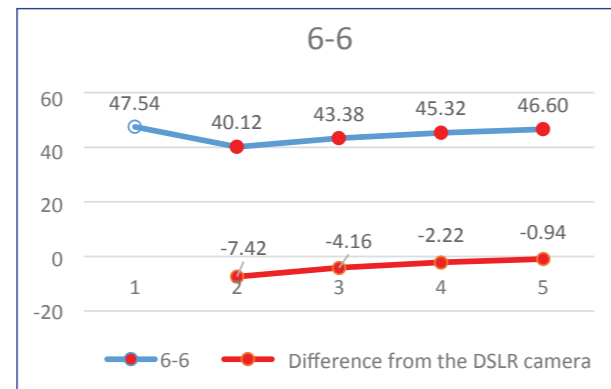


Fig. 8. Dynamics of the 3-3 parameter

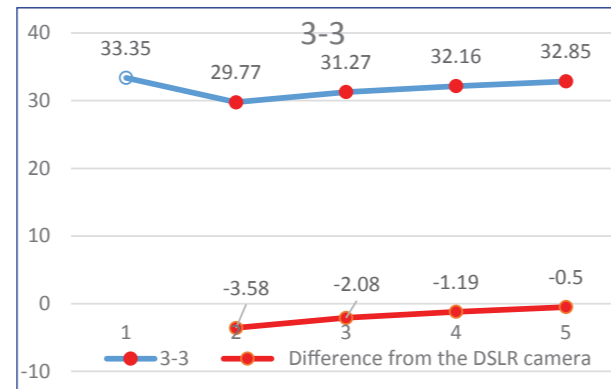


Fig. 9. Dynamics of the 6-6 parameter

Discussion

The working hypothesis that image deformation will be observed when shooting with a mobile phone has been confirmed. The main reason is the perspective, as the objects that are closer to the lens appear larger than those that are further away. The small lens of mobile phones and the short focal length cause visible image distortion. The closer the photos are taken, the more deformed the image, as the objects located in the center are close to normal sizes and with the distance to the periphery the dimensions decrease.

It is noteworthy that the values for the height of the clinical crown of the central incisor and canine are with similar changes, and at five times magnification there is no statistically significant difference from the photos taken with a DSLR camera. When measuring the height of the molar, a difference is observed even at magnification x5.

Measurements of the parameters in the horizontal direction show a decrease in the width of the incisor, the intercanine and intermolar distance. The most pronounced are the changes in the width of the dental arch in the area of the mesiobuccal cusps of the first permanent molars. The difference is noticeable even without measuring when comparing the photos taken with mobile phone with different magnification with the one taken with a DSLR camera (Fig. 1). However, at five times magnification, the difference is less than 1 mm, which is acceptable when the images are used for comparison between the different stages of treatment and not for diagnosis with biometric measurements. In the area of canine teeth, the changes are less pronounced. At five times magnification, there is a statistically significant difference even for the width of the central incisor, but it is only 0.05 mm.

There are not enough publications in the literature to compare measurements made on photos taken with a mobile phone with different magnification and a DSLR camera. In his study, Lui M. et al. [7] obtain results that differ from those obtained from this study. They recommend using four times digital zoom when imaging the front teeth, with no difference in the height and width of the central incisor or in the ratio between the widths of the upper anterior teeth compared to a DSLR camera. The authors do not recommend an exact distance from which to take photos.

The optimal magnification for taking intraoral photos in dental practice with a mobile phone is five times and the distance between the camera and the object – 40cm.

Conclusion

The DSLR camera remains an indispensable device in the arsenal of equipment of the Dentist. Mobile phones still cannot be relied on to take intraoral photos in which the size and proportions of the teeth are as close as possible to the real ones. However, the values measured at five times magnification are close to the real ones.

In disciplines such as Orthodontics, where photos are used for documentation and treatment follow-up, mobile phones can be used using five times digital zoom for imaging. In cosmetic dentistry, where photos are used to create a digital smile design and/or to communicate with dental technicians, it is preferable to use a DSLR camera.

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Opportunities for access to dental care

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Възможности за достъп до дентална помощ

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Summary

Dental health is an integral part of general human health. Access to dental health is one of main prerequisites for good health. Demographic characteristics of population, as well as dynamics of number and territorial disposition of dentists determine opportunities for access to dental care.

Aim

The aim of the study is to explore opportunities for access to dental care in different regions of Bulgaria in connection with the number and territorial provision of the population with dentists and dynamics of these processes in the last 12 years.

Material and method

A meta-analysis of statistics from official sources providing information on the status and dynamics of the demographic characteristics of the population and of dentists, was conducted. A statistical analysis of the results was made.

Results and discussion

Increasing the number of dental specialists offers greater opportunities and accessibility of dental services for the population. At the same time, there is a clear tendency for concentration of dentists in economically and demographically better developed regions of the country, favoring access to dental care in these areas. Bulgaria is on the first places by dentists per capita in Europe, but the level of dental health of the population is still far from desired.

Key words: access, barriers, dental care, dental health

Резюме

Денталното здраве е неизменна част от общото здраве на човека. Достъпът до дентална помощ е основна предпоставка за добро дентално здраве. Демографските характеристики на населението, както и динамиката на броя и разпределението на денталните лекари определят възможностите за достъп до услуги.

Цел

Целта на изследването е да проучи възможностите за достъп до дентална помощ в различните региони на България във връзка с броя и териториалната осигуреност на

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населението с лекари по дентална медицина и динамиката на тези процеси в последните 12 години.

Материал и методи

Осъществи се мета-анализ на статистически данни от официални източници, даващи информация за състоянието и динамиката на демографската характеристика на населението и на лекарите по дентална медицина. Направи се статистически анализ на резултатите.

Резултати и обсъждане

Повишаването на броя на денталните специалисти предлага по-големи възможности и достъпност на денталните услуги за населението. Същевременно с това се наблюдава ясно изразена тенденция за концентрация на денталните лекари в икономически и демографски по-добре развитите региони в страната, благоприятствайки достъпа до дентални грижи в тези области. България се намира на едно от първите места по брой на денталните лекари на глава от населението в Европа, но въпреки това нивото на дентално здраве на населението все още е далеч на желаното.

Ключови думи: бариери, дентално здраве, дентална помощ, достъп

Introduction

“Access to healthcare” is defined as an indicator for measuring health inequalities. There are different aspects of access to medical and dental care - physical accessibility, time access to services, affordability, organizational and cultural aspects of access. [1] Access to professional dental care is crucial for opportunity to receive and use dental services.[2] Access to health care includes such factors as the availability of regular healthcare provider, convenient location and the absence or presence of health insurance. The availability of regular access to medical and oral health care is perceived as a key indicator, as it facilitates the continuity and quality of health services. Impaired access to services is even more significant factor obstructing obtaining of dental care. [3, 4, 5] Different factors influence access to healthcare services for different groups of population. According to Oliver et al. [6] this factors can be distinguished by:

- Income – as a barrier for obtaining dental care,
- Geographic location – expressed in the remoteness of practice as an obstacle for access
- Ethnicity – as a prerequisite for opportunities and difficulties for communication
- Factors of supply and demand of health services (availability of dental practices (general and specialized), dental needs of

the population, specifics of requested and offered services, etc.).

Geographical location of medical institutions determines the proximity of health services to the costumers and differs significantly between the different regions on the territory of the same country. It should be noted that exist so-called “permissible” variations in the supply of health services – especially specialized ones, which cannot be located completely evenly on the territory of the country. However, it is necessary to provide accessible services in all regions in such quantity and quality that is defined as needed by population according to its health needs. In order to achieve this, health resources must be distributed among the regions according to population size, health needs and income disparities in all of the regions. [7]

Purpose and tasks

The aim of the research is to study opportunities to access to dental care in different regions of Bulgaria and to trace the development if these processes over the last 12 years.

The following tasks were formulated to accomplish the aim:

- To study the dynamic of the demographic characteristics of population in last 12 years.
- To study the territorial distribution of dentists in the last 12 years.

- To study the access to dental services for the population.

