

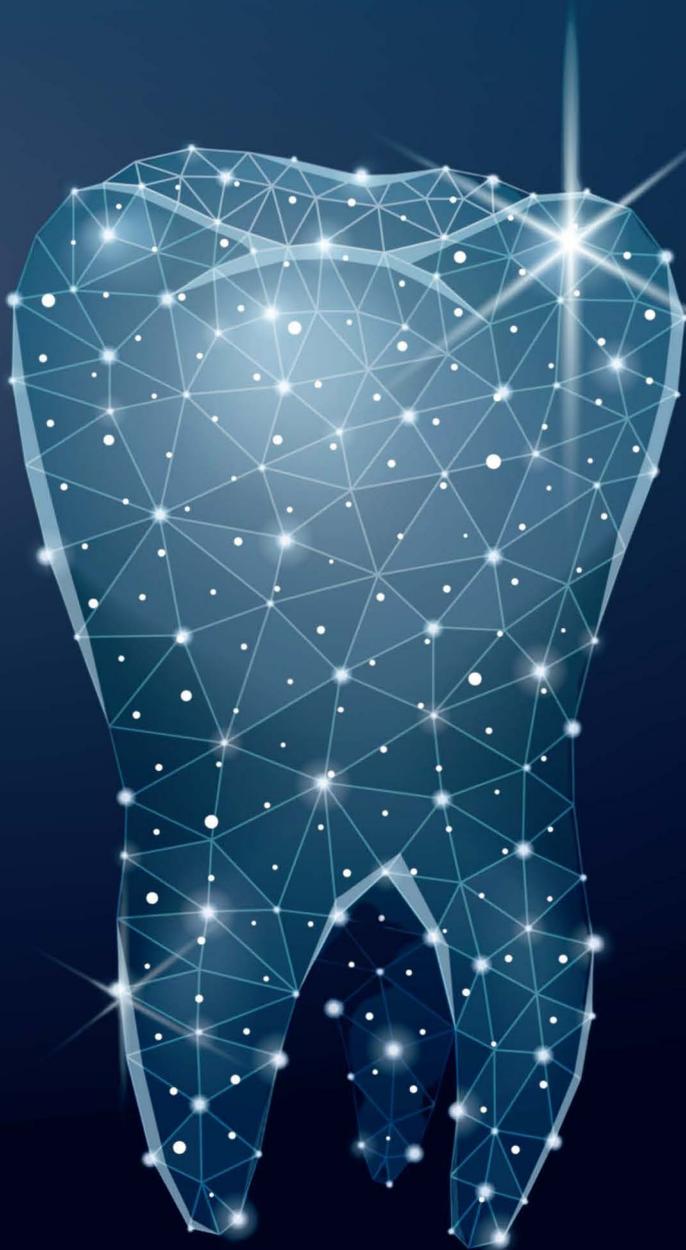


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ORIGINAL ARTICLE

THE IMPORTANCE OF THE TOTAL EDENTULOUS PROSTHETIC FIELD MORPHOLOGY IN THE DESIGN OF CONVENTIONAL COMPLETE DENTURES

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Abstract: *Introduction.* The complete denture has the role of reproducing the missing dental and maxillary structures: teeth, gums and facial contours, ensuring a harmonious integration with the patient's remaining features. The main *objective* of this study aims to evaluate the knowledge of dental students and dentists regarding complete denture. *Material and method.* The evaluation of the knowledge among students and dentists regarding the prosthetics of the complete edentulism was carried out by the questionnaire method. The study was attended by students of the Faculty of Dental Medicine of the University of Medicine and Pharmacy, Craiova and dentists, from the urban environment. *Results.* Regarding the sources of information, 26% of the participants mentioned that the main source of information was represented by specialized books, 86% of the participants believed that the patient's general state of health influences the morphology of the total edentulous prosthetic field. 74 of the participants stated that the installation of the "suction cup" phenomenon between the mucosal face of the prosthesis and the fully edentulous prosthetic field is the main factor for achieving the suction of the complete denture. 44% of the respondents considered that the main factor contributing to the stability of a complete denture is the anatomical retentiveness *Conclusions.* The complete denture plays an essential role in the restoration of the dento-maxillary system by ensuring the morphological and functional rehabilitation of totally edentulous arches.

Keywords: complete denture, edentulism, questionnaire.

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1. Introduction

Complete edentulism represents an important pathological condition of the dento-maxillary system, defined by the absence of all teeth in one or both arches and negatively influences the functionality of the other components of the ADM such as the articular, muscular, intraoral tissue and self-maintenance [1]. Another problem encountered, and perhaps the most important for the totally edentulous patient, is the psychological impact on the quality of life [1].

Alteration of the facial appearance is not only caused by the loss of teeth, but also by the process of bone resorption, by changes in the dynamics and tone of the perioral muscles, as well as by the age, usually older, of these patients [1]. Facial muscles can lose some of their tone through the aging process, but the loss of tone can also occur because the muscles cannot work as efficiently as before.

The total edentulous prosthetic field represents the totality of the structures that come into direct contact with the mobile prosthetic works and participate in their maintenance, support and stability. Total edentulism is defined as the absence of all teeth in one or both jaws. It can be unimaxillary, when only the maxilla is of interest (total maxillary/mandibular edentation) or bimaxillary [1].

For the replacement of dental units lost by a totally edentulous patient during his life, making a conventional complete denture can be an effective and fast therapeutic solution.

The complete denture has the role of reproducing the missing dental and maxillary

structures: teeth, gums and facial contours, ensuring a harmonious integration with the patient's remaining features. Thus, in a totally edentulous patient, the mobile prosthesis helps to restore the functions: masticatory, phonetic, physiognomic, digestive and psychological. In addition, total prostheses effectively contribute to restoring the natural appearance of the face, allowing patients to regain their confidence and self-esteem [2].

Restoring the loss of tissues, therefore the support of the lips and the fullness of the cheeks are limited in the case of oral rehabilitation with the help of complete denture, which can even contribute to the appearance of premature aging in edentulous patients.

In Romania, total edentulism still represents an important health problem that is widespread and that requires a fast and effective prosthetic treatment. Currently, the number of total edentulous cases is increasing in rural areas, as a result of the countless disadvantaged environments where access to education and health is limited, and material possibilities are also restricted [3].

In the UK, patients who had lost their remaining teeth in the past 10 years, 59% said that they only visited the dentist when they had problems, while 29% said they visited the dentist regularly. This pattern of presence was almost completely opposite to those patients who still had their teeth [4].

According to Slade et. al, in the United States, in a study in which 432,519 adults were surveyed, it was concluded that among adults over the age of 15, the prevalence of

edentulism was 4.9% [5]. In Canada, the overall edentulous rate in 2010 was 6.4% to 21.7% among adults aged 60 to 79 years [6].

The main objective of this study aims to evaluate the knowledge of dental students and dentists regarding complete denture.

2. Materials and method

The evaluation of the knowledge among students and dentists regarding the prosthetics of the complete edentulism was carried out by the questionnaire method. The studied material was represented by the answers to the questionnaire questions given by the study participants.

The study was attended by students of the Faculty of Dental Medicine of the University of Medicine and Pharmacy, Craiova, of both genders, Romanians and foreigners, and dentists, of both genders, from the urban environment.

The questionnaire included a number of 15 questions:

- questions regarding the category of participants: professional category, age, gender, seniority;
- a question about information sources;
- questions related to the topic discussed: questions about the factors that influence the morphology of the prosthetic field, questions about the maintenance, support and stability of a total prosthesis;
- a question about training the patient regarding the use of the complete denture.

The questionnaire was uploaded in Google Forms and distributed online in social media in dental groups. Each question had several answer options, the participant having the opportunity to choose the answer he considered correct.

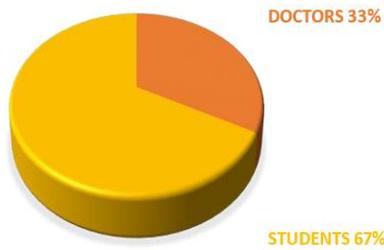
The results of the questionnaire were centralized and statistically processed through descriptive statistical analysis.

The study was conducted after obtaining informed consent from all participants regarding the objectives and method of conducting the study, in compliance with the Declaration of Helsinki. Scientific Ethics and Commission of UMF Craiova approval (no. 59/29.01.2024) was obtained in advance.

3. Results

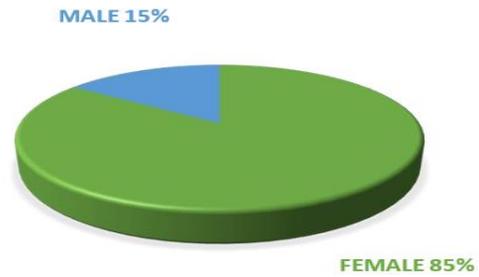
To the questionnaire about the knowledge assessment of the treatment of total edentulism, 79 participants responded to the questionnaire, of which 53 were students of the Faculty of Dental Medicine in Craiova, Romania, and 26 were dentists from Romania and the Republic of Moldova (Figure 1a), 85% (n=67) were female and 15% (n=12) male (Figure 1b), 75% belonged to the 20-29 age group (Figure 1c), 42,5% of the doctors had a working experience between 0-5 years and 47% of the students were enrolled in the 6th year of study (Figures 1d. and Figure 1e.). Regarding the sources of information, 26% of the participants mentioned that the main source of information was represented by specialized books (Figure 1f).

DISTRIBUTION OF PARTICIPANTS BY PROFESSIONAL CATEGORY



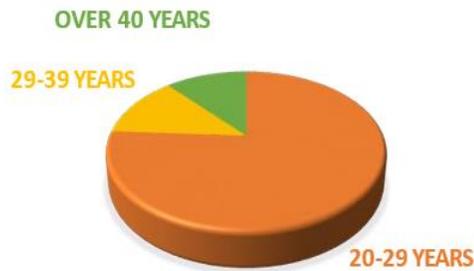
(a)

DISTRIBUTION OF PARTICIPANTS BY GENDER



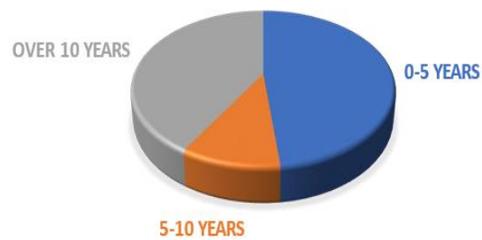
(b)

DISTRIBUTION OF PARTICIPANTS BY AGE



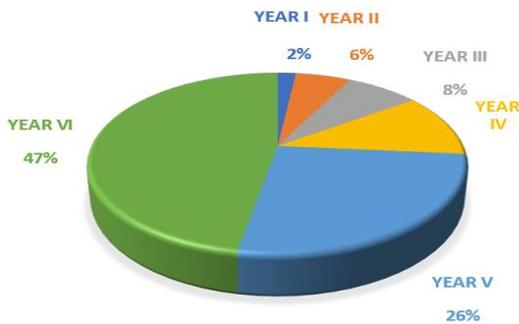
(c)

DISTRIBUTION OF DOCTORS IN RELATION TO EXPERIENCE



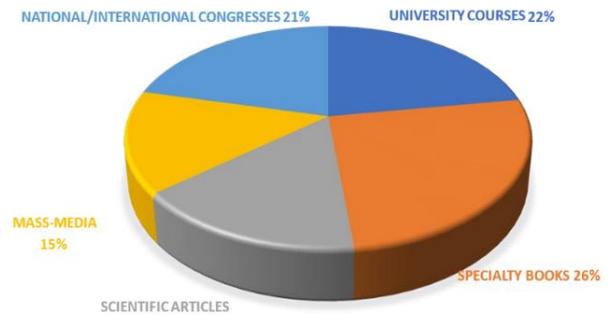
(d)

DISTRIBUTION OF STUDENTS BY THE YEAR OF STUDY



(e)

DISTRIBUTION OF PARTICIPANTS BY INFORMATION SOURCES



(f)

Figure 1. Distribution of the study group. (a) Distribution of participants by professional category; (b) Distribution of participants by gender; (c) Distribution of participants by age; (d) Distribution of doctors in relation to experience; (e) Distribution of students by the year of study; (f) Distribution of participants by information sources.

97.5% (n=77) of the participants considered that the patient's age and gender influence the morphology of the total edentulous prosthetic field (Figure 2a) and that the etiology of complete edentulism can

influence the morphology of the total edentulous prosthetic field (Figure 2b).

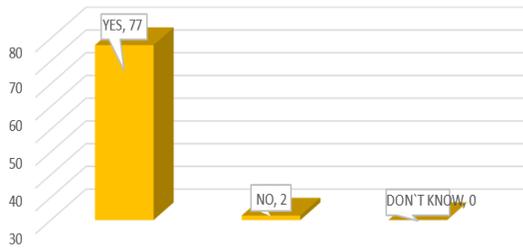
86% (n=68) of the participants believed that the patient's general state of health influences the morphology of the total

edentulous prosthetic field, and 5.1% (n=4) of them have no knowledge of these aspects (Figure 2c).

Among the 79 participants, 52 considered that vertical forces are the main

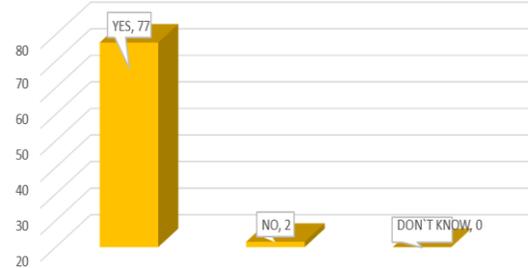
categories of forces that act on a complete denture and 51 took into account occlusal pressures (Figure 2d).