Material and methods

We performed meta-analysis of statistical data from official sources – National Statistical Institute (NSI), Bulgarian Dental Association (BDA), Eurostat, and a number of publications providing information on the status and dynamics of the demographic characteristics of the population and the number of the dentists in Bulgaria and European Union (EU). A statistical analysis of the results was made to determine the opportunities for access to dental care. Existing trends were described and analyzed.

Results

Dynamics of population

According to data from the National Statistical Institute [8], there is a clear trend of decreasing of the absolute number of the population in the country over the past 12 years (Table 1).

Table 1. Average annual population

Year	Population				
	Total number	Residence		Gender	
		City	Village	Male	Female
2007	7640238	5403188	2237050	3699689	3940549
2008	7606551	5407105	2199446	3681280	3925271
2009	7563710	5401214	2162496	3659311	3904399
2010	7504868	5375069	2129799	3629809	3875059
2011	7327224	5324900	2002324	3566767	3760457
2012	7284552	5307868	1976684	3545073	3739479
2013	7245677	5291675	1954002	3524945	3720732
2014	7202198	5267480	1934718	3502015	3700183
2015	7153784	5227182	1926602	3477177	3676607
2016	7101859	5204385	1897474	3449978	3651881
2017	7050034	5181755	1868279	3422409	3627625
2018	7000039	5159129	1840910	3395701	3604338

Table 2. Population and natural increase by administrative regions

Administrative region	Year									Natural increase
	2010	2011	2012	2013	2014	2015	2016	2017	2018	
North-Western	894724	842416	830035	816935	803771	790526	776766	762790	749130	-145594
North - Central	908411	857793	848989	840162	830675	820489	810441	800220	789583	-118828
North - Eastern	985748	964147	959712	955997	952246	947208	941860	936484	931370	-54378
South - Eastern	1111505	1075723	1070415	1065836	1061103	1055545	1049350	1042837	1035814	-75691
South - Western	2113036	2132482	2130008	2128201	2126414	2123199	2118265	2111869	2105300	-7736
South - Central	1520865	1475767	1466729	1457984	1449728	1441026	1431140	1421748	1413840	-107025

When considering the dynamics of the population in the six administrative regions of the country in the period 2010 - 2018 (Table 2), we found the tendency for decrease of the population number in all the regions, but this process is more noticeable in those of them that are more underdeveloped economically. The depopulation is the strongest in the North-Western and North-Central regions, and the least in the South-Western region of Bulgaria. [9]

When considering the dynamics of the population in the cities and villages in the six administrative regions of the country, we found the following trends (Table 3):

- Decrease of the rural population in all regions, as it is most significant in the North-Western region, and the least in the North-Eastern.
- Decrease in the urban population in all regions except the South-western, where there is a positive growth of urban population number.
- The most significant is the decrease of the population number in the urban areas in the North-Western and North-Central regions, and it surpasses in value even the decrease in the rural population in these regions.

When considering the dynamics of the population in the largest municipalities in the regions, we found again a tendency to reduce the population number in them, except the municipalities of Sofia and Varna. (Table 4)

Available data on migration for the period 2012 – 2018 show a predominance of the number of emigrants with 93 709 compared to the

Table 3. Dynamics of population by regions

Year	Region											
	North-Western		North-Central		North-Eastern		South-Eastern		South-Western		South-Central	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
2010	558422	336302	596013	312398	700404	285344	779501	332004	1741945	371091	1011857	509008
2011	532609	309807	571143	286650	704928	259219	770287	305436	1772908	359574	984491	491276
2012	525858	304177	566376	282613	702651	257061	766874	303541	1774431	355577	980194	486535
2013	518951	297984	561524	278638	700845	255152	764548	301288	1776871	351330	977033	480951
2014	511227	292544	555871	274804	698295	253951	761974	299129	1779056	347358	973154	476574
2015	500600	289926	548813	271676	692989	254219	760044	295501	1777882	345317	967004	474022
2016	490388	286378	542127	268315	688432	253428	758019	291331	1775512	342753	961307	469834
2017	483514	279276	536478	263742	685809	250675	754871	287966	1774105	337765	958294	463454
2018	476955	272176	530490	259094	683258	248112	751476	284339	1772786	332514	955479	458362
Growth	-81468	-64127	-65524	-53305	-17146	-37232	-28026	-47666	30841	-38578	-56379	-50647

Table 4. Population in the largest municipalities

Municipality	Year									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	Growth
Pleven	288543	268490	264917	261166	257556	253868	250062	246174	242295	-46248
Veliko Tarnovo	273397	257558	254929	252353	249454	246394	243633	240696	237420	-35977
Varna	465283	474560	473880	473745	473940	473365	472790	472387	471686	6403
Burgas	421786	415428	414550	414320	414335	414034	413284	412132	410955	-10831
Sofia	1254622	1294205	1299465	1305975	1313095	1318181	1321721	1324533	1326775	72153
Plovdiv	698992	682091	679872	678528	676892	674435	672428	670685	669065	-29927

number of Bulgarians returned to the country.

Dynamics of the dentists in Bulgaria

There is an increase in the number of dentists in the country according to the data of the NSI and the BDA for the period 2007-2017. According to NSI, their number has increased by 1923 people. (Table 5)

Table 5. Number of population and dentists

Year	Population	Dentists
2007	7640238	6432
2008	7606551	6288
2009	7563710	6493
2010	7504868	6355
2011	7327224	6655
2012	7284552	6706
2013	7245677	7247
2014	7202198	7013
2015	7153784	7512
2016	7101859	8011
2017	7050034	8355

According to the BDA, the dynamics of the number of dentists in the country shows an increase in recent years. [10] Data for the last seven years show an increase in the number of dentists by 1558 people. (Table 6)

Dentists are unevenly distributed throughout the country. Their number increases in centers such as Varna (from 381 in 2000, to 426 in 2009, and 758 in 2019), Plovdiv (from 785 in 2000 to 936 in 2009, and 1383 in 2019), Sofia (from 1543 in 2008 to 2400 in 2011, and 3238 in 2019), where are located the Faculties of dental medicine in Bulgaria. The changes in the age composition of the dentists for the country as a whole and for Sofia are opposite. The gender distribution corresponds to the statistical ratios in other countries as well. [11]

The general trend for increasing the number of dental specialists after 2011 is valid for the Regional colleges of BDA – Blagoevgrad, Burgas, Varna, Veliko Tarnovo, Pernik, Plovdiv, Ruse, Sofia and Sofia-region. There is preservation and even a decrease in the number of dentists in the other Regional colleges of BDA. These divergent changes in the number of practicing

Table 6. Members of BDA by District

District	Year						
	2012	2013	2014	2015	2017	2018	2019
Blagoevgrad	297	319	308	344	360	367	373
Burgas	369	384	383	399	413	430	431
Varna	537	589	614	683	719	731	759
Veliko Tarnovo	214	218	209	209	208	215	223
Vidin	107	106	106	106	100	97	100
Vratsa	136	142	138	142	141	143	142
Gabrovo	128	129	99	130	135	133	131
Dobrich	132	135	125	126	126	127	130
Kurdzhali	141	144	150	148	157	157	155
Kjustendil	160	153	137	149	144	149	146
Lovech	117	116	116	116	114	108	112
Montana	100	102	101	95	96	94	94
Pazardzhik	200	173	252	251	255	252	249
Pernik	140	146	148	151	147	156	153
Pleven	188	186	182	188	183	187	191
Plovdiv	1151	1292	1275	1309	1346	1355	1383
Razgrad	74	74	63	72	75	72	72
Ruse	197	194	194	203	209	208	212
Silistra	76	76	71	78	82	81	79
Sliven	156	166	161	162	167	157	153
Smolyan	127	128	130	125	127	125	128
Sofia	2372	2472	2888	2879	3002	3138	3238
Sofia - region	149	148	157	165	165	169	169
Stara Zagora	332	352	336	341	340	343	348
Turgovishte	68	69	68	67	69	70	49
Haskovo	242	246	239	238	243	244	245
Shumen	116	105	118	118	120	136	126
Yambol	105	110	106	103	100	97	98
Members of BDA	8131	8474	8874	9097	9343	9541	9689

dentists prove once again that the negative trend of uneven distribution of dentists throughout the country is deepening. [11]

Accessibility of dental services for the population

Based on the considered data on the population dynamics and the number and territorial distribution of dentists in the country, we calculated the *Average number of patients per one dentist* and the *Average dentists per 100 000 people*. (Table 7) These indicators show the opportunities for access to dental treatment and the coverage of the population with dental services. The NSI data were used to calculate these indicators. [9]

The quality of dental services and thus the characteristics of dental status of population depend not only on the socio-economic environment, but also on the number of the serviced population by a dentist. This ratio varies in dif-

ferent countries. In Denmark, Finland, Greece, Iceland and Sweden the ratio is 1:1000, in Spain and Portugal it is 1:2700 – 3500. [11, 12]

According to Tsokov [11], there were 2971 patients per dentist (including dentists from the public and private sector) in Bulgaria in 1956; in 1980 there were 1834 per dentist; in 1990 – 1419; in 1995 – 1530; in 1996 there were 1803 patients per dentist. NCHI data for 2000 indicate 1202 patients per dentist; 2001 – 1217 patients; 2003 – 1205 patients; 2004 – 1196 patients; 2005 – 1189 patients; 2006 – 1179 patients; 2007 – 1188 patients; 2008 – 1210 patients; 2009 – 1165 patients per dentist. [11]

Comparing the Eurostat data for 2016 [13], we found that our country ranks second in Europe by the number of dentists per 100 000 inhabitants with a value of 112 dentists. (Fig.1) This is more than 30 dentists more than leading European economies such as Germany (85 den-

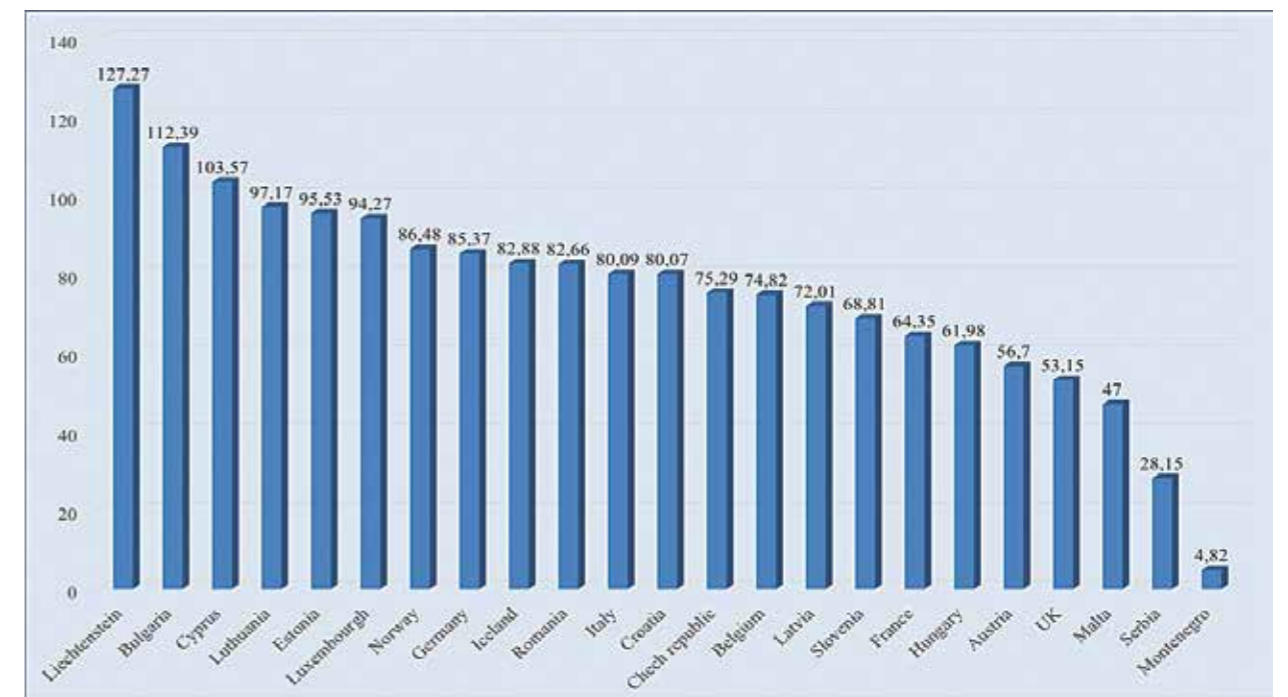
Table 7. Opportunities for access to dental care

Year	Population	Number of dentists	Average number of patients per one dentist	Average number of dentists per 100 000 people
2007	7640238	6432	1188	84
2008	7606551	6288	1210	83
2009	7563710	6493	1165	86
2010	7504868	6355	1181	85
2011	7327224	6655	1101	91
2012	7284552	6706	1086	92
2013	7245677	7247	1000	100
2014	7202198	7013	1027	97
2015	7153784	7512	952	105
2016	7101859	8011	887	113
2017	7050034	8355	844	119

tists per 100 000 inhabitants) and Italy (80 dentists per 100 000 inhabitants), and almost double compared to France (64 dentists per 100 000 inhabitants). On the other side of the ranking are countries as Serbia with 28 dentists per 100 000 inhabitants and Montenegro with only five dentists per 100 000 inhabitants.

The total number of dentists in 2016 for the entire EU is 358 000, which is equivalent to 70.0 specialists per 100 000 inhabitants. The available data show that the total number of dentists in the member states shows low grow rates in the period 2009 – 2016 with total increase of 4.9%. this leads to an increase of the number of dentists per

100 000 inhabitants for the period from 67.6 to 70.0. The highest values of the dentist/population ratio are observed in the capital regions of the respective countries. Such regions are observed in Romania, Germany, Bulgaria, Spain, Czech Republic and especially Greece (Attiki had the highest ratio in the EU, at 163.5 dentists per 100 000 inhabitants). The high number of dentists in capital city regions may be linked, at least in part, to the critical mass of potential patients provided by such large urban areas, as well as the high number of universities, research establishments, dental schools and specialist hospitals that are located in and around capital cities. In 2015, the

**Figure 1.** Dentists per 100 000 inhabitants in EU countries

only non-capital city region among the seven highest regional ratios was South-Central region in Bulgaria (129.8 dentists per 100 000 inhabitants). [14]

According to EUROBAROMETER report on oral health [15] from February 2010, 92% of Europeans state that they have no problems accessing dental services when needed. The highest opportunities for access to dental care were found in Cyprus – 99%, Malta and Hungary – 98%, and the lowest in Latvia – 88%, Poland and UK – 87%, Romania – 81%, and Lithuania – 76%. The result for Bulgaria coincides with that of the EU – 93%. [15]

The proximity of dental practice is a key factor when it comes to consultation and dental treatment. The majority of Europeans (88%) believe that it would be possible to visit a dental office located within 30 minutes of their home or workplace. The highest percentage is in Cyprus (96%), Belgium (96%), and France (95%), and the lowest in Slovakia (78%) and Estonia (76%). Eighty-seven percent of Bulgarians said that they have such opportunity. [15]

The availability of dentists does not seem to be a problem for Europeans, as 89% of small and medium-sized city residents stated that they can find a dentist within thirty minutes of home or workplace. This confidence is shared by 87% of the inhabitants of villages and large cities. These results suggest that the territorial coverage is equally satisfactory, both in the developed regions and the less favorable ones. Only one percent of Europeans indicates the remote location of dental practice as an obstacle to access to dental services. [15]

The results of a study by B. Bonev et al. [16] show that only 4,2% of the 1636 people surveyed obtain difficulty accessing dental care due to lack of practice nearby, with 96% of them living in the rural areas.

Discussion

The dynamics of the population in the period 2007 – 2018 shows a tendency to decrease its number, due to migration processes, and the negative natural growth. The most significant population decline was observed at the beginning of the previous decade. Freedom of move-

ment within the EU has led to serious migration of the Bulgarians.

There is a tendency to reduce the number of the population in all regions of the country, and this process is more noticeable in the less economically developed ones. The most serious is the depopulation in the North-Western and North-Central regions, and the weakest in the South-Western region of the country.

There is a tendency for concentration of the population in the cities, especially in the economically better developed regions. An example of this are cities like Sofia and Varna, as in Sofia the tendency is towards constant increase of residents. This fact can be explained by the concentration of a large part of industrial production and business, as well as the universities in the capital of Bulgaria.