DISTRIBUTION OF PARTICIPANTS BY THE INFLUENCE THAT THE AGE AND GENDER OF THE PATIENT HAVE ON THE MORPHOLOGY OF THE TOTALLY EDENTED PROSTHETIC FIELD



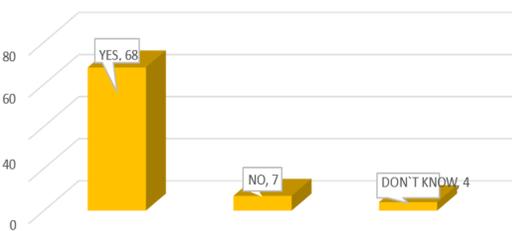
(a)

DISTRIBUTION OF PARTICIPANTS BY THE OPINION REGARDING THE INFLUENCE OF EDENTATIONAL ETIOLOGY ON THE MORPHOLOGY OF THE TOTALLY EDENTED PROSTHETIC FIELD



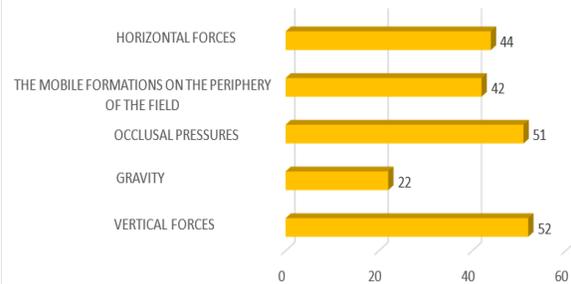
(b)

DISTRIBUTION OF PARTICIPANTS BY THE KNOWLEDGE ABOUT GENERAL HEALTH STATUS ON THE MORPHOLOGY OF THE TOTALLY EDENTATE PROSTHETIC FIELD



(c)

DISTRIBUTION OF PARTICIPANTS BY THE OPINION ON THE MAIN CATEGORY OF FORCES WHICH ARE ACTING ON THE TOTAL PROSTHESIS



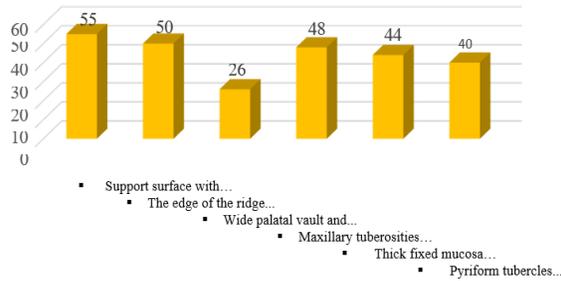
(d)

Figure 2. Distribution of the study group. (a) Distribution of participants by the influence that the age and gender of the patient have on the morphology of the totally edentulous prosthetic field; (b) Distribution of participants by the opinion regarding the influence of etiology of edentulism on the morphology of the totally edentulous prosthetic field; (c) Distribution of participants by the knowledge about general health status on the morphology of the totally edentulous prosthetic field; (d) Distribution of participants by the opinion on the main category of forces which are acting on the total prosthesis.

In the questionnaire, both doctors and students were asked "What are the main factors with a role in supporting a complete denture?". It is observed that 55 of the participants considered the support surface

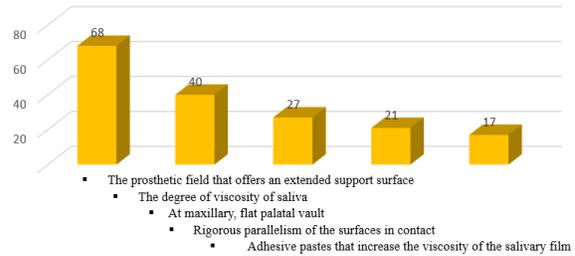
with large dimensions, the main factor for the adhesion to be achieved, and 50 participants considered the well-represented edentulous ridges as the main factor (Figure 3a).

DISTRIBUTION OF PARTICIPANTS ACCORDING TO THE OPINION ON THE MAIN FACTORS WITH ROLE IN THE SUPPORT OF TOTAL PROSTHESIS



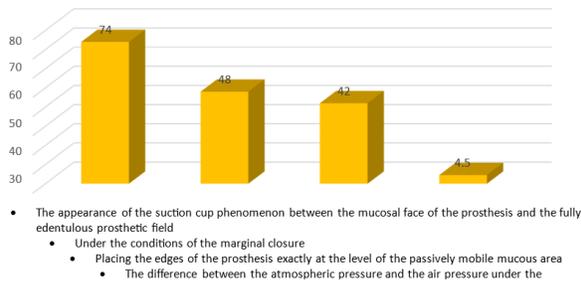
(a)

DISTRIBUTION OF PARTICIPANTS ACCORDING TO THE KNOWLEDGE OF ACHIEVING THE ADHESION OF A TOTAL PROSTHESIS



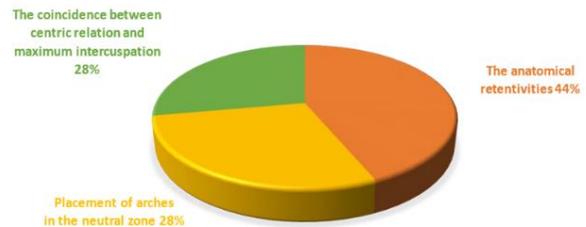
(b)

DISTRIBUTION OF PARTICIPANTS ACCORDING TO THE KNOWLEDGE OF PERFORMING SUCTION OF TOTAL PROSTHESIS



(c)

DISTRIBUTION OF PARTICIPANTS ACCORDING TO THE KNOWLEDGE ABOUT THE STABILITY OF A TOTAL PROSTHESIS



(d)

Figure 3. Distribution of the study group. (a) Distribution of participants according to the opinion on the main factors with role in the support of total prosthesis; (b) Distribution of participants according to the knowledge of achieving the adhesion of a total prosthesis; (c) Distribution of participants according to the knowledge of performing suction of total prosthesis; (d) Distribution of participants according to the knowledge about the stability of a total prosthesis.

To the question "What factors contribute to achieving the adhesion of a complete denture?", 68 of the participants considered that a prosthetic field that offers an extended support surface contributes to the achievement of the adhesion of a complete denture (Figure 3b). To the question "Which of the following factors contribute to the suction of a complete denture?" 74 of the participants stated that the installation of the "suction cup" phenomenon between the mucosal face of the prosthesis and the fully edentulous prosthetic field is the

main factor for achieving the suction of the complete denture (Figure 3c). 44% of the respondents considered that the main factor contributing to the stability of a complete denture is the anatomical retentiveness, 28% considered that the placement of the arches in the neutral zone ensures the stability of the prosthesis and 28% chose the coincidence between the centric relationship and the maximum intercuspation as the main factor which ensures the stability of the complete denture in the prosthetic field (Figure 3d).

Both doctors and students felt that the patient needed special instructions to wear the complete denture (Figure 4).

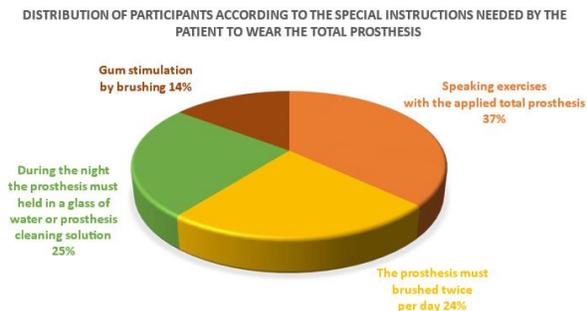


Figure 1. Distribution of participants according to the special instructions needed by the patient to wear the total prosthesis.

37% of the participants considered that speech exercises with the applied complete denture are a special instruction for the patient, and 25% considered keeping the complete denture during the night in a glass of water or cleaning solution as a special instruction.

4. Discussions

The aim of the study was to evaluate the knowledge of students and practicing dentists about the importance of the morphology of the fully edentulous prosthetic field in prosthetics. It should be noted that 67% of the respondents were students, but only 47% of them were enrolled in the 6th year of study. This result indicates that the interest in the topic addressed has increased among the students who are in

the middle of the study process. The theme did not have a high impact among doctors, although they face this problem in current dental practice.

An interesting aspect is the fact that only 26% of the participants mentioned specialized books as the main source of information on the studied topic. The other information options chosen were: university courses, national and international congresses, mass media and scientific articles, the first three involving audio-visual means. Almost all participants considered that the morphology of the prosthetic field is influenced by age, gender and the etiology of total edentulism. The total loss of teeth is related not only to age, but also to other variables, such as social class and marital status. When multivariate analyzes were undertaken, any association between tooth loss and gender disappeared. The differences that are evident in Britain can be illustrated by comparing the extremes. To quote from Steele et al. (2000), women from an unskilled manual background living in Scotland were 12 times more likely to be totally edentulous than men from a non-manual background in southern England [4, 7]. More than 80% of the respondents appreciated that the morphology of the totally edentulous prosthetic field varies depending on the general state of health of the patients. It should also be taken into account that complete edentulism has a strong negative impact on the patients' quality of life, expressed by the loss of functional abilities, such as mastication and phonation, as well as nutritional, aesthetic and psychological losses, with a direct influence on reducing self-esteem and social integration [8-11]. According to the opinion of approximately 65% of the respondents, vertical forces and

occlusal pressures are the main categories of forces that act on complete denture. In the case of an unstable complete denture on the prosthetic field, it is possible to reduce the maximum intercuspation forces. Due to disuse atrophy, the muscles of the dento-maxillary system can lose their tone in such cases [12]. The weakening of the jaw muscles, resulting in such situations, can further reduce the maximum forces that occur during mastication, being a vicious circle. This effect is more pronounced in patients who are long-term wearers of conventional complete dentures and, more so, unstable lower complete dentures [13, 14].

Regarding the retention of the complete denture through adhesion, more than 50% of the participants considered that the support surface of the prosthesis or the well-represented edentulous ridges play an important role. Almost all of the respondents considered that the appearance of the "suction cup" phenomenon between the mucosal face of the prosthesis and the fully edentulous prosthetic field is important for achieving the maintenance of a complete denture through suction. Retention of a complete denture depends on both under-pressure and adhesion to the underlying tissue [15]. When a good peripheral seal exists, between the base of the complete denture and the mucosa of the fully edentulous prosthetic field, under-pressure will appear. Peripheral sealing represents the close contact between the marginal surface of the complete denture and the oral mucosa. [16]. The survey indicated that 44% of the participants considered that anatomical

retentiveness is the main factor involved in the stability of a complete denture, but 56% appreciated that functional factors such as the placement of the arches in the neutral zone and the coincidence between centric relation and maximum intercuspation are the factors that contribute significantly to the stability of the complete denture. It is of fundamental importance to remember that tooth extraction does not simply mean losing visible crowns. With the loss of the roots, the alveolar bone, implicitly the anatomical retentivities, undergo the processes of bone resorption and atrophy. Although it is relatively simple to provide an effective replacement for dental crowns by means of a prosthesis, it is often difficult, if not impossible, to remedy the problem of resorbed alveolar bone; the more bone is resorbed, the bigger the problem [4].

It is suggested that the later stages of resorption are likely to be influenced by factors such as age, nutrition, drug therapy (eg corticosteroids) and hormonal factors. There is also the view that severe resorption, particularly of the mandible, is influenced more by systemic factors than by local factors [17].

With the passage of time and implicitly the technological advance, numerous branches of dentistry have contributed to establishing the diagnosis in complete edentulism and the principles and optimal treatment methods for this condition. Moreover, even though at the present time the therapeutic possibilities in dentistry have seen a remarkable technological advance, according to the previously mentioned data, many patients

become totally edentulous at the age of over 65 in well-developed countries.

5. Conclusions

The complete denture plays an essential role in the restoration of the dento-maxillary system by ensuring the morphological and functional rehabilitation of totally edentulous arches. The survey highlighted the fact that the participants in the study considered that

the morphology of the prosthetic field is influenced by age, gender and general state of health. They also appreciated that the retention, support and stability of a complete denture are influenced by adhesion and anatomical retentiveness. The success of edentulism therapy through conventional complete denture depends on the level of specialist knowledge.

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ORIGINAL ARTICLE

ASSESSMENT OF DENTAL STUDENTS' AND DENTISTS' KNOWLEDGE OF POST AND CORE TECHNIQUE USE IN ENDODONTICALLY TREATED TEETH

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Abstract: Restoring the morpho-functionality of a dental crown that shows extensive surface and depth lesions can be achieved by means of prosthetic therapy represented by different post and core techniques. Purpose The present study aims to assess dental students' and dentists' knowledge of post and core techniques using a questionnaire. *Material and methods.* For this survey-based study a questionnaire was designed consisting of 15 questions related to the category of participants, questions related to the sources of information and questions related to the topic discussed. *Results.* This study included 55 participants including 39 students in years IV, V and VI, and 16 dentists. Of the 55 participants, 44 were in the 20-29 age group, 10 in the 29-39 age group, and 1 participant was over 40 years old. In terms of gender, 43 were females and 12 males. 74.5% of the participants (n=41) thought that prefabricated fiberglass posts are most often used, followed by cast metal posts, mentioned by 58.2% (n=32) of the respondents. 81.8% (n=45) of the respondents specified intra-radicular aggregated metal-ceramic crowns as the most used substitution method. *Conclusion.* Based on the results of the study, it can be concluded the main types of prefabricated posts used in post and core techniques were: fiberglass posts and screwed metal posts.

Keywords: post and core technique, fiber post, cast post and core.

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1. Introduction

Restoring the morpho-functionality of a dental crown that shows extensive surface and depth lesions can be achieved by means of prosthetic therapy represented by different types of post and core restorations. Due to the extensive loss of tooth tissue and the increased fragility of endodontically treated teeth compared to vital teeth, they may fracture [1]. Any of the methods of post and core consist of replacing the natural crown of a tooth with an aggregate prosthetic restoration in the root of the tooth.

For teeth with significant crown damage, endodontic treatment is required as a first step. Therefore, these teeth have a reduced resistance, by preparing canals. After endodontic therapy, post and core procedures are necessary for reconstruction of tooth morphology [2], restoration of normal occlusion and tooth functions. Certain factors affect the restoration selection of endodontically treated teeth. The most important factors are the amount of remaining coronal tooth structure, the position of the tooth on the dental arch and whether it serves as an abutment tooth for fixed or removable dentures [3-5].

To restore endodontically treated teeth, dentists have to choose from a variety of materials and techniques, from conventional cast metal posts, prefabricated metal posts, fiber glass posts or computer-assisted milling posts. Clinical performance and longevity may vary depending on the material [6].