The dynamics of the number of dentists in Bulgaria shows a tendency for continuous increase regardless of the application of the so-called “Dental directives”- 78/686 and 78/687 of the EU, protecting the law in practice throughout the Union, and leading to migration of specialists in the other member states. This increase is due to several factors:

- Increasing of the number of graduate dentists – as in 2005 was established the third Faculty of dental medicine in the country (in Varna), and the first graduates of it was in 2011.
- Another main reason for the increase of the number of dentists is the increased retirement age in the country. The characteristics of dental profession in Bulgaria show a tendency for the dentists to work until elderly, while they are healthy. This is due to the desire to feel useful for the society, as well as for economic reasons.

The dynamics of the number of patients per dentist shows a clear tendency to reduce the number of the population served by a dental specialist. During the reviewed period, it decreased from 1188 to 844 patients per dentist. (Fig.2) The reasons for this can be sought in two directions. On the one side, the total number of the population in the country decreases as a result of the demographic processes, and on the other side the total number of the dentists in the country increases,

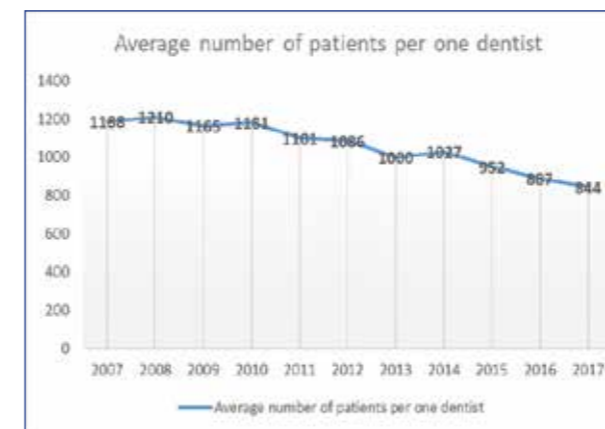


Figure 2. Average number of patients per dentist

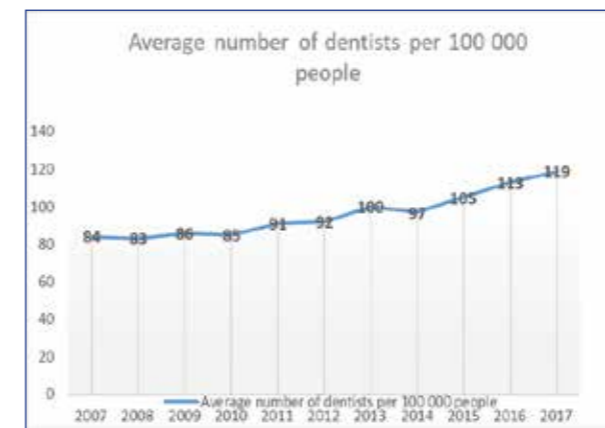


Figure 3. Average number of dentists per 100 000 inhabitants

due to the larger number of newly graduated ones from the dental faculties in the country, as well as the professional longevity.

The healthcare system in Bulgaria is organized in such way that allows freedom of choice for the patient for his attending dentist. The dynamics of the number of dentists per 100 000 inhabitants shows a tendency to increase the average number during the reviewed period. In 2007 it was 84 dentists per 100 000 people, while in 2018 it was already 103 dentists. (Fig. 3) This is a prerequisite for better coverage of the population with dental services and leads to increase of their opportunities for access to dental care.

Conclusion

The increase in the number of dentists predisposes better access to dental services for the population, giving options for choosing a dentist and dental practice according to the patient's needs. The higher number of dentists in relation

to the number of population leads to the greater probability for affordable quality medical care. This is a prerequisite for increasing the level of dental health of the population.

As a result of the demographic and economic characteristics of the different regions of the country, there is a concentration of dentists in the economically better developed ones. This helps to meet the increased need for dental care of the population in these areas, but at the same time it creates preconditions for inequalities in healthcare and dental care for the population in the less developed regions. Incentives for dentists practicing in disadvantaged areas are still insufficient.

Considering the dynamics of the number of dentists per 100 000 inhabitants in the six administrative regions of Bulgaria in the period 2010 – 2018 we can make the following conclusions (Fig. 4):

- The smallest is the number of dentists in the North-Western, North-Central and South-Eastern regions.
- There are low values in the North-Eastern region at the beginning of the period, but towards the end it marked a significant increase in the number of dentists. The reason for this phenomenon can be found in the development of the Faculty of dental medicine in Varna and the increase in the number of graduates from it after 2011.
- The highest is the number of dentist per 100 000 inhabitants in the South-West and South-Central regions. The fact that a large part of the country's population is concentrated in these regions should not be overlooked, which gives even greater importance to the observed trend.

The considered dependencies allow us to summarize that there is a tendency for uneven territorial distribution of dentists/dental practices and striving for their concentration in economically better developed regions of the country. This, on one hand, creates opportunities for providing the necessary needs for dental services to the population of these areas, but at the same time is a prerequisite for limiting such in the less developed ones.

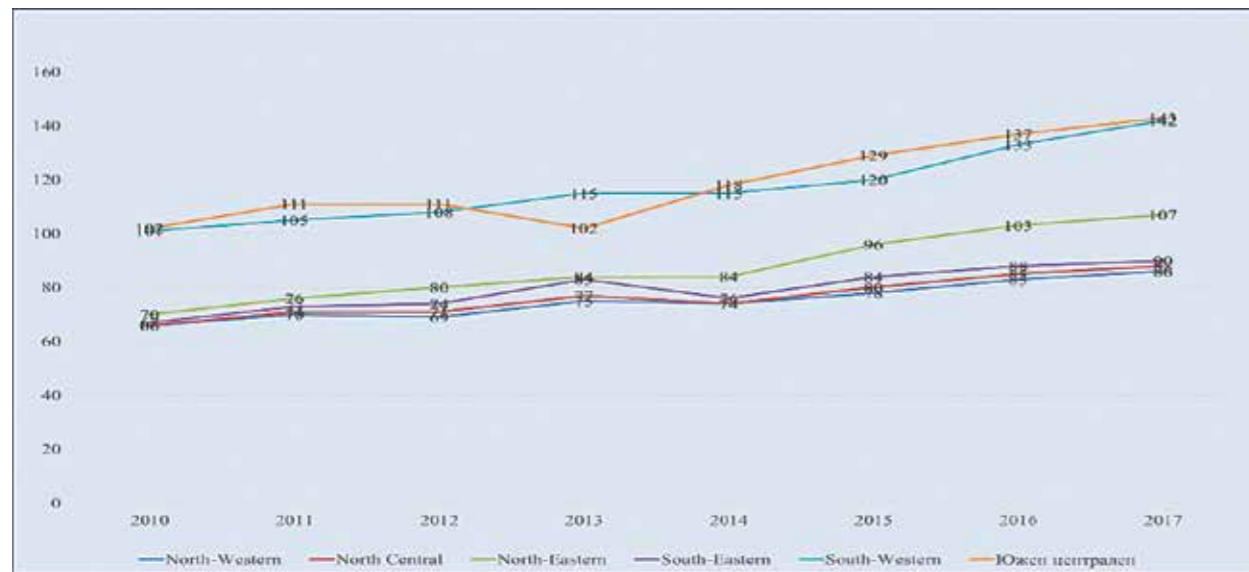


Figure 4. Dentists per 100 000 inhabitants by administrative regions

Access to dental care is fundamental to the dental health of the population. Providing opportunities for dental care for the population should be a major task and priority of the state, society and the dental profession.

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Emergence profile of porcelain veneers and gingival design in the digital workflow

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Профил на порцелановите фасети и оформяне на венечния контур в дигиталния работен процес.

Илиев Г.¹

Abstract

This clinical report describes a step-by-step novel digital protocol on the relation between the tooth's cervical emergence profile and gingival soft tissues. The clinical finding represents a challenging case, as a subgingival restoration margin is needed in order to distinguish subgingival emergence profile responsible for support, sculpting and stability of soft tissue. This requires a technique for obtaining a deeper reading of the sulcus when the digital approach falls short. Aligning two (or more) 3D models is an operator-sensitive operation. Three models were superimposed and the boundary between the soft tissue level before and during the retraction was clearly marked. This allowed us to read very well the depth of the sulcus and the specific limitations when creating the subgingival aspect of the emergency profile of the veneers. Acrylic alveolar hard model with polyurethane removable dies, as well as wax prototypes of the veneers were milled. Veneers were carefully adapted and manually finished on the dies, and then pressed from lithium disilicate. Post treatment result observed during the three-year follow up period is still stable and beautiful.