There were two methods for crown rehabilitation in severe crown loss:

- single prosthetic piece with cast post, core and crown, making a single prosthetic piece that provides both crown restoration and root aggregation;
- double prosthetic piece with cast post and core and separately a crown, the first piece is cast post and core, which is added to the root plus a capping crown. The two pieces are independent and are fixed to each other by cementation.

Crown substitution is a means of prosthetic therapy that fully restores the morpho-functional crown of a tooth with extensive surface and depth lesions. It consists of replacing the damaged dental crown with a prosthesis whose aggregation is achieved through a root post that penetrates into a special recess made by widening the root canal. The substitution crown is a means of prosthetic therapy that fully restores the morpho-functional crown of a tooth with extensive surface and depth lesions [7]. Nowadays it is used only as an endocrown.

Preparation of the root canal for a cast metal post results in an increase in canal space and a reduction in root wall thickness, with the risk that the post through wedge effect may result in root fracture.

Prefabricated metal posts can be used to preserve the root wall thickness of endodontically treated teeth, resulting in high fracture resistance, and reduced chair time [8]. However, the difference between the elastic modulus of the metal post compared to dentin can induce stress and also increase the risk of root fracture leading to failures [9].

Instead, fiberglass posts are considered a viable alternative by most professionals due to its aesthetic characteristics and dentin-like modulus of elasticity, which improves stress distribution and reduces the risk of root fractures [10]. They are used in direct technique, preserving chair time.

Considering these varieties of materials, it is essential that dental students as well as dentists have adequate knowledge of the materials and techniques available to be able to perform tooth crown rehabilitation by these methods.

The present study aims to assess dental students' and dentists' knowledge of post and core techniques using a questionnaire.

2. Materials and method

The study was conducted on a group of dental students of UMF Craiova and dental doctors also from Craiova. The participants were volunteers, anonymous, and agreed to be included in the study. The study was approved by the Ethics Committee of the University of Medicine and Pharmacy of Craiova (no. 57/29.01.2024).

The study method consisted of a questionnaire that included 15 questions related to the category of participants, questions related to the sources of information and questions related to the topic discussed. The questionnaire was distributed online using Google Forms on social media between late January and February 2024 among students and doctors from Craiova. The questions were the following: Specify your professional category; If you are a student, specify the year;

Gender; Specify the age group you belong to; If you are a doctor, specify your work experience; What are the sources of information you have approached?; Have you witnessed one of the post and core techniques being carried out?; Have you carried out one of the post and core techniques?; Which of the following dental diseases are treated by the post and core techniques?; What conditions do you think a dental root must meet in order to use the post and core techniques?; Which of the following post and core techniques do you consider to be the most commonly used?; Which of the following types of posts do you consider to be the most commonly used?; Which type of crown do you consider to be the most commonly used in post and core techniques for crown lesions?; Which of the following posts do you consider to have the highest mechanical strength?; Which of the following mistakes do you consider to be the most common when preparing the root canal for a post?.

The answers to the questionnaire questions were centralized and statistically processed by descriptive statistical analysis.

3. Results

Fifty-five participants responded to the questionnaire, including 39 students in years IV, V and VI, and 16 dentists. Of the 55 participants, 44 were in the 20-29 age group, 10 in the 29-39 age group, and 1 participant was over 40 years old. In terms of gender, 43 were female and 12 male (Fig.1a,b).

According to the number of years of experience, the 16 dentists were divided as

follows: 10 were included in the 0-5 years age group, 3 in the 5-10 years age group and 3 in the over 10 years age group (Fig 1d). It was observed that out of 55 participants, 39 were students and 16 dentists. Of the students, 3 were in 4th year, 5 were in 5th year and 31 were in 6th year (Fig 1c).

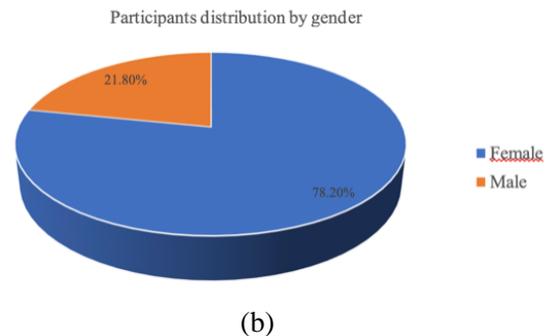
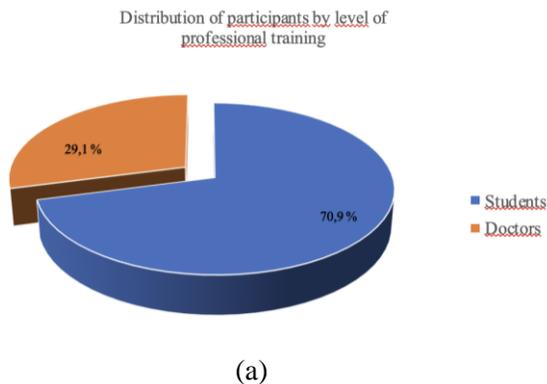
Regarding sources of information, 42 participants mentioned university courses, 37 specialist books, 36 national and international congresses, 31 media and scientific articles (Fig 1e,f).

The distribution of participants according to their responses to the question "Which of the following lesions are treated by the post and core technique" was: 78.2% (n=43) indicated that superficial and deep carious lesions are treated by the post and core techniques, 69.1% (n=38) mentioned total or subtotal coronary fracture (Fig 2a).

Concerning "What conditions do you consider a dental root must fulfil in order to use the post and core techniques" 76.4% of the participants (n=42) considered that the roots must be anatomically intact and 74.5% (n=41) stated that there must be no periapical pathological processes (Fig 2b).

For the question "Which of the following post and core techniques do you consider to be most commonly used?", 70.4% of the participants (n=38) considered that intra-radicular aggregate composite restoration with prefabricated glass fiber post is one of the most commonly used (Fig 2c).

When asked "Which of the following types of posts do you think are most often used?", 74.5% of the participants (n=41) thought that prefabricated fiberglass posts are most often used, followed by cast metal posts, mentioned by 58.2% (n=32) of the respondents. (Fig. 2d).



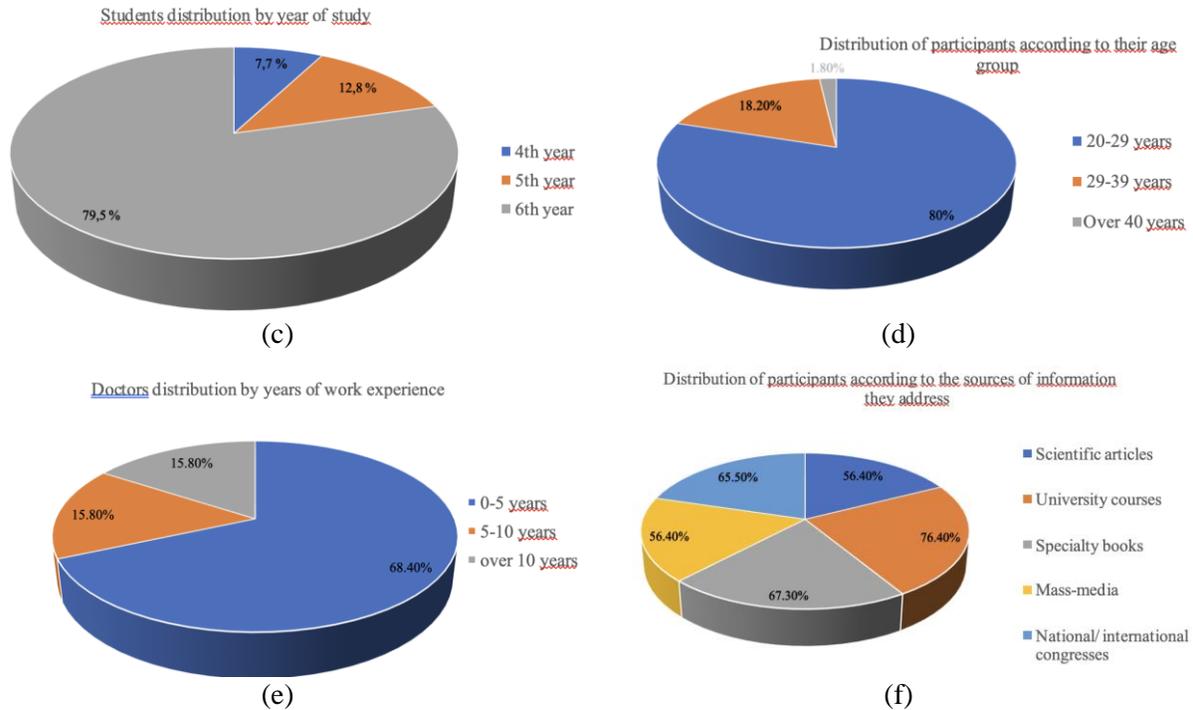


Figure 1. Distribution of the study group. (a) Distribution of participants by level of professional training; (b) Students distribution by year of study; (c) Participants distribution by gender; (d) Distribution of participants according to their age group; (e) Doctors distribution by years of work experience; (f) Distribution of participants according to the sources of information they address.

An 81.8% (n=45) of the respondents specified intra-radicular aggregated metal-ceramic crowns as the most used crown substitution method (Fig. 2e).

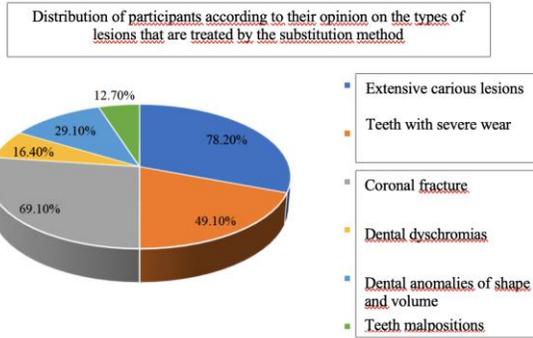
When asked "Have you witnessed one of the post and core techniques being performed?", 73.1% of participants (n=38) stated that they had witnessed intra-radicular aggregated composite restoration using prefabricated fiberglass post (Fig. 2f).

To the question "Have you carried out one of the post and core techniques?" 89.7% (n=26) mentioned that they had participated in the

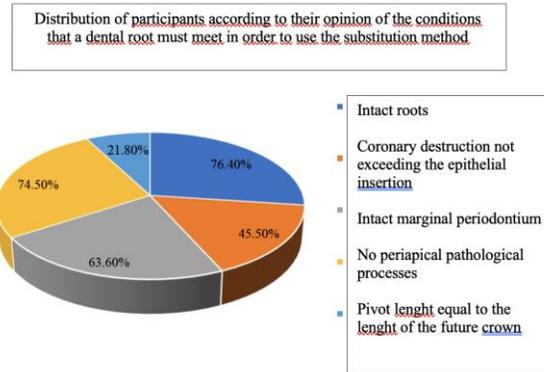
performance of intra-radicular aggregate composite restoration using prefabricated fiberglass post (Fig. 2g).

A percentage of 58.2% of respondents (n=32) considered metal cast posts have the highest mechanical strength (Fig. 2h).

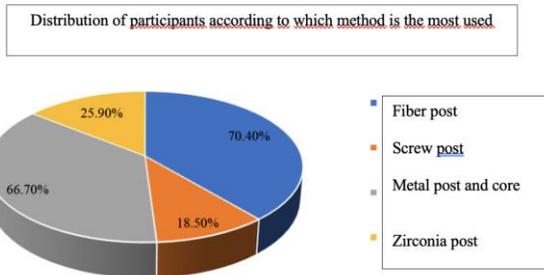
In the last question the participants of this survey were asked "Which of the following mistakes do you think are most commonly encountered when preparing the root canal for a post?", 75.5% (n=40) of them considered excessive widening of the root canal (Fig 2i).



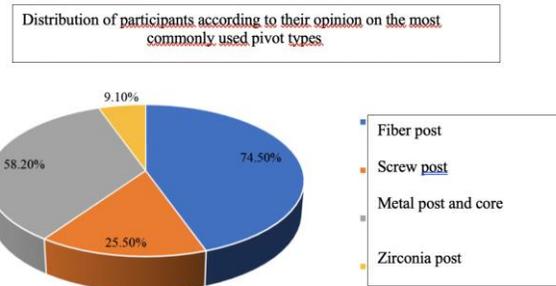
(a)



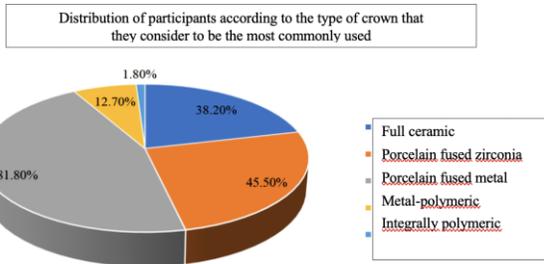
(b)



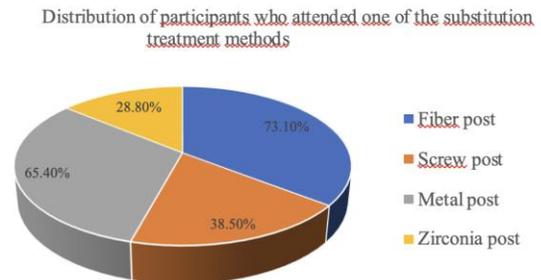
(c)



(d)



(e)



(f)

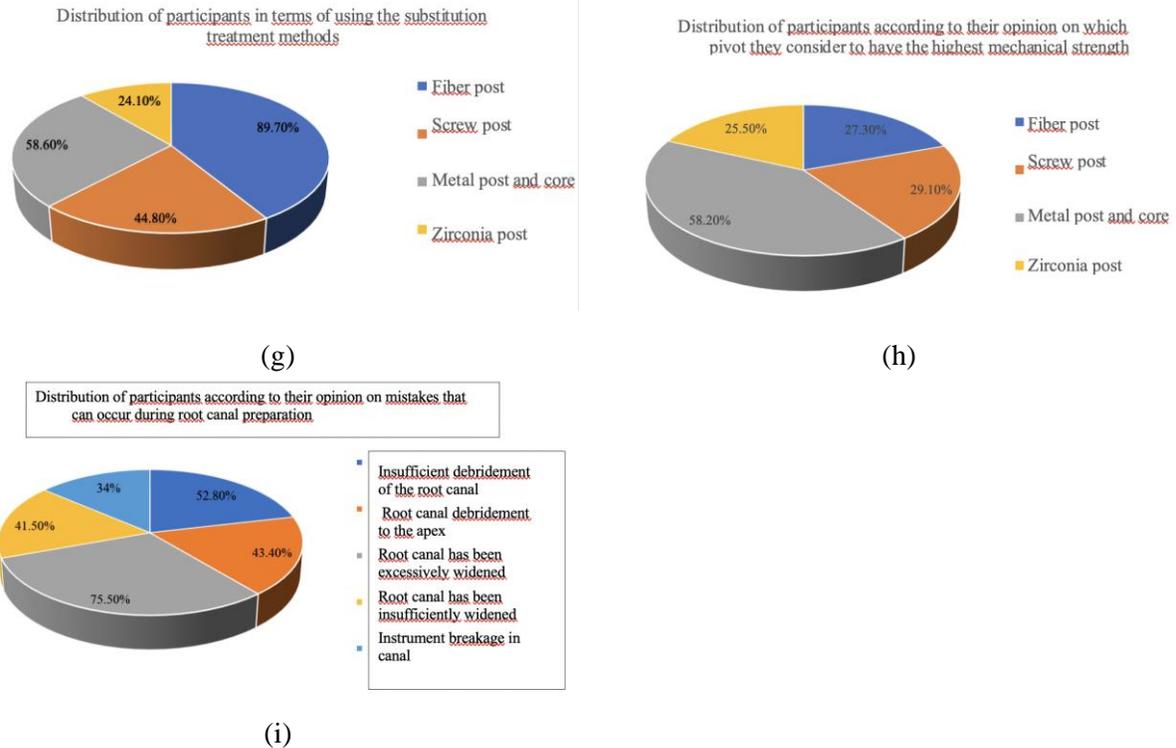


Figure 2. Distribution of the study group. (a) Distribution of participants according to their opinion on the types of lesions that are treated by the substitution method; (b) Distribution of participants according to their opinion of the conditions that a dental root must meet in order to use the substitution method; (c) Distribution of participants according to which method is the most used; (d) Distribution of participants according to their opinion on the most commonly used pivot types; (e) Distribution of participants according to the type of crown that they consider to be the most commonly used; (f) Distribution of participants who attended one of the substitution treatment methods; (g) Distribution of participants in terms of using the substitution treatment methods; (h) Distribution of participants according to their opinion on which pivot they consider to have the highest mechanical strength; (i) Distribution of participants according to their opinion on mistakes that can occur during root canal preparation.

4. Discussions

The results of this study can provide information about opinions, attitudes, and knowledge about crown substitution therapy.

Of the respondents, almost 80% were students and of these almost 80% were 6th year students, denoting that the topic was of interest mainly to final year students. This could be explained by the fact that this questionnaire was mainly distributed in online social groups

of students. More than 70% of the respondents were female and about 80% belonged to the age group 20-29 years, among both students and dentists. The topic was of interest to young doctors, with about 70% having experience between 0-5 years. Regarding the sources of information, the analysis of the answers showed that all the participants considered that more sources of information are needed, starting from the university courses.

In the present study the participants considered that post and core techniques are recommended mainly in the treatment of carious lesions, then in coronary fractures, shape anomalies, malpositions and dyschromias. But the results of studies by other authors indicated that post and core techniques can be successfully used in teeth with dental lesions characterized by limited loss of dental tissue [11]. To perform the post and core techniques, respondents considered that dental roots should be intact and without periapical processes. The results are in agreement with the results of other authors who stated that the post and core method is recommended in teeth without intra-radicular and peri-radicular infections and even more it is indicated to maintain an apical seal of 5 mm. Also, teeth should have at least half of the root anchored in the alveolar process [12]

Respondents felt that prefabricated fiberglass posts are most often used. Their fibers have elasticity, high tensile strength, low electrical conductivity, resistance to solubility and resistance to biochemical degradation. These qualities have led to the preference for fiber pivots [13]. As the most commonly used posts are fiberglass posts, the majority of respondents stated that they had assisted or participated in the performance of post and core techniques using this type of posts.

Intra-radicular aggregated metal-ceramic crown has been voted as the most widely used substitution method for lost crown. Other authors consider ceramic materials popular for restorations by the endocrown method. Many

factors that could influence the success of the post and core techniques are: the used materials, the size of the post, the presence of the ferrule effect [14].

Most respondents considered that metal cast post has the highest mechanical strength. The responses received are in agreement with literature data, with numerous studies indicating that non-precious metal cast posts have higher fracture toughness compared to fiber and prefabricated metal posts [15, 16]. However, these issues are still controversial, as other in vitro studies have shown that fiberglass posts increase the fracture toughness of teeth compared to cast or prefabricated metal posts [17,18]. From the category of the most common errors during preparation of the socket for the post, respondents considered excessive widening of the root canal as the most common error.

5. Conclusions

The survey revealed that study participants considered fiber posts to be the most widely used restorative technique for lost crown, followed by the use of cast metal posts. The main type of crown restoration commonly used for coronal lesions was the metal-ceramic crown. Regardless of which category the participants belonged to, students or clinicians, regarding the topic addressed, most of them felt that information from several sources was necessary. The knowledge of methods and techniques of restoration of lost crown creates the premises for a good morpho-functional rehabilitation of dental arches.

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ORIGINAL ARTICLE

PREVALENCE OF MALOCCLUSIONS IN SCHOOLCHILDREN FROM DOLJ COUNTY, ROMANIA

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Abstract: In recent years, a significant increase in the prevalence of malocclusions has been noted globally. General, loco-regional and local factors are involved in the appearance of orthodontic pathology. Their association with cross-breeding, environmental factors and nutritional scheme contribute to worsening the clinical picture of malocclusions. *Objective.* This study aims to investigate the prevalence of malocclusions in a specific population of schoolchildren from Dolj County, Romania. *Materials and method.* The study group consisted of 216 schoolchildren aged between 6 and 14 years old, who were enrolled in two randomly selected schools from both urban and rural areas of Dolj County, Romania. *Results.* After collecting and centralizing the data, the prevalence of malocclusions was 43.98%, almost similar in urban and rural areas. *Conclusions.* Almost half of the children had malocclusions, and this underline the need for specialized treatment, but also for prevention.

Keywords: prevalence, malocclusion, schoolchildren.

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1. Introduction

Malocclusions show a continuously increasing prevalence. It has been noted that in prosperous countries the prevalence of malocclusions is much higher than in less developed countries. That is why one of the main causes is the change in diet, mainly the consumption of processed foods, during the development period of the stomatognathic system [1].

At the same time, there are disturbances in the dento-maxillary apparatus' functions (mastication, phonation, deglutition and physiognomy) and oral hygiene. Due to the fact that more and more patients require orthodontic treatment, therapeutic methods have evolved rapidly in recent years [2-4].

However, the assessment by pedodontists and orthodontists of the risks of occurrence of malocclusions in children, using modern prevention techniques, is one of the most important objectives of epidemiology in dental medicine. The identification of general (prenatal etiopathogenesis, heredity, constitutional bone diseases, phylogenetic, endocrine and dysmetabolic factors), loco-regional (dysfunctions and parafunctions) and local factors (maxillofacial trauma and tumors, scars, suppurated inflammatory lesions of the temporomandibular joint, dental caries and their complications and early tooth loss) incriminated in the etiopathogenesis of malocclusions constitutes another essential epidemiological goal [1,5]. It is necessary to promote new epidemiological research with an important role in providing useful data for establishing priorities and solving public health

problems [6-8]. Thus, quality and regular publication of research is crucial. In order to achieve these goals, dentists must play active roles by getting involved in the prevention of malocclusions.

Nowadays, malocclusions are the third most common oral health problem, after dental caries and periodontal disease, according to the World Health Organization [9-14].

The aim of the study was to investigate the prevalence of malocclusions in a specific population of schoolchildren from Dolj County, Romania.

2. Materials and method

The study was approved by the Ethics Committee of the University of Medicine and Pharmacy of Craiova, Romania (approval reference no. 56/29.01.2024), in accordance with the ethical guidelines for research with human participants of the University of Medicine and Pharmacy of Craiova, Romania. Also, the informed consent was obtained from the legal guardians of the children included in our research.

We conducted a comparative epidemiological study on the prevalence of malocclusions between two groups of schoolchildren, one from the urban area of Craiova, Romania and one from the surrounding rural areas.

The research was carried out through a partnership with two randomly selected schools from Dolj County, Romania and the related School Inspectorate. The inclusion criteria for our study was: children's age must be between 6 and 14 years old; the children

must be students of the selected schools; the informed consent must be obtained from the legal guardians of the children; the children must give their verbal consent for examination; the participation must be voluntary and the children must be cooperative. We excluded from our study: children outside the age range 6-14; children who did not receive informed consent from a legal guardian and uncooperative children.

After applying the previously mentioned criteria, our study group consisted of 216 schoolchildren.

Despite the existence of numerous classifications of malocclusions, we opted in our study for the classification of Angle, being the first to appear and the most used even today. It uses the static relation of the first permanent molars. The first permanent upper molars are assumed to have a fixed position and, thus, the mesial-distal relations that they establish with the first permanent lower molars are followed. Within this classification, there are three classes of malocclusions: Angle class I, Angle class II (with the divisions 1 and 2) and Angle class III (with the divisions 1 and 2) [15].

The data obtained were recorded electronically with the help of the software package Microsoft Excel 365 and, thus, the results could be presented through representative graphs.

3. Results

From the total number of 216 schoolchildren included in our study, 127 (58.8%) came from the urban area of Craiova,

Romania and 89 (41.2%) came from the surrounding rural areas (see Figure 1).

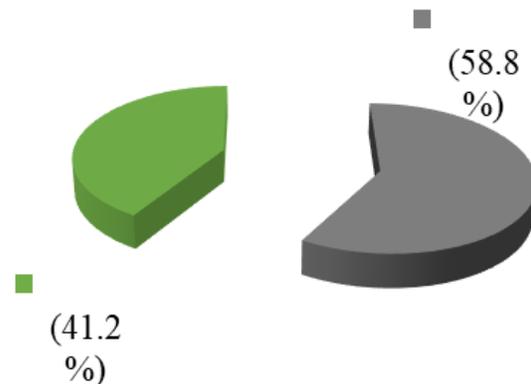


Figure 1. Schoolchildren's statistics according to the place of origin.

Among the 216 schoolchildren, 95 presented malocclusions, meaning a prevalence of 43.98% (see Figure 2).

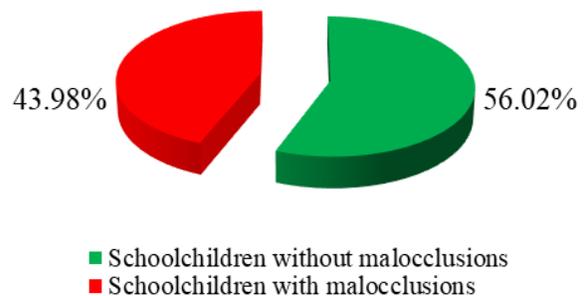


Figure 2. Statistics of schoolchildren with malocclusions.

In the urban area, out of the 127 schoolchildren, 58 presented malocclusions, so a prevalence of 45.67% (see Figure 3).

Among the 58 schoolchildren with malocclusions from the urban area: 39 (30.71%) presented Angle class I malocclusions; 13 (10.24%) presented Angle class II division 1 malocclusions; 5 (3.94%) presented Angle class II division 2

malocclusions and 1 (0.79%) presented Angle class III division 2 malocclusion (see Figure 4).

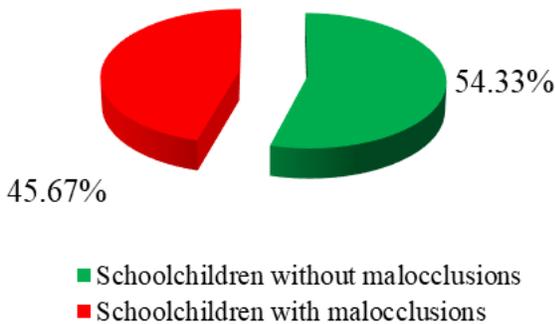


Figure 3. Statistics of schoolchildren with malocclusions from the urban area.

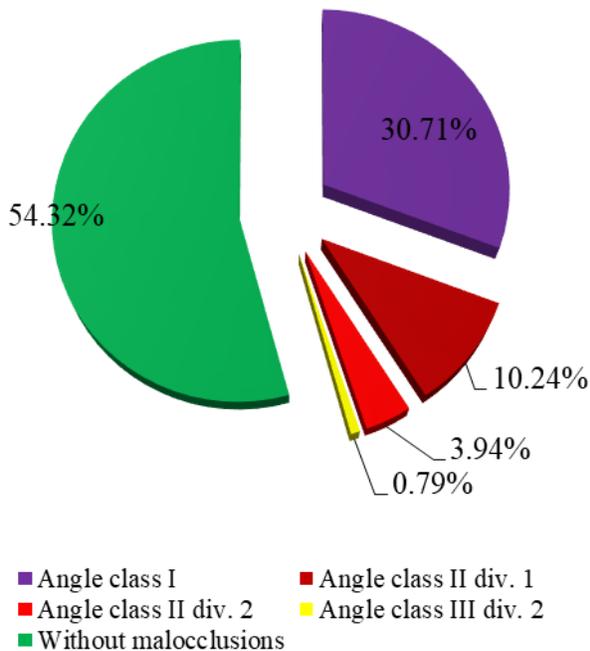


Figure 4. Statistics of schoolchildren with malocclusions from the urban area according to Angle's classification.

In the rural areas, out of the 89 schoolchildren, 37 presented malocclusions, so a prevalence of 41.57% (see Figure 5).