These techniques should be applied during the laboratory procedures in order to understand the relation between tooth and gingiva and create restorations while preserving the shape and stability of the soft tissue.

Key words: emergence profile, porcelain veneers, digital workflow, marginal design, smile design, prosthodontics.

Резюме

Представеният клиничен случай описва поэтапно нов изцяло дигитален протокол за оформяне на профила на порцелановите фасети и взаимовръзката с маргиналният венечен контур. Клиничната находка представлява труден случай, тъй като е необходимо прецизно оформяне на субгингивален контур на порцелановите фасети, отговорен за поддържането, оформянето и стабилността на меките тъкани. За целта е необходимо да се използва техника, чрез която ясно да се визуализира венечният джоб в неговата пълна дълбочина, при което интраоралното сканиране може да се окаже недостатъчно ефективно. За постигането на тази цел три дигитални модела бяха съпоставени и границата между нивото на меките тъкани преди и по време на ретракцията беше ясно маркирана. Това позволи да се разграничи много добре дълбочината на венечният джоб и специфичните

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ограничения при създаването на субгингивалния аспект на профила на изникване на фасетите. Акрилен алвеоларен твърд модел с подвижни пънчета от полиуретан, както и восьчни прототипи на фасетите бяха фрезовани. Фасетите бяха внимателно адаптирани и ръчно завършени върху модела и след това пресовани от литиев дисиликат. Резултатът след лечението, наблюдаван през тригодишния период на проследяване, е все още стабилен и красив.

Представеният изцяло дигитален протокол спомага за по-прецизно оформяне на профила на порцелановите фасети отговорен за поддържането, оформянето и стабилността на меките тъкани.

Ключови думи: профил на изникване, порцеланови фасети, дигитален протокол, маргинален дизайн, дизайн на усмивка, протезиране.

Introduction

Dental esthetics always must be supported by gingival esthetics. The morphology of the cervical third greatly influences the gingival design. The marginal precision of restorations is also responsible for the health and stability of the soft tissue.[1]

With the different prosthetic technique on periodontally healthy teeth using a feather edge preparation (BOPT), the clinician and laboratory technician may interact with the surrounding tissues by modifying their shape and scalloped architecture regardless of any preexisting dental or gingival limitation.[2]

In the case of the BOPT with full crowns it is the emerging profile of the crown that controls the tissue, whereas when applying the principles of BOPT to veneers the tissue behavior is controlled on the frontal cervical emergence profile of the veneers. This emergence profile is naturally anatomical and is thus conducive to correct oral hygiene.[3]

It is well known that hard tissue supports soft tissue. Based on the tooth anatomy of the emergence profile in the cervical third we may design and drive the gingiva where and how we want in relation of the quantity and quality of the soft tissue, thus reaching harmony and stability. In the restorative phase, when working conventionally, the dental technician scallops the architecture of the surrounding tissues on alveolar gypsum model, providing dynamic compression on the soft tissues by the cervical third of the restoration to idealize the marginal and papillary levels.[4] In order to accomplish this,

a precise impression from the gingival sulcus should be made. The viscosity of the impression material, promoting the flow into gingival sulcus toward the bottom, increase the abutment surface. In the digital workflow, due to the intrinsic nature of the sulcus, optical impression cannot rely on the viscoelastic properties that allow a conventional material to penetrate into with pressure. The use of retraction cords to dislocate the gingival margin apically becomes visible to the IOS light beam and the digital intraoral scan used to capture the soft tissue profile.[5] This significantly changes the relation, balance, and harmony that exist between the tooth and gingiva.

One of the challenges applying new digital approach in clinical esthetic dentistry is closing anterior spaces without creating “black triangles” between the teeth. Using adhesive restorations and digital gingival recontouring is a viable option for the clinician because it restores esthetic harmony between soft and hard tissues. [6] Indirect and direct digitalization, two access points to the digital workflow and to digital generated dental restorations are available at the present stage.[7] For both impression techniques, two retraction cords are used for tissue management. Median total operating time for CI (Conventional Impression) taking was around 15:47 minutes (interquartile range [IQR] 15:18 to 17:30), and for IOS (Intraoral Optical Scanning) was 5:05 minutes (IQR 4:35 to 5:23). According to this study IOS was less time consuming than CI taking, and patient perception was in favor of IOS.[8] However, when

taking an optical impression there is a lack of solid working model especially for dental laboratory use. Because of the recent improvements in block material and computerized numeric control milling machines, the subtractive rapid prototyping method may be a good choice for dental arch models.[9] A combination of a digital impression system and a milling machine, can produce a Polyurethane (PUT) dental model duplicating the patient's dental arch features, which is beneficial for treatment and storage because it is extremely strong, lightweight, and resistant to abrasion.[10] The mean difference between plaster models and PUT models ranged from 0,07 mm to 0.33 mm and as Reich et al. suggested, the diameter of the milling bur may determine the smallest grindable radius, and therefore excessive removal may have occurred on line angles or complicated occlusal surfaces, while more exact removal is expected on flat axial surfaces.[11] Another technology for producing working models is 3D printing. Printed models with a regular base or a horseshoe-shaped base with a bar shows enough accuracy regardless of the printing technique used. Printed models with a horseshoe-shaped base without a connecting bar made with the stereolithography printer have a statistically significant reduction in the transversal dimension that was not found in the models printed with the polyjet technique.[12] Controversial publications on this issue justified our choice of milling technique than printing for production of laboratory

solid models in that case. Despite the currently available digital technology for 3D virtual planning the integration between the 3D data acquired from scanning systems is usually limited, which may limit the accuracy of the smile design technique and if it is not done properly, the patient will lose all confidence in the dentist. In addition, if the impression of the mock-up is digitally recorded before the final restoration (STL1), it may be used with (STL2) to generate the final (STL3) file. The future development of software allowing direct superimposition in the capturing software could simplify the digital workflow.[13] Although IOS of the palatal mucosa is promising higher, difficulty is expected when scanning palate and since we have only a few reference points and matching on dentition, it is very difficult to make completely accurate superimposition of the models.[14]

This article describes a clinical and technical digital workflow interacting with the harmonious utility between the teeth and soft tissues and maintaining it from the impression obtained during the laboratory procedures until the final cementation of restorations.

Case Presentation

A 30-year-old woman presented with esthetic concerns regarding her smile, which were attributed to a high smile line, diastema and tremas between her teeth. The challenge was to harmonize uneven gingival levels and teeth shapes by minimally invasive approach.

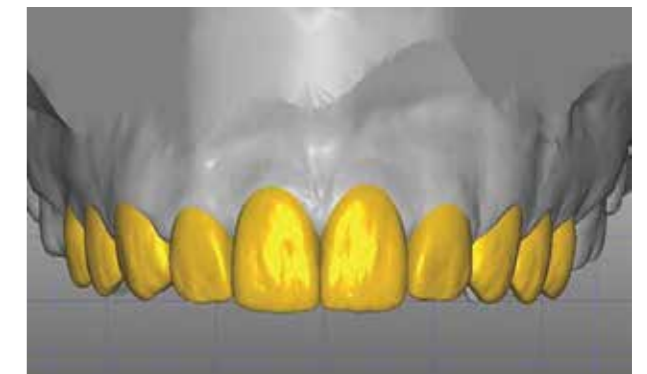


Figure 1 & 2. Intraoral frontal and lateral view. The challenge was to harmonize uneven gingival levels, to distribute interdental space and open the arch so we can achieve more symmetric look to narrow the buccal spaces and correct the present crossbite on the left premolars.