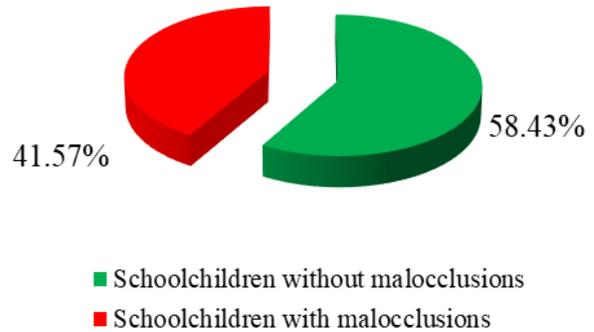


Figure 5. Statistics of schoolchildren with malocclusions from the rural areas.

Among the 37 schoolchildren with malocclusions from the rural areas: 28 (31.46%) presented Angle class I malocclusions; 8 (8.99%) presented Angle class II division 1 malocclusions and 1 (1.12%) presented Angle class II division 2 malocclusion (see Figure 6).

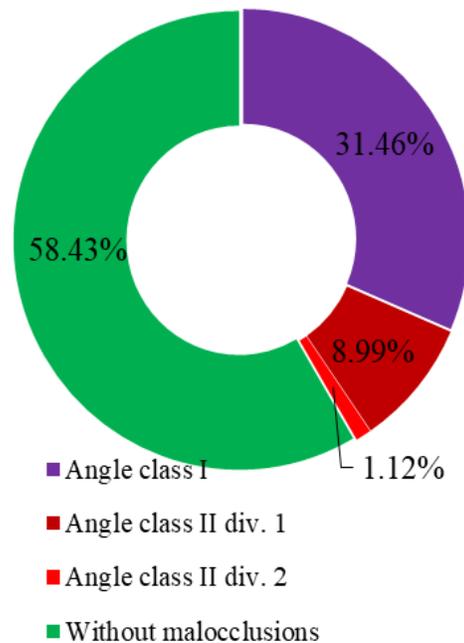


Figure 6. Statistics of schoolchildren with malocclusions from the rural areas according to Angle's classification.

4. Discussions

An epidemiological study conducted in 2001 in Romania, the researchers found the following prevalence of malocclusions: 44.7% for Angle class I; 24.6% for Angle class II and 2.3% for Angle class III [16].

After a statistical research conducted in the Dental Ambulatory for Children in Iași, Romania, covering the period from 2000 to 2010, the authors found the highest prevalence for Angle class I malocclusions (63.2%) and the lowest prevalence for Angle class III malocclusions (5.8%) [17].

It's interesting to note that another study conducted in the mining areas of the Apuseni Mountains, Romania found a similar distribution of malocclusions, but with slightly different percentages: 56.4% for Angle class I; 37.9% for Angle class II and 5.7% for Angle class III [18].

After a statistical analysis performed in Bucharest, Romania, the distribution of malocclusions was as follows: 60% for Angle class II; 28.6% for Angle class I and 11.5% for Angle class III [19]. This data shows a different prevalence pattern compared to the previous studies. This information shows that the prevalence of malocclusions can vary across different populations and regions. Factors such as genetics, environmental influences and cultural habits can contribute to these variations.

Angle class I malocclusions are the most prevalent overall, with a wide range observed in different countries, from 31% in Belgium to 96.6% in Nigeria. The distribution pattern indicates a higher prevalence among Africans

(89.44%) compared to Caucasians (71.61%) and Asians (74.87%). Additionally, Angle class I malocclusions in Asians increase during puberty, suggesting that there are developmental factors influencing the occurrence of malocclusions in this population during specific life stages [1].

Angle class II malocclusions have an overall prevalence of 19.56%, with a considerable range of variation across different countries, from 1.6% in Nigeria to 63% in Belgium. Caucasians have the highest reported prevalence at 22.9%, followed by Asians at 14.14% and Africans at 6.76%. The global distribution pattern of Angle class II malocclusions according to race is somewhat similar in the two sets of teeth. Particularly in the transition from mixed to permanent dentition, there is a tendency for correction of Angle class II malocclusions during pubertal growth, with the exception of Africans. Both the prevalence and correction of Angle class II malocclusions, as a result of pubertal growth, can be attributed to genetic influence. Recent research emphasizes the basic role of genetic control in the growth of condylar cartilage and condyles [1].

The data indicates that the overall prevalence of Angle class III malocclusions is relatively low at 5.93%, with varying percentages across different countries, ranging from 0.7% in Israel to 19.9% in China. The reported prevalence for Caucasians is 5.92%, for Africans 3.8% and for Asians 9.63%. The model of global distribution of Angle class III malocclusions seems to be consistent across both mixed and permanent dentitions. Notably,

there is a tendency for the development of Angle class III malocclusions to increase during the transition from mixed to permanent dentition in Africans and Caucasians. The importance on the genetic factor in the etiology of Angle class III malocclusions is significant. These malocclusions in Asians are primarily due to developmental deficiencies in the middle third of the face rather than mandibular prognathism [1].

5. Conclusions

Almost half of the children had malocclusions, and this underline the need for

specialized treatment, but also for prevention. Understanding the prevalence and characteristics of different malocclusions is crucial for orthodontic diagnosis and treatment planning. It also highlights the multifactorial nature of these conditions, involving multiple factors, such as genetic and developmental factors. Also, addressing the ever-increasing prevalence of malocclusions through prevention programs in collaboration with public health institutions, schools and school medical offices is a proactive approach to promote oral health.

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Author contributions

All authors read and approved the final manuscript. All authors have equally contributed to this work.

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Conflict of interest statement

The authors declare no conflicts of interest concerning this study.

Data availability statement

Will be provided on request.

Ethics statement

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ORIGINAL ARTICLE

PARTICULARITIES OF PLACING THE CERVICAL LIMITS OF PROSTHETIC CROWNS WITH IMPLANT SUPPORT – CASE SERIES

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Abstract: In implant-prosthetics, individualized implant abutments have become a popular subject of interest. Their position, height and shape can be individualized. Abutments can be made of materials such as zirconium oxide, lithium disilicate or hybrid materials. The purpose of this research was to exemplify, through a series of cases, various particularities of the placement of the cervical limits of prosthetic restorations with implant support. Materials and method This study is retrospective and was carried out by analyzing the images belonging to the cases from the archive of the Faculty of Dental Medicine of the University of Medicine and Pharmacy in Craiova. The selected cases belonged to partially edentulous patients who benefited from fixed implant-prosthetic treatment performed through the digital protocol. Results After applying the inclusion and exclusion criteria, 23 cases were selected. For this article, images belonging to several cases were used to exemplify the particularities of the cervical limits of prosthetic crowns with implant support. Conclusions If in the lateral area or on the oral surfaces it is recommended to place the cervical limit as close as possible to the gingival margin or even supragingival to favor the maintenance of peri-implant health, in the frontal area the aesthetic requirements demand a deeper subgingival placement of the cervical limit of the implant abutment.

Keywords: implant-supported crowns, cervical limit, CAD-CAM technology.

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1. Introduction

The technology of implant-supported prostheses derives from the technology of classic prostheses with dental support, having a series of particularities, related to the fact that the abutment is a prosthetic piece obtained outside the oral cavity, in the dental laboratory or in the factory of the implant manufacturer.

In making implant-supported prosthesis, special attention is paid to the meso-structure, part of the prosthesis located on top of the implant, bearing the prosthesis and the super-structure, the final prosthesis itself [1].

The prosthetic field impression stage marks the beginning of the realization of the prosthetic super-structure. The impression technique differs depending on the super-structure chosen, its support and the implant system used. In implant prosthetics, the direct impression technique and the indirect impression technique have become common. The appearance of intraoral scanners determined the development of digital impression [2]. By developing scannable transfer devices, whose image can be perfectly matched with their standard image from the manufacturer's virtual library, this technique has become increasingly used in current practice as a component of the CAD-CAM protocol [3].

The CAD-CAM protocol involves three consecutive steps: scanning, CAD modeling and CAM production. Scanning refers to the 3D recording of the data of a classic model or an impression and transforming it into a virtual working model. The CAD component refers to the 3D modeling or design of the future

prosthesis or a final component on the implant. The CAM system physically produces that 3D designed component, by milling it in precision milling machines, using biocompatible metals, especially titanium [4].

One of the most important aspects of using the CAD-CAM system in the creation of implant-supported prosthetic components is the fact that there is the possibility of custom design for each case, thus being able to modify a series of parameters, such as the emergence profile, thickness, line package and the external outline of the component [5].

In the fabrication of a super-structure within a prosthetic restoration on implants, several principles and rules must be respected. In most cases, it is preferred to place the limits of the super-structure supragingivally, especially in the lateral area.

The design of the super-structure must facilitate, through the presence of embrasures, the possibility of perfect hygiene and good gingival stimulation [6]. Some of the new implant systems launched in order to satisfy aesthetic demands, allow the juxtagingival or even intratissue placement of the gingival margins of the prosthesis [7].

In the field of implant-supported prosthetics, individualized implant abutments have become a subject of interest. The position, height and shape, especially in the emergence area, can be individualized. The abutments can be made of materials such as zirconium oxide, lithium disilicate or hybrid materials. For the lateral area, there are alternatives of bicomponent abutments from a prefabricated titanium base and a bonded ceramic post [8].

Classically, standard abutments supplied by the manufacturer are used, which are individualized by milling by the dental technician in the dental laboratory. Modern, individualized abutments are made that are obtained by classical casting methods or are milled by CAD CAM techniques after their design is digitally created [9, 10].

The classic method of obtaining customized abutments consists in using a castable abutment composed of a prefabricated titanium interface to which a castable plastic tube is attached. On this castable tube, the technician customizes the abutment by adding wax, giving it a shape specific to that case. It follows the classical procedure of investing, calcination and casting, thus obtaining a single common body after the fusion between the titanium interface and the cast metal [11].

Personalized abutments obtained by the digital protocol are the most suitable solution for any case, regardless of its complexity. Once the working digital model is obtained, the design of a customized prosthetic abutment (custom abutment) is not at all difficult, but the way it will be physically produced by a milling machine will be taken into account when designing it [12].

The purpose of this research was to exemplify, through a series of cases, various particularities of the placement of the cervical limits of prosthetic restorations with implant support.

2. Materials and method

This study is retrospective and was carried out by analyzing the images from cases treated

at the Faculty of Dental Medicine of the University of Medicine and Pharmacy in Craiova. This research was approved by the Ethics Commission of the University of Medicine and Pharmacy in Craiova (no. 58/29.01.2024).

Inclusion criteria were: (1) patient with maxillary or mandibular partial edentulism, who benefited from fixed implant-prosthetic treatment; (2) two-component implants were inserted; (3) the digital implanto-prosthetic restoration protocol was done; (4) prosthetic crowns with implant support were made.

Exclusion criteria were: (1) patient with partial/total maxillary/mandibular edentulism who did not benefit from fixed implant-prosthetic treatment; (2) monocomponent implants were inserted; (3) the conventional implanto-prosthetic restoration protocol was done; (4) bridges with implant support were made.

The digital stages of obtaining prosthetic abutments began with the scanning of the prosthetic field on the working model/directly in the oral cavity. The scan included gingival registration and digital transfer abutments. Next came the alignment of the components and the preparation of the files necessary for the design. Then the project of the future customized abutment was defined in EXOCAD, the scanned files were loaded, the implant model used was identified from the digital library, the emergence profile was drawn according to the scanned gingiva, the appearance of the abutment was defined by drawing the Bottom and Top lines/points, then the project was saved. Figure 1 shows some of

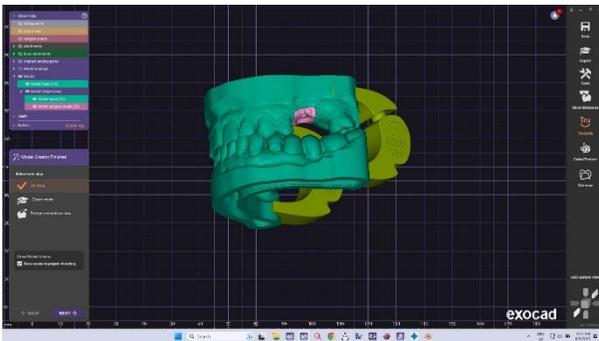
the working stages of the digital protocol for obtaining the personalized abutment of a case selected for this study.

3. Results

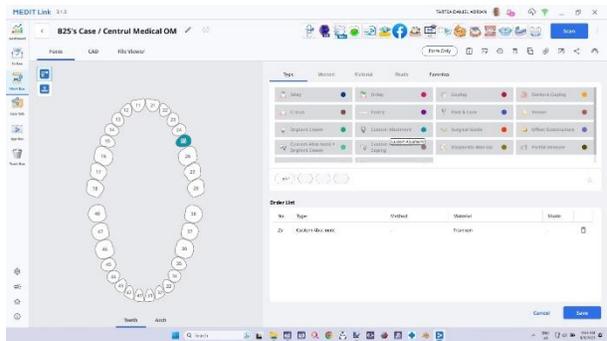
After applying the inclusion and exclusion criteria, 23 cases were selected. For this article, we will exemplify through images from several

cases, the particularities of the cervical limits of prosthetic crowns with implant support to achieve the proposed objective.

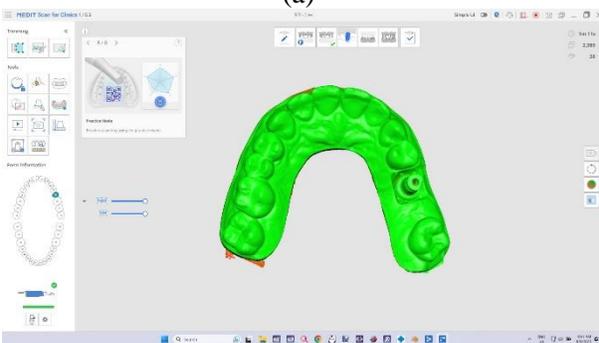
The first case presented is of a patient with maxillary partial edentulism who had a Bredent implant inserted in the position corresponding to tooth 2.5. It was decided to create an individualized prosthetic abutment.



(a)



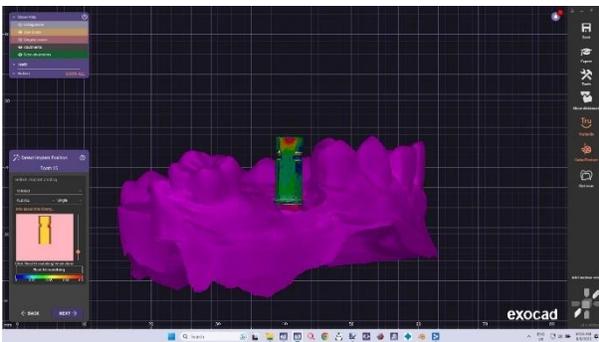
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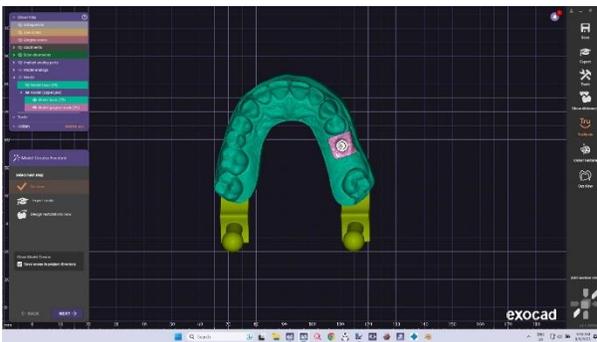
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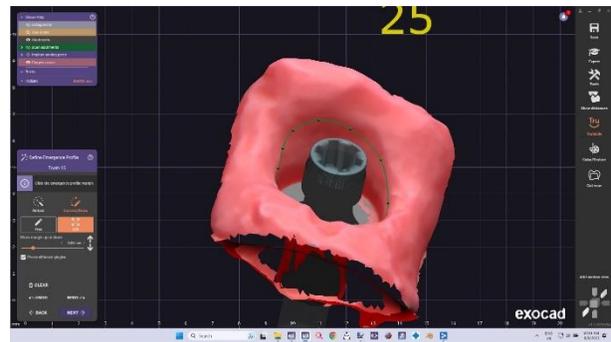
(e) (f)
Figure 1. Working stages. (a) ExoCAD software interface; (b) interface of the scanning software used; (c) the digital appearance obtained after scanning the printed model; (d) the interface of the design software used highlighting the parameters used; (e) identifying the digital transfer device mounted on the implant analog and pairing it with the one in the software's digital library; (f) the gingival emergence profile definition menu and a first line suggested by the software.

With the help of the EXOCAD-Bredent implant library, the position and shape of the future prosthetic crown was established, depending on the potential prosthetic space available. The design of the abutment was

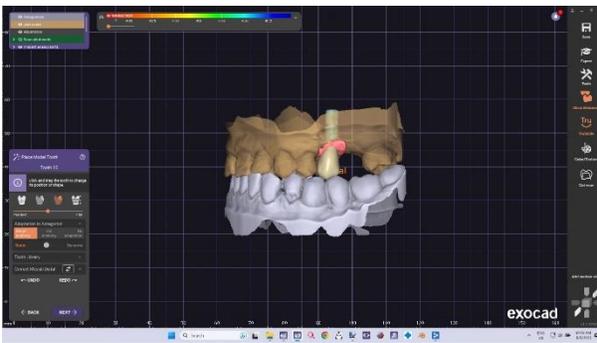
made according to the desired shape for the prosthetic crown in position 2.5. Some of the working steps, most relevant for the purpose of this article, are shown in Figure 2.



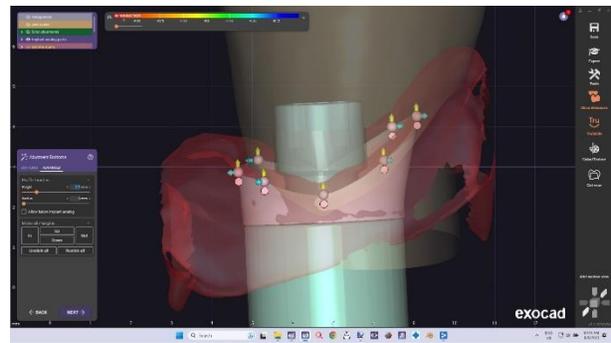
(a)



(b)



(c)



(d)

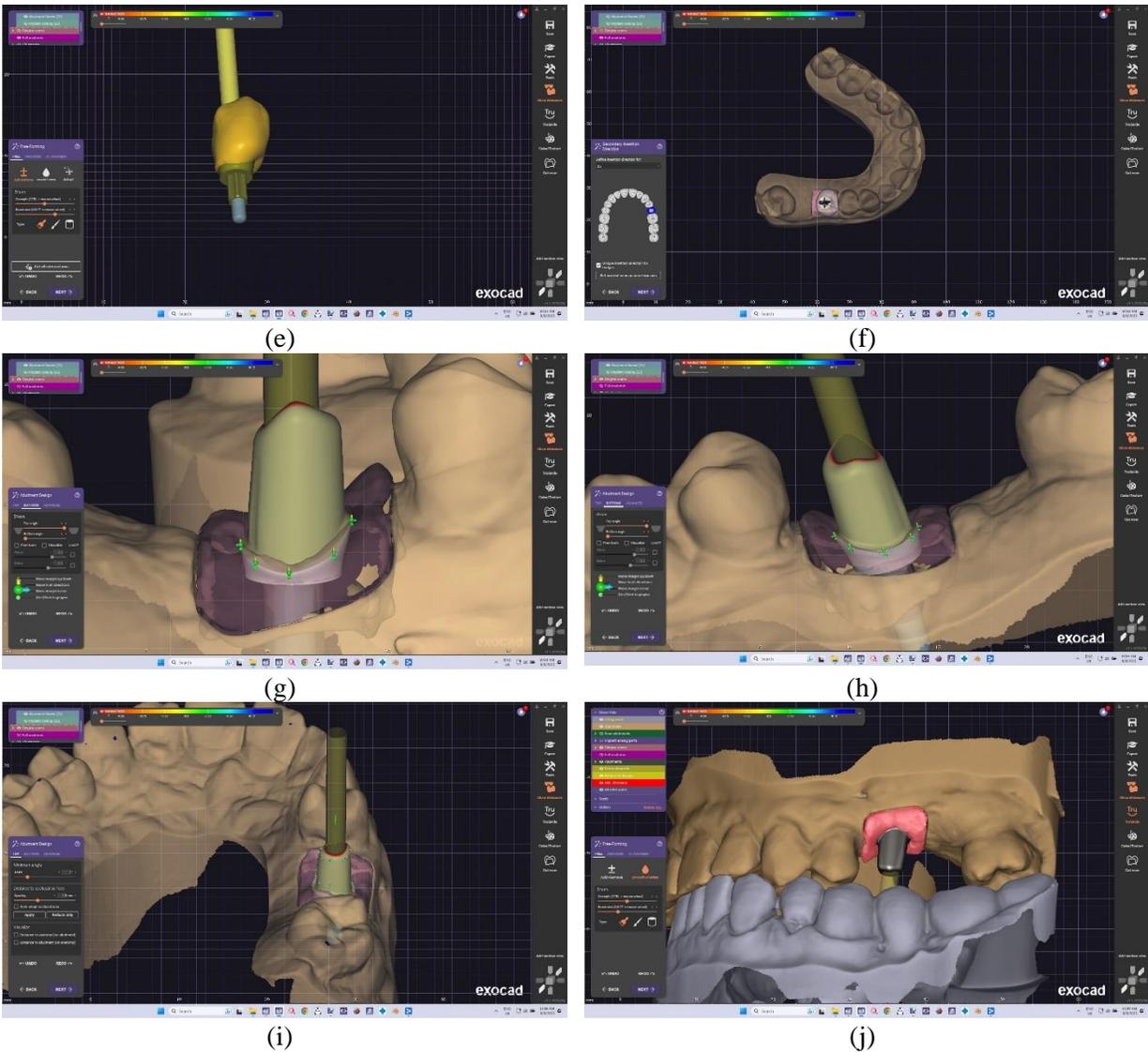


Figure 2. (a) digital appearance of the printed model; (b) gingival emergence profile editing menu; (c) crown appearance; (d) editing the position of the cervical limit of the abutment; (e) visualization of the cervical profile of the abutment; (f) view of abutment insertion axis; (g) visualization of the cervical profile of the abutment; (h) oral view of the cervical profile of the abutment; (i) distal view of the ratio of the cervical border of the abutment; (j) the final digital appearance of the abutment.

The second case presented is of a partially edentulous patient who was inserted a Bredent implant in the position corresponding to tooth 3.6. It was decided to create an individualized prosthetic abutment, on which a prosthetic crown with implant support was applied.

Obtaining digital information was done by performing an intraoral scan for which a scan transfer device placed at the level of the implant was also used. Figure 3 shows some of the work stages.