The most creative part of the digital workflow process is the smile design. Meeting a patient's expectations in terms of esthetics presents as a major challenge for the dentist. Computer-aided design facilitates the process the creation of a prototype of the patient's smile. This guides the treatment planning process, and also aids discussion with the patient. Smile design software like Rebel Simplicity (Visagismilile Ltd.) create a completely automated 3D digital mock-up of the treatment outcome on STL files, which are used to print a resin model (Figure 3)



Figure 3. A three-dimensional digital design over the intraorally scanned upper jaw. After the initial IOS (STL1) and preliminary analysis, the most appropriate digital tooth libraries in size and shape were selected and the new digital smile design was created.

Full-face photography was performed and digital scanning IOS (STL1) was made. All data were transferred to an online-based digital laboratory. We used an online-based smile design software (Rebel Simplicity, Visagismilile Ltd.) to create 2D digital designs of the restorations, which reflected the patient's esthetic preferences and expectations. The 2D designs were used to guide the complete rendering of the 3D digital model for subsequent printing. Once the positions of the incisal edges of the incisors were defined, we created new 3D digital designs for the teeth proportions, and extended the length of the teeth in the coronal and apical

directions and complete 3D digital mock-up (on STL files) for the subsequent printing of a resin model. A mock-up for clinical try-in was fabricated with a silicon index and bis-acryl resin, and this provides both a preview of the treatment outcome for the patient, as well as a guide for the clinician during the treatment. (Figure 4)



Figure 4. Printed resin model of the design. The initial situation is presented at the back and the mock up model is shown in front.

After evaluating the final esthetic outcome and the possible treatment options, it was decided to place ten porcelain laminate veneers on the maxillary incisors, canines and premolars using a fully digital work protocol. The teeth in the presented case were not prep and the existing subgingival cervical part of the natural tooth could be perceived as a natural finishing line. As there was no defined finishing line, the tooth abutment was located to the bottom of the gingival sulcus. The clinical finding represented a challenging case, as a subgingival restoration margin was needed in order to distinguish the subgingival emergence profile responsible for the support, sculpting and stability of the soft tissue. This required a technique for obtaining a deeper reading of the sulcus when the digital approach fell short. Teeth were prepared for impression by a double retraction cord technique. The first cord (Ultrapack #00, Ultradent) was gently pressed into the gingival sulcus apically to a second, wider-diameter cord (Ultrapack #1, Ultradent). (Figure 5)



Figure 5. Teeth were prepared for the impression with a double retraction cord technique. The first cord (Ultrapack #00, Ultradent) was gently pressed into the gingival sulcus apically to a second, wider-diameter cord (Ultrapack #1, Ultradent). After the second cord was removed, the digital impression was performed (STL 2).

After the second cord was removed, the digital impression was performed: mandible, maxilla, and bite registration (STL 2). (Figure 6)

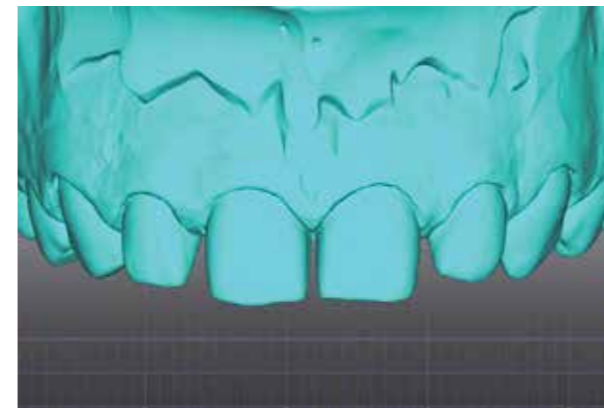


Figure 6. The use of retraction cord dislocates the gingival margin apically and it becomes visible to the IOS light beam and the use of digital intraoral scanning. Intraoral scan with retraction cord imported into Zirkonzahn (Zirkonzahn GmbH) dental software as an indeterminate model (green STL 2).

In addition, a diagnostic impression showing the initial situation was digitally recorded (STL1) and used with (STL2) to generate the final (STL3) file. (Figure 7)

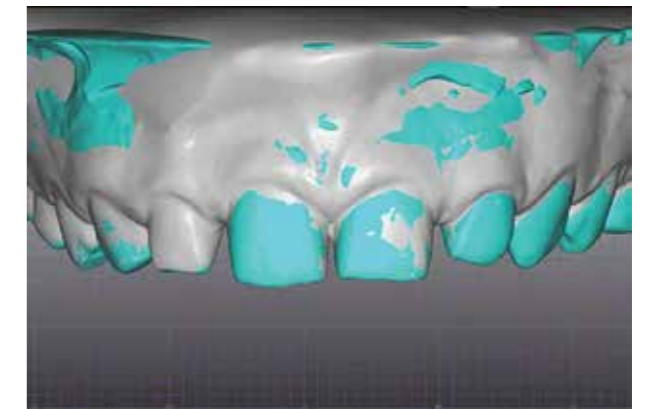


Figure 7. In addition, a diagnostic impression showing the initial situation was digitally recorded (grey STL1) used with (green STL 2).

Aligning two (or more) 3D models is an operator-sensitive operation. In the CAM software, both models were superimposed and the boundary between the soft tissue level before and during the retraction was clearly marked. This allowed us to read very well the depth of the sulcus and the limitation when creating the subgingival aspect of the emergency profile of the veneers. The third model containing the finalized and approved tooth design was also superimposed over the previous two. The marginal contour of the restorations was clearly marked according to the sulcus depth and the existing soft tissue contour. (Figure 8,9&10)

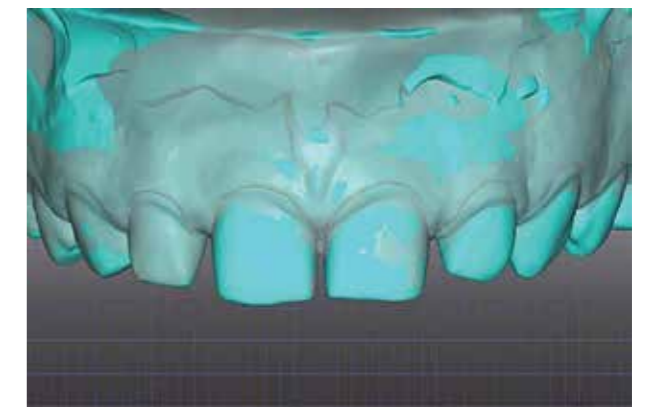


Figure 8. By changing the opacity of the first model (grey STL1) the boundary between the soft tissue level before and during the retraction becomes clearly visible.

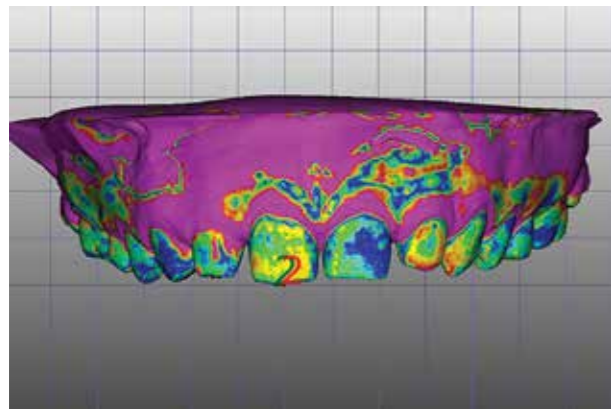


Figure 9. Aligning two (or more) 3D models is possible by choosing the same reference points of the teeth to match automatically both (STL1 and STL2). By the color histogram it is visible that the matching of the models in the area of the teeth is almost perfectly compared to the mismatch present in the gingival area provoked by the retraction cords, which dislocate the gingival margin apically and the mobility of the soft tissues.

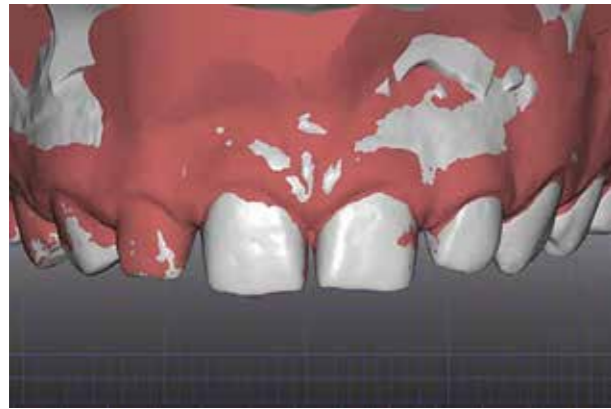


Figure 10. Aligning the models is an operator-sensitive operation. In the Zirkonzahn (Zirkonzahn GmbH) software, the initial (red STL1) model was assigned as a gingiva reflecting the real status of the present gingival soft tissue and colored in red. Both models were superimposed and the boundary between the soft tissue level before and during the retraction was clearly marked. This allowed us to read very well the depth of the sulcus and the limitation when creating the subgingival aspect of the emergency profile of the veneers.