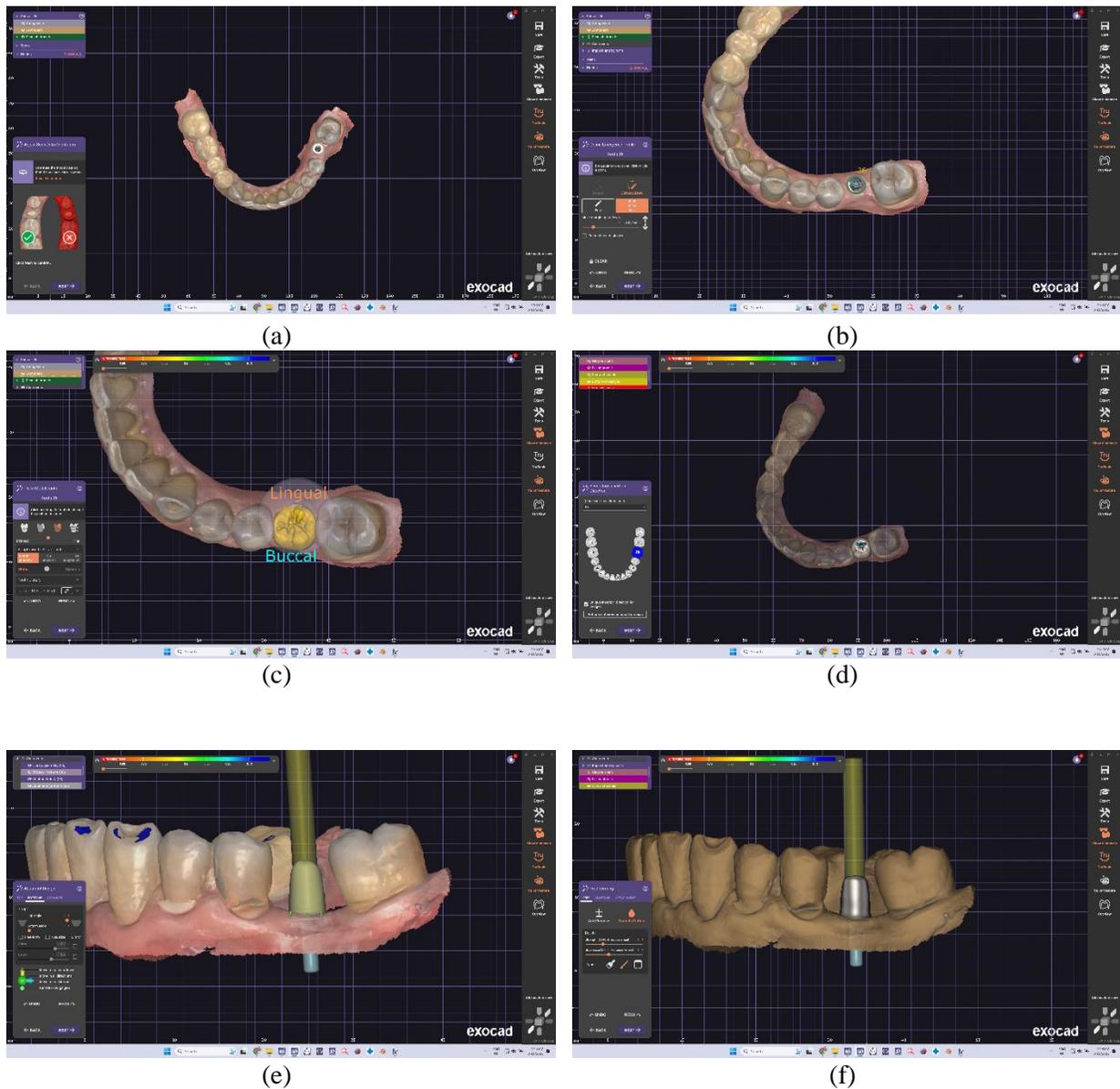


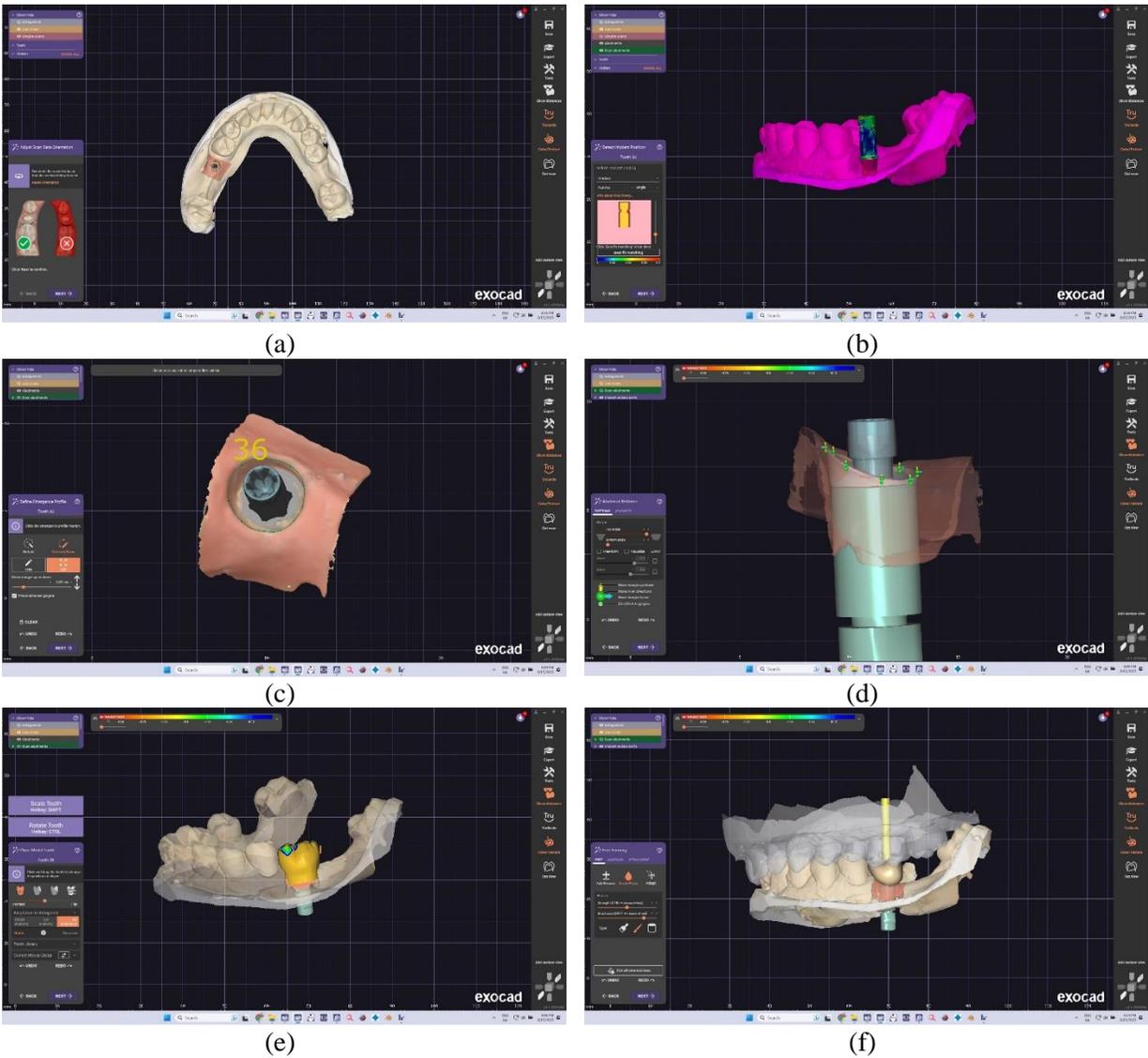
Figure 3. (a) appearance in ExoCad design software of the intraoral scan of the mandibular arch with the scannable transfer device mounted at the implant level; (b) gingival emergence profile definition menu and a first line suggested by the software; (c) crown suggested by software library; (d) view of the insertion axis of the future crown; (e) establishing the design of the basal portion of the prosthetic abutment and its cervical limits; (f) final shape of the prosthetic abutment showing the insertion axis.

The last case presented is that of a patient with partial mandibular edentulism who had a BREMENT implant on the position

corresponding to tooth 3.6. It was established, again, the realization in EXOCAD of an individualized prosthetic abutment. The

acquisition of digital information was done by scanning the plaster working model and the gingival profile reproduced from the silicone material, together with a scanning marker

placed at the level of the implant. Certain working stages, the most relevant for this article, are shown in Figure 4.



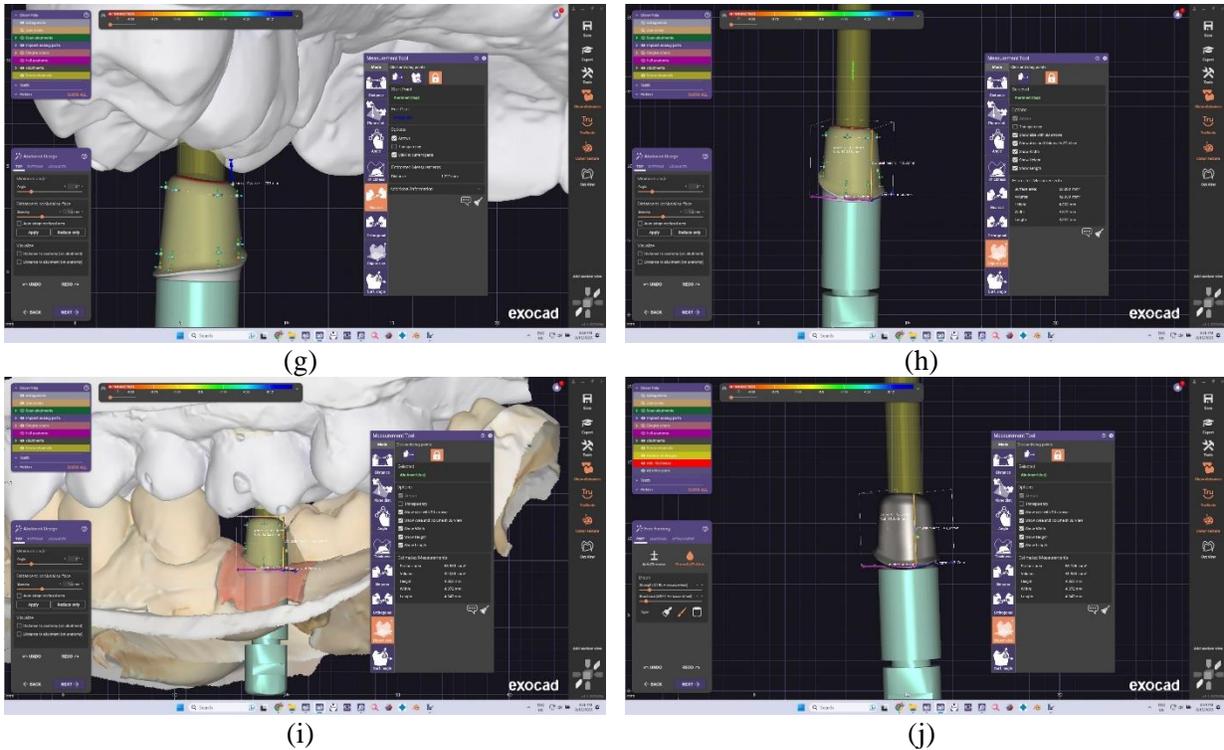


Figure 4. (a) appearance of the scanned plaster model; (b) aligning the scanning marker with the device in the software library; (c) gingival emergence profile editing menu; (d) editing the position of the cervical margin of the abutment; (e) the appearance of the crown suggested by the software library; (f) establishing the shape of the zirconia crown; (g) establishing the shape of the upper portion of the abutment with the measurement of the prosthetic space left for the crown; (h) establishing the final shape of the prosthetic abutment with the measurement of its dimensions; (i) establishing the final shape of the abutment; (j) the final digital appearance of the abutment.

4. Discussions

Implant-supported prostheses are a popular treatment choice for the rehabilitation of patients with missing teeth, particularly those in the anterior region of the maxilla, where esthetics is highly important [13].

Despite its popularity amongst dental practitioners and patients, one must be aware that after implant restoration, several postoperative complications can appear, including food traps, poor esthetic outcomes, periimplantitis, mucositis [14]. The success of

the implant-prosthetic treatment is dependent on the health of the surrounding bone and soft tissues. Prevention and management of mucositis and peri-implantitis are essential for long-term maintenance of the health of these tissues [15].

Dental implantology has seen a significant evolution in recent years, including the implementation of CAD-CAM systems that ensure a high success rate for the prosthetic restoration. Some of the most popular CAD software are Exocad, 3Shape, DentalWings, and referring to the CAM software, the most

frequently used are hyperDENT, CIMSystem-Millbox and WorkNC [16]. Use of CAD/CAM technology in implantology allowed the fabrication of custom abutments. Nowadays, the realization of individual custom abutments can be done according to the patients' anatomic landmarks and/or with the ideal emergence profile of the absent tooth [13].

Although design software offers a wide range of tools for individualizing the shape of the prosthetic abutments of implant-supported restorations, there is currently no consensus on the design of all prosthetic abutments [17].

Abutment designs may be customized to enhance the emergence profile of the crown in relation to the soft tissue or to increase crown retention [18, 19]. Custom abutments based on CAD-CAM technology can be individualized to each clinical situation, and materials such as titanium may be used, zirconia, ceramic and PEEK [16]. Customized abutments enable the creation of an individualized emergence profile for the prosthesis, simplifying the removal of excess cement compared to standardized abutments [20]. Personalized medicine offers better solutions for various health problems. In

implantology, this trend represents the customizing dental abutments for each clinical situation. The patients' and dentists' demands for better esthetics and function of implant-supported restorations have imposed a more personalized variety of prosthetic abutments [21].

5. Conclusions

A good knowledge of the possibilities of realizing the design of prosthetic abutments, as well as the existing limits, is important for both the dental technician and the dentist, in order to ensure a good collaboration between them in order to optimally fulfill the wishes of a successful implanto-prosthetic treatment functionally.

If in the lateral area or on the oral surfaces, it is recommended to place the cervical limit as close as possible to the gingival margin or even supragingival to favor the maintenance of peri-implant health, in the frontal area the aesthetic requirements require a deeper subgingival placement of the cervical border of the implant abutment.

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All authors read and approved the final manuscript. All authors have equally contributed to this work.

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Will be provided on request.

Ethics statement

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ORIGINAL ARTICLE

APPLICATIONS OF CAD/CAM TECHNOLOGY IN DENTISTRY

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Abstract: Digital dentistry has been introduced for over 40 years, but their overspread use has become available in the last two decades, after year 2000. First to introduce it in dentistry was a dentist, but the widespread of the digital dentistry was carried out mostly by dental technicians. In Romania, digital dentistry had become available with state funding projects for the dental field. Objective The aim of the study was a broader assessment of the use of CAD/CAM systems in dental practices and dental technology laboratories. *Materials and method.* The study consisted in a survey based on a questionnaire, distributed in electronic form, applied to two branches of dentistry, respectively, for dentists and dental technicians. The study was attended by dentists and dental technicians, from the urban environment. Results were analyzed using statistical methods with Microsoft Excel. *Results.* The results of the present study showed a high degree of knowledge regarding CAD/CAM technology, as most of the participants were aware of the introduction and use of digital technology in dentistry. Majority of dental technicians have introduced and have worked with CAD_CAM systems, comparative with dentists, which only a third part worked usually with these technologies. *Conclusions.* Even though digital dentistry is a modern technology with advantages, there are still some concerns from dentists and technicians about the quality and costs of CAD/CAM restorations.

Keywords: CAD/CAM, digital technology, dentists, dental technicians, questionnaire.

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1. Introduction

In the last 20 years, computer-aided design (CAD)/computer-aided manufacturing (CAM) has become increasingly used in all medical fields, including dentistry [1]. CAD/CAM technology is used to manufacture inlays, onlays, veneers, crowns, fixed partial dentures, implant abutments, in orthodontics and even in complex oral rehabilitation [2]. Modern dental practice involves an increasingly frequent application of new technologies, which present numerous advantages that facilitate the work of the dentist, but also from the point of view of the patients, who are becoming more and more demanding in terms of aesthetic requirements, and with the clearly expressed desire to spend as little time as possible in the dental office [3].

The computer, as a means of interactive communication, has a greater role in modern dental prosthetics in terms of practice in the dental office, but also in dental technical laboratories. The use of computers in dental therapy is a challenge for enthusiasts and visionaries who have developed an entirely new field: computerized dentistry. CAD/CAM systems represent the pinnacle of computer technology with many realized and potential applications in dentistry [4].

According to the production methods, CAD/CAM systems can be classified into three categories [5]: dental office system, laboratory system and centralized production. With the laboratory system and the centralized production system, the responsibility of producing the dental restoration is delegated to the dental technician with the help of the CAD/CAM milling unit.

Older CAD/CAM systems required a minimum of two visits to the dental office to complete the dental restoration, whereas the in-office system allows the dentist to control the entire process, starting with taking a digital impression of the prepared tooth(s) and then designing and manufacturing the restoration their dental. Finally, the final restoration is delivered at the same visit. In general, CAD/CAM systems involve three elements. The first element is a digitizer/scanner tool that transforms the geometry into digital data that can be processed by the computer. The second element is the Software that processes the data obtained from the digital scanner. The third part of the CAD/CAM system is a milling machine that receives the information from the Software to produce a dental restoration with specific features and design. To date, CAD/CAM technology has been implemented to produce various types of dental restorations, including inlays, onlays, crowns, veneers, fixed partial dentures, and implant abutments [6].

In digital denture manufacturing workflow, it has been highlighted that different types of dental CAD software can affect the quality of dentures [7].

Standards for dental CAD software released by various manufacturers are still ambiguous as to what criteria dental staff should consider when purchasing such software. Moreover, the information required by different dental personnel remains insufficient for the development and advancement of dental CAD software [8].

By now, CAD/CAM technology has become an essential part of modern dentistry. It can be speculated that this technology will change the shape of future dental practice. However, research investigating the current place of CAD/CAM technology among practicing dentists worldwide is still scarce. What is the attitude of dentists towards this technology? Are they well trained and properly educated to provide such dental services? What about the current nature of dentists' practice in providing CAD/CAM dental restorations? All these questions still do not have clear answers [6]. The present study aimed at a wider evaluation of the use of these systems in dental practices and dental technology laboratories.

2. Materials and method

The studied material was represented by the answers given by the study participants, a comparison was made between the opinions of dentists and those of dental technicians. The following parameters were used: age, workplace, knowledge of CAD/CAM systems, use of CAD/CAM system, tendency to use CAD/CAM systems by certain dental branches, results of CAD/CAM system, results of doctors and technicians, the evaluation of the CAD/CAM system. The study was approved by the University and Scientific Ethics and Deontology Commission of the University of Medicine and Pharmacy of Craiova, respecting the Helsinki 1995 norms, opinion No. 197/24.11.2021.

The research method consisted of conducting a survey based on a questionnaire, distributed in electronic form, applied to two

branches of dentistry, respectively, for dentists and dental technicians. At the beginning of the questionnaire, the purpose of completing the form was stated, participation in the study was optional, and filling in personal data was not necessary, the questionnaire remained anonymous. The electronic format of the questionnaire was created using Google Forms and distributed as a URL. The form was distributed online, using a social media application, over the course of 4 months, from December 2021 to March 2022. The questionnaire allowed each participant to complete the next question only after ticking the answer for the previous question, thus ensuring that all the questions provided will be answered.