Some marginal areas of the restorations were partially overlapped cervically by the existing tissues, others were exposed. The dental technician scalloped the architecture of the surrounding tissues using tools provided by the software and modified the cervical marginal third of the veneers to simulate the compression on the soft tissues in order to idealize the marginal and papillary levels. This approach is also highly sensitive due to the fact that there is no tactile sensation during the software sculpting of the tissues, as well as marginal compression pressure which is present on the alveolar gypsum model when working conventionally. The subgingival emergence profile of the veneers was limited to the depth of the gingival sulcus with a line marking the retracted tissue. (Figure 11)

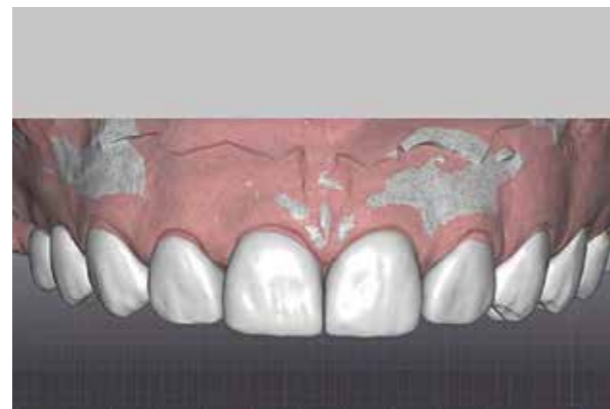


Figure 11. The third model (STL3) containing the finalized and approved tooth design was also superimposed over the previously matched (STL1) and (STL2). The marginal contour of the restorations was marked accordingly the sulcus depth and existing soft tissue contour. Some marginal areas of the restorations were partially overlapped cervically by the existing tissues, others were exposed. Dental technician scalloped the architecture of surrounding tissues by modifying cervical marginal third of the veneers using Free Forming tools by Zirkonzahn (Zirkonzahn GmbH) to simulate compression on the soft tissues to idealize the marginal and papillary levels.

Acrylic alveolar hard model with polyurethane removable dies, as well as wax prototypes of the veneers were milled. Veneers were carefully adapted and manually finished on the dies, and then pressed from lithium disilicate. (Figure 12, 13 & 14)

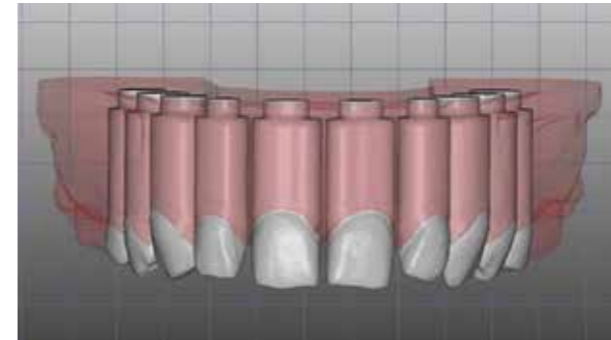


Figure 12 & 13. Alveolar laboratory model was created by Model Creator (Zirkonzahn GmbH) and milled in acrylic base with polyurethane removable dies.



Figure 14. Wax prototypes of the veneers were milled. Veneers were carefully adapted and manually finished on the dies, and then pressed from lithium disilicate.

The final ceramic restorations were finished, polished, stained and glazed by hand and delivered in patient's mouth under a rubber dam isolation. (Figure 15 & 16)



Figure 15 & 16. Final ceramic restorations were finished, polished stained and glazed by hand and delivered in the patient's mouth under a rubber dam isolation. Scallop architecture of surrounding tissues by modifying cervical marginal third of the veneers to simulate compression on the soft tissues, to idealize the marginal and papillary levels is well noted.

Post treatment result observed during the three-year follow up period is still stable and beautiful. By the emergence profile and marginal precision of restorations in the cervical third we design and drove the gingiva where and how we wanted in relation of the quantity and quality of the soft tissue, thus reaching high-level precision, harmony, health and stability in a long term. Beautiful tooth shapes in an accurate pro-

portion with precise finish lines and veneer textures are assured during the three-year follow up period. (Figure 17, 18)



Figure 17 & 18. Post treatment result observed during the three-year follow up period is still stable and beautiful.

Conclusion

Presented clinical report describes a step-by-step novel digital protocol regarding the relation between the tooth's cervical emergence profile and gingival soft tissues. These techniques should be applied during laboratory procedures in order to understand the relation between the tooth and gingiva and to create restorations preserving the shape and stability of the soft tissue.

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На 30.11.2020 г. успешно беше защитен дисертационен труд на тема „СТРУКТУРНА ЦЯЛОСТ НА КОРЕНОВИЯ ДЕНТИН В ХОДА НА ОРТОГРАДНО ЕНДОДОНТСКО ЛЕЧЕНИЕ“ от д-р Ирина Калинова Ценова-Илиева, катедра Консервативно зъболечение, ФДМ, МУ-София с научен ръководител доц. д-р Емилия Гошова Карова, дм. На д-р Ирина Калинова Ценова-Илиева е присъдена ОНС „Доктор“.

Дисертационният труд съдържа 225 страници и е онагледен с 22 таблици, 47 фигури и 3 приложения. Библиографията включва 450 литературни източника, от

които 29 на кирилица и 421 на латиница.

Целта на дисертационния труд е да се изследва влиянието на отделните етапи от първичното ендодонтско лечение и на прелекуването върху структурната цялост на кореновия дентин. Тя е изпълнена чрез 6 задачи.

Дисертационният труд е насочен към изследване на въздействието на отделни етапи от първичното ендодонтско лечение и прелекуването върху структурната цялост на кореновия дентин. Микрорукнатините, които могат да възникнат в хода на корено-каналното лечение, са рисков фактор за възникване на вертикална коренова фрактура, която е сред най-честите причини за екстракция на зъбите.

Чрез анкетно проучване сред лекарите по дентална медицина у нас е установено предпочитанието им към машинните пили, изработени от конвенционална NiTi сплав и задвижвани с непрекъсната ротация в присъствието на натриев хипохлорит. В *in vitro* условия е доказано, че независимо от конструкционния си дизайн, ротационните NiTi системи генерират значително по-голям брой дефекти в апикалната коренова трета, а пилите за прелекуване не оказват съществено въздействие върху кореновия дентин на зъби с овални коренови канали. Топлите обтурационни методи и студената латерална кондензация могат да предизвикат появата на дефекти в стената на кореновия канал, без да се регистрира значима разлика в техните отрицателни въздействия.

Времето, концентрацията и допълнителната ултразвукова активация на най-често използваните ендодонтски разтвори влияят върху биомеханичните качества на кореновия дентин като съществено редуцират неговата микротвърдост, а ултразвуковата активация води до разграпяването му в най-висока степен.

Чрез СВСТ е проследена в клинични условия промяната в дебелината на дентина в критичните зони на корените на долни резци след машинна обработката на каналите като косвен белег за появата и разпространението на дентинови микрорукнатини.



На 13.01.2020 г. успешно беше защитен дисертационен труд на тема „РЕГЕНЕРАТИВНА ЕНДОДОНТИЯ ПРИ ЛЕЧЕНИЕ НА ПОСТОЯННИ ЗЪБИ С НЕЗАВЪРШЕНО КОРЕНОВО РАЗВИТИЕ“ от д-р Красимир Митков Христов, катедра Детска дентална медицина, ФДМ, МУ-София с научен ръководител доц. д-р Наталия Христова Грънчарова, дм. На д-р Красимир Митков Христов е присъдена ОНС „Доктор“.

Дисертационният труд съдържа 177 страници и е онагледен с 10 таблици, 14 фигури, 5 диаграми и 2 приложения. Библиографията включва 657 литературни източника, от които 4 на кирилица и 653 латиница.