Structurally, the questionnaire included 16 questions. The first 2 questions had in mind the collection of information on the basis of which the professional variables of the study group were defined: age and place of work. The second part of the questionnaire included 14 simple and multiple-choice closed questions, related to: knowledge about CAD/CAM systems, use of CAD/CAM systems, tendency to use CAD/CAM systems by certain industries, results of CAD/CAM systems, physician and technician outcomes, CAD/CAM system evaluation.

3. Results

A number of 105 dentists and 52 dental technicians from the Oltenia area responded to the questionnaire. Regarding the age groups of the interviewed dentists, most dentists were between 20 and 40 years old (61.9%), followed

by the 40-55 (31.4%), and the majority of dental technicians were aged between 20 and 40 (73.1%), followed by the 40-55 category (21.2%) (Figure 1).

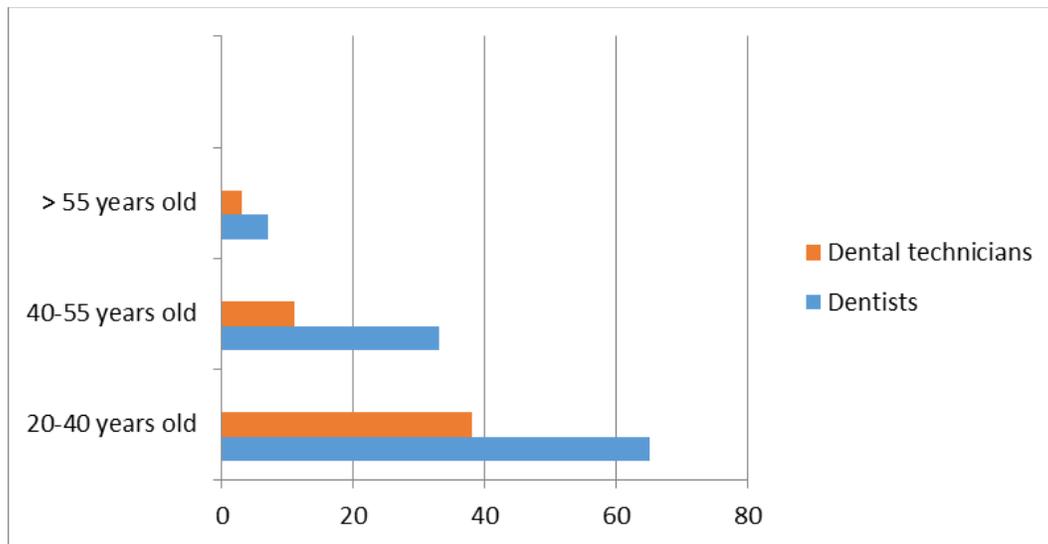


Figure 1. Distribution of study participants in relation to their age.

Regarding the place of work of the interviewed dentists, the majority worked in the private sector (62.9%), then there were those who worked both in the private system and in the state system (30.5%), while very few (6.7%) worked in the public system. Regarding the form of employment of the interviewed

dental technicians, the majority of dental technicians worked as employees with an employment contract (51.9%), then there were those who worked in collaboration (30.8%), the lowest percentage being of those who worked in their own laboratory (23.1%) (Figure 2).

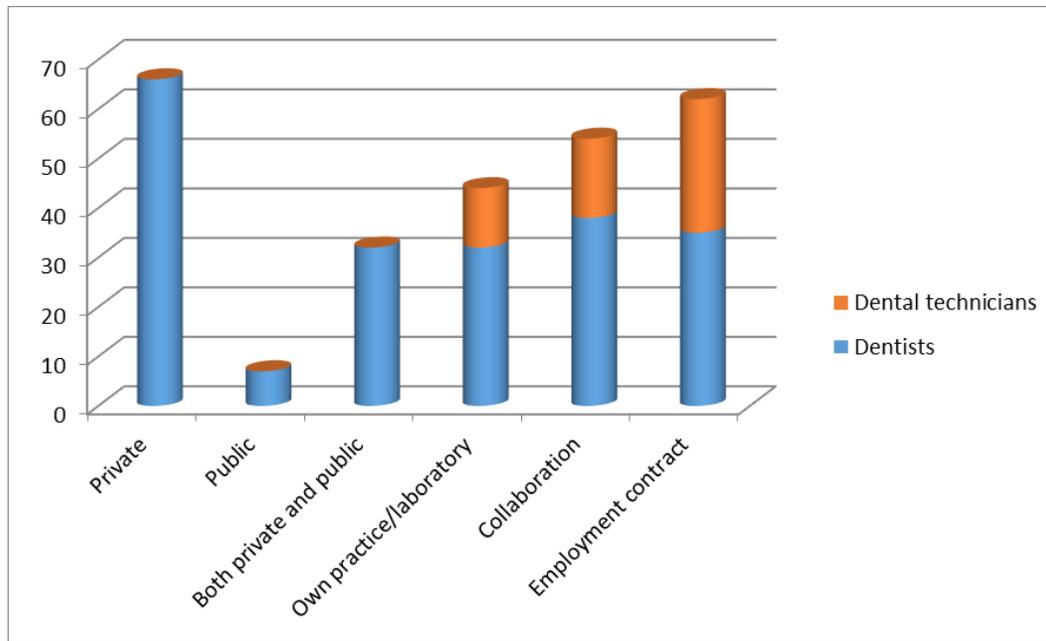


Figure 2. Distribution of study participants in relation to their workplace/form of employment.

Regarding the familiarity of interviewed doctors and dental technicians with CAD/CAM systems, most doctors (79%) and dental technicians (67.3%) are familiar with this concept, most dentists (50.5%) and the

majority of dental technicians (53.8%) used these systems and the majority of dentists (72.38%) and dental technicians (67.3%) expressed their desire to use CAD/CAM systems in the future (Table 1).

Table 1. The answer of the study participants to questions no. 3-9.

Question no.	Dentists		Dental technicians	
	Yes	No	Yes	No
3. Are you familiar with CAD/CAM technology?	83 (79%)	22 (21%)	35 (67,3%)	17 (32,69%)
4. Have you used CAD/CAM technology to date?	53 (50,5%)	52 (49,5%)	28 (53,8%)	24 (46,2%)
5. If you haven't used CAD/CAM technology yet, are you considering using it in the future?	76 (72,38%)	29 (27,61%)	35 (67,3%)	17 (32,69%)
6. Have you used CAD/CAM technology for prosthetic purposes?	57 (54,3%)	48 (45,7%)	30 (57,70%)	22 (42,30%)
7. Have you used CAD/CAM technology for a purpose other than prosthetics?	23 (21,9%)	83 (79,1%)	6 (11,53%)	46 (88,46%)
8. Do you think that using CAD/CAM systems improves dental services?	95 (90,47%)	10 (9,52%)	44 (84,61)	8 (15,38)
9. Do you think that in the future the CAD/CAM system can replace conventional methods?	83 (79%)	22 (21%)	38 (73,07%)	14 (26,92%)

The vast majority of dentists, as well as the vast majority of dental technicians, consider the use of CAD/CAM systems an improvement in dental services and believe that in the future the CAD/CAM system can replace conventional methods (Table 1).

Regarding the performance of CAD/CAM systems, the majority of dentists and dental technicians rated it as very good in terms of aesthetics, durability and value for money (Figure 3).

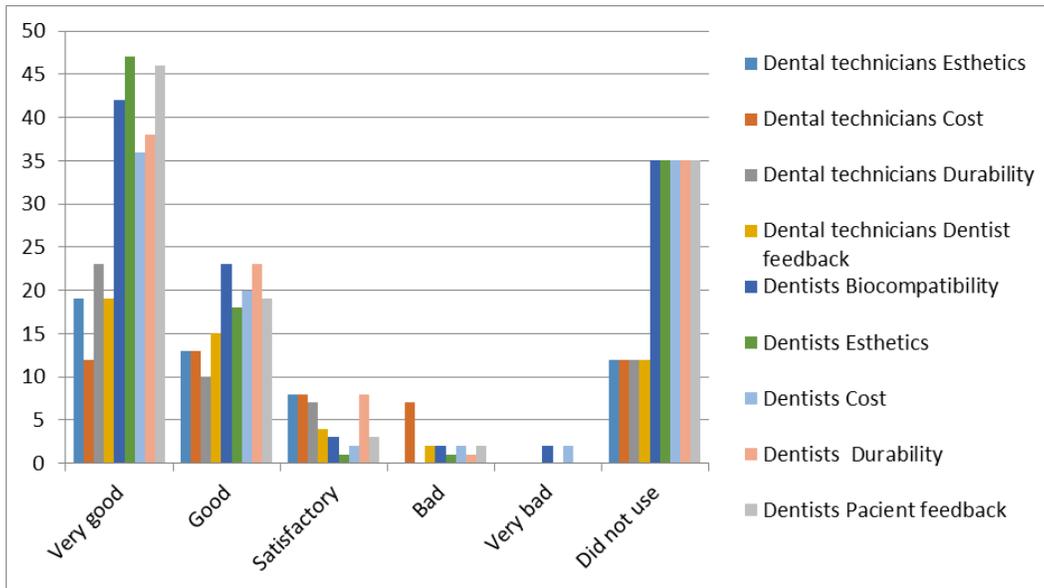


Figure 3. Evaluation of CAD/CAM system performance by study participants.

Regarding the type of system used, the majority of dental technicians used the Exocad

system, followed by the VHF system (Figure 4).

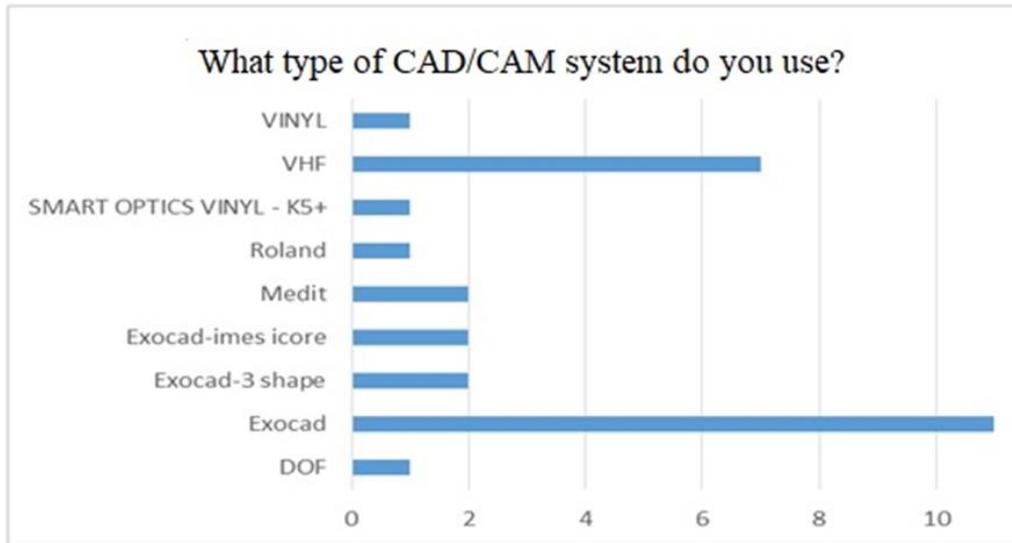


Figure 4. The CAD/CAM system most frequently used by dental technicians.

4. Discussions

Currently, almost every branch of dentistry uses CAD/CAM technology, in the case of maxillofacial surgical prosthetics [9], in the manufacturing of aligners and brackets in orthodontics [10] and up to the manufacture of removable dentures, dental bridges and crowns dental [11,12]. The literature also shows that CAD/CAM technology allows the use of new materials for prosthetic restorations while maintaining quality control of the final prosthetic parts. All these benefits of CAD/CAM technology are expressed in the form of patient satisfaction and long-term reliability of ceramic and composite restorations [13,14].

Despite the major role of CAD/CAM technology in modern dental practice, little information is available on the current practice and attitudes of dentists regarding this

innovative technology [6], questionnaires being undoubtedly one of the most important sources of data in any research project [15].

Most of the survey respondents stated that they are familiar with CAD/CAM systems and have used these systems. Similar results were also reported by studies by Blackwell et al. [16] and Krastev T et al. [17], where about half of the respondents were using CAD/CAD systems in their current practice.

It should be noted, however, that our study shows that dental technicians assimilated this technology much faster compared to dentists, one third of whom stated that they still do not use it in the office. This can be explained by the much greater proximity to the industry of dental laboratories, where digitization has gained considerable momentum in the last decade, compared to dental practices. Thus, in a study carried out in the community of dentists in the UK, Tran et al. showed that less than half

of the respondents to their study used CAD/CAM systems in their practice, demonstrating that CAD/CAM technology is still relatively new to the dental world for most practitioners [18]. In the study conducted, the majority of respondents who did not already use a CAD/CAM system

stated that they seriously consider using CAD/CAM systems in the future, a result also confirmed by the similar study conducted by Mandar et al. [19].

In the present study, the majority of respondents evaluated the aesthetics, durability and value for money aspects of CAD/CAM prosthetics as "very good". Previous studies have reported that the esthetic results and marginal fit of dentures can vary depending on the dental CAD software used in the design process [20].

Similar results were also reported by Nassani et al. [6] in a study where the majority of those who used CAD/CAM systems declared themselves satisfied with them and were willing to recommend them to other

practitioners. In contrast, the study by Tran et al. [18] reported the aesthetics of dentures made by CAD/CAM technology as unsatisfactory.

5. Conclusions

Digital workflow integration in dental practices has streamlined and improved various clinical and laboratory processes. This transformation addressed several limitations associated with conventional procedures, particularly in terms of quality, labor, and time efficiency.

The results of the present study showed a high degree of knowledge regarding CAD/CAM technology, as most of the participants were aware of the introduction and use of digital technology in dentistry.

However, although CAD/CAM technology can be used to create accurate and efficient dental components, there are still some concerns from dentists and technicians about the quality and costs of CAD/CAM restorations.

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Author contributions

All authors read and approved the final manuscript. All authors have equally contributed to this work.

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