Целта на дисертационния труд е да се изследват възможностите на регенеративната ендодонтия при лечението на постоянни зъби с незавършено кореново развитие и некротична пулпа. Тя е изпълнена чрез 5 задачи с 2 подзадачи.

Дисертационният труд е насочен към изследване на съвременните концепции на регенеративната ендодонтия за възстановяване на кореновите канали до нормално състояние, което позволява завършване на развитието на корена, задебеляване на дентиновите стени и затваряне на апекса. Усилията ѝ включват прилагането на най-новите стратегии на тъканното инженерство като коренова реваascularизация чрез индуциране на образуването на кръвни съсиреци, прилагане на терапия с постнатални стволови клетки, инжекционни биохимично активни безклетъчни матрици и триизмерни клетъчни принтове. Най-голямото предизвикателство за тъканното инженерство на „пулпа“ е да се постигне *in vivo* реваascularизация от кръвоносната система на домакина. Знанията в областта на пулпната биология, зъбната травма и тъканното инженерство могат да бъдат приложени за постигане на биологично базирано регенеративно ендодонтско лечение на некротични зъби с незавършено кореново развитие. Разработките в областта на регенерацията на функционален пулпо-дентинов комплекс имат обещаващ ефект върху опитите за запазване на естественото съзъбие, основна цел на ендодонтското лечение.

AUTHOR GUIDELINES

These requirements are in accordance with the Recommendation for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals, Updated December 2013, www.icmje.org, and „Uniform Requirements for Manuscripts Proposed for Printing in Biomedical Magazines“ - N Engl J Med 1997; 336: 309-15.

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The materials and procedures used in the research must meet the ethical criteria established in experiments with humans or animals and comply with the Rules of Procedure of the Research Ethics Committee at Medical University of Sofia (KENIMUS) and be authorized by this committee. Patients should not be given names, initials or photographs by which they can be identified.

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The following types of scientific materials are accepted for publication:

1. Original scientific articles - up to 10 standard pages / 30 rows, 60 characters on one page including tables, figures and other illustrative material and bibliography;
2. Scientific reviews - up to 15 standard typescript pages, including tables, figures and other illustrative material and bibliography.
3. Case reports - up to 3 standard typing pages, including tables, figures and other illustrative material and bibliography.

Manuscripts should be printed on standard A4 typewriter white paper (210 x 297mm).

Font: Times New Roman font, 12 pt, 1.5 spacing, left and right margins - 2 cm; top and bottom 2.5 cm. Pages should be numbered bottom right;

Firstpage:

Title in bold, without abbreviations;

Full Name and Surname of all authors;

Footnote: the academic positions and academic degrees of the authors, affiliating institutions (Medical University of Sofia, Faculty of Dental Medicine and the corresponding department).

Summary:

It should be on a separate page (separate file) with the authors and affiliation in the same way. Summary must be up to 250 words maximum. Summary should include introduction, purpose, material and methods, results, keywords (use terms cited in MEDLINE or Index Medicus headings).

The structure of the original scientific article. It should include: introduction, purpose and objectives, material and methods, results, discussion, conclusions / conclusion, and bibliography. Indicate in the text the number of references cited in square brackets and in font size of the text itself, example: [1]. The presentation of material in absolute values, without statistical processing, is not considered scientific evidence. It is incorrect to duplicate the same material presented in a table and graph. The numerical information shown in the table should not be repeated in the text, but the information analyzed. Only standard conventional abbreviations may be used and abbreviations in the title and abstract are not allowed.

Tables, figures, photographs, diagrams and other illustrative materials should be given in the text and in a separate file (in electronic form).

Tables should be numbered in Arabic numerals, starting with 1 in the order of their reference in the text. This numbering shall be independent of the numbering of the figures.

The table title is centered above the table, for example: Table 1 - Mechanical Properties. The first word of the name of each column or row must start with a capital letter. When units of size are used in a column or row, they must be recorded in the middle of the column under the name of the columns in light font (in the Si system). The data must be presented in an easily understandable and transparent form. The use of large and complex tables should be avoided, for example by presenting data in two or more simple tables.

Statistical processing:

- Describe the statistical method, define statistical terms and use commonly used statistical abbreviations and symbols. Indicate the level of significance;

- It is obligatory to observe the conditional signs when filling in the grid of the table, namely: for promils, prodecimiles, etc. not semicolons, but a single character spacing. E.g. one million - 1,000,000;

- Give digital results except in derivatives (e.g. in percentages) and in averages.

Structure of the scientific review. It should constitute an analytical review of the literature on specific scientific topics related to dental medicine. Up-to-date information (50% of the last 5 years) must be presented in a logical sequence, and certain scientific data must be supported by scientific evidence cited in the relevant scientific articles. It is advisable to cite new methodologies, the volume of material studied, on the basis of which relevant scientific conclusions are drawn. Studies for and against the thesis as well as the opinion of the author of the review should be cited.

We recommend the use of the principles of meta-analysis when presenting review material on a specific scientific topic.

Structure of case reports. They should represent well-documented, interesting clinical cases. The article should be shorter (up to 3-4 pages). The introduction should be more extensive than the original scientific article, and there should be a brief literature review on the topic of the case presented. It should not follow the structure of a scientific article. The clinical case presented should follow the classic clinical trial and documentation scheme.

References

The bibliography is written in Latin and follows the text of the article. Each source is numbered in Arabic numerals and arranged sequentially according to the first author's surname. Important! Literary sources in Cyrillic should be translated in Latin (in English), with the title in square brackets, and finally the name of the country from which the magazine comes. The data is formulated as follows:

- Journals: Family name of authors. Title. The title of the journal/ foreign journals is given according to the accepted abbreviations in MEDLINE /, year; volume, (no ...), pages: ... - The names and initials of the first author and each of the next to sixth authors are displayed, followed by et al., If there are more authors. If there is a citation ID it can be displayed at the end.

Example: Halpern SD, Ubel PA, Caplan AL. Solid-organ transplantation in HIV-infected patients. *N Engl J Med.* 2002; 347 (4): 284-7.

- Books, monographs: Author / and /. Title. Place of publication / city /: publishing house; year of issue. pages. If there is an editor it fits in after the title.

Example: Peneva M, Tzolova E, Kabakchieva R, Rashkova M. Oral embryology, histology and biology. Textbook of Pediatric Dentistry. ed: East-West: Sofia; 2009 p. 232.

- Book chapter and non-periodical articles: Author (s). Head Title. In: Author (s). book title. Sequence of the edition. Place of Issue / City /: Publishing House; year of issue. pages / from-to /.

Example: Krasteva-Panova, A. Summary of changes in oral cavity and subjective complaints. In: Krasteva-Panova, A, A. Kisselova-Yaneva, B. Girova, VI. Panov, Ad. Krateva, An. Beans. Edited by Zahari Krastev. Oral lesions. Sofia: Ivan Sapundziev; 2011. p. 240-248.

- Dissertations: Family name, first name and last name. Title followed by explanation in middle brackets [dissertation]. City, year.

Example: Kirov Dimitar Nikiforov, Diagnosis and prevalence of temporomandibular disorders. [dissertation]. Sofia, 2014

From Internet:

a / ebook - Family name. Title. [Online]. - Headquarters, (electronic) publishing, year of publication. Available from: <full web address> [last visited date].

Bergman, Ronald A., Adel K. Afifi, Ryosuke Miyauchi. Illustrated Encyclopedia of Human Anatomic Variation. [Online]. - Last rev. 2006. // Anatomy atlases: A digital library of anatomy information. Curated by Ronald A. Bergman. 1995-2011. Available from: <<http://www.anatomyatlases.org/AnatomicVariants/AnatomyHP.shtml>> [05/25/2011].

b / institutional web site - Example: World Health Organization. Home page. 2011. Available from: <<http://www.who.int/en/>> [05/25/2011].

Online / Post - Example: The International Pharmacopoeia. 4th ed. (incl. First Supplement). WHO, 2008. Available from: <<http://apps.who.int/phint/en/p/about/>> [05/25/2011].

The report was prepared according to the International Committee of Medical Journal Editors (ICMJE) Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals: Sample References. More details can be found on the relevant site.

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