ORIGINAL RESEARCH

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DOI: 10.2478/asmj-2022-0003

Use of different matrix systems in the treatment of simple caries.

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Abstract

Dental matrix systems are instruments used in the treatment of simple caries which replace the missing wall of the tooth during restoration. The aim of the study is to evaluate, using a questionnaire-based survey, the most used matrix systems among dentists and dentistry students. Materials and methods: Two hundred and fifty questionnaires containing 8 questions were distributed in electronic and printed format to dentists in Mureș and Harghita countries and dentistry students from 4th to 6th year of study at George Emil Palade University of Medicine, Pharmacy, Science, and Technology of Târgu Mureș. The obtained data were then analyzed using Microsoft Excel and SSPS 20.0.0. Statistical analysis was performed using the one tailed ANOVA and Tukey/ Kramer test. Significance level was set at a value of $p<0.05$. Results: Of the persons who completed the questionnaire 97.78% consider it important to use a matrix system during tooth restoration, 98.25 % use it when restoring class II Black cavities. Sectional matrixes are used most commonly during class II Black cavity restoration, for MOD cavities the circular matrix systems are the preferred ones. During class V Black cavity restoration only 5.45% of the doctors and students use a matrix system. Wooden wedge is used most frequently in combination with a matrix system. Only 3.3% always ask for a control X-ray after a tooth restoration. Conclusion: The use of matrix systems is considered to be very important by both dental students and dentists in the restoration of simple caries lesions and are most commonly used for a Black class II, III, IV, and MOD cavity. More importance should be given to follow-up X-rays after tooth restoration.

Keywords: dental matrix systems, tooth restoration, dental wedges, control X-ray.

Introduction

During teeth restoration three important rules should be followed by every practitioner. The first objective should be the optimization of tooth crown anatomy and function, followed by the conservation of tooth structure utilizing minimal preparation techniques, and finally the esthetical improvement of the restored tooth.

During mastication, deglutition, and phonetics there is a constant transposition of the dentition which results in increased attritional forces and alterations of the proximal contact surface positions. An acceptably restored dentition mandatorily requires that the teeth which come in contact to be in close approximation to each other, thereby the optimum protection of the oral tissues is maintained.

Absent or incorrect proximal contact points/ surfaces may result in a poorly aligned dentition. Displacement of teeth may cause food impaction, secondary caries formation, and periodontal disease [1].

Dental matrix systems are instruments used in the treatment of simple caries which replace the missing proximal wall of the tooth during restoration. Thereby the aim of the matrix systems is to restore the integrity of the tooth or replace the missing part, which includes establishing the appropriate interproximal contact point [2-4]. Interproximal contact points are essential elements that preserve the integrity of dental arches and stabilize teeth [5,6].

The aim of the study is to evaluate, using a questionnaire-based survey, the most used matrix systems during proximal wall restorations in simple caries treatment among dentists and dentistry students.

Material and methods

The research was carried out on a prospective basis based on questionnaires [7]. The questionnaires were completed by dentists in Harghita and Mureş countries. Also, students studying dentistry (4-6th year) at George Emil Palade University of Medicine,

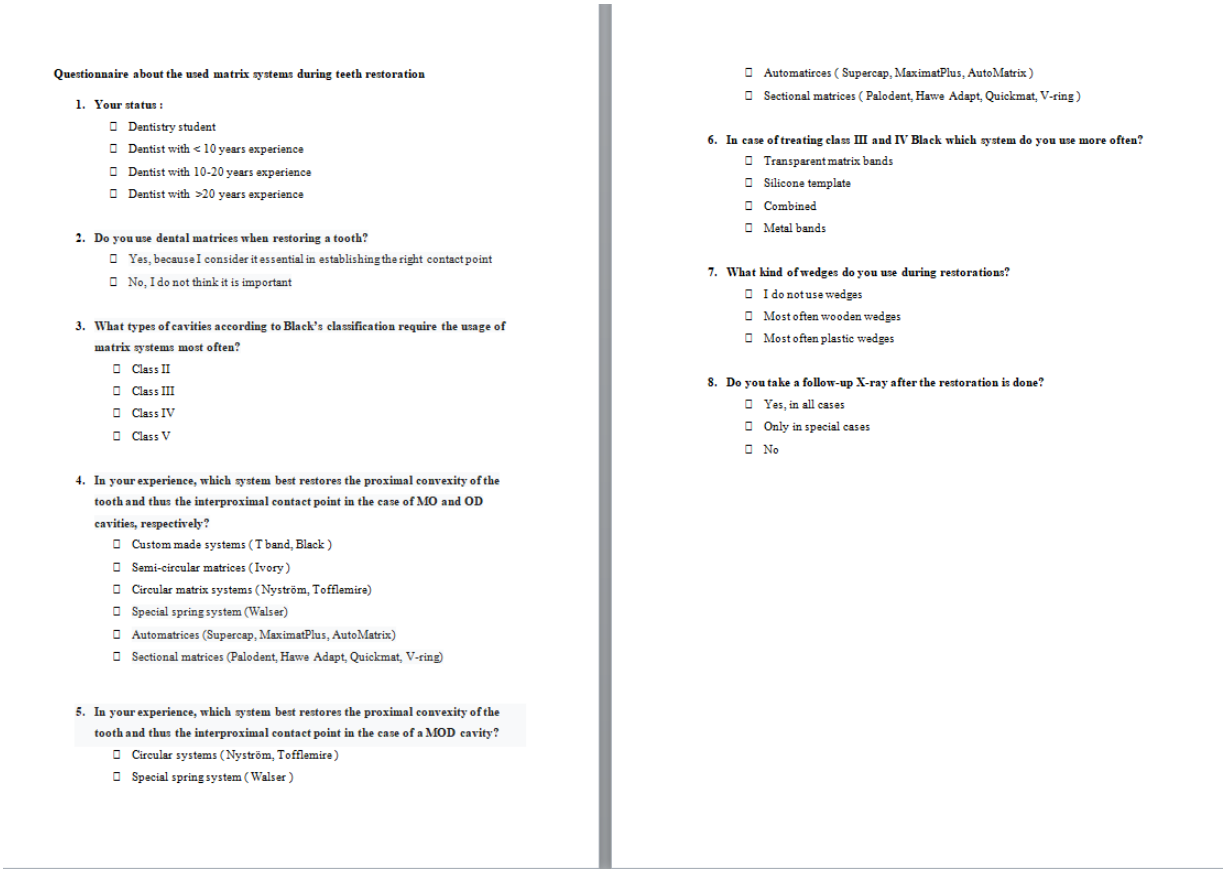
Pharmacy, Science, and Technology of Târgu Mureş, Romania were included in the study.

The questionnaires were distributed in electronic and printed forms. The electronic form was edited with the help of Google Forms which was then distributed to the doctors with the help of social media. The printed questionnaires were used to assess the professional knowledge of dental students as well as the knowledge of dentists in Mureş and Harghita counties.

Two hundred and fifty questionnaires were distributed in Romanian, Hungarian, and English languages.

The questionnaire contains 8 questions. The first question, regarding the status of the persons who completed the questionnaire, and the second, which refers to the responder's habit regarding matrix system usage are single answers. The next four questions, from 3rd to 6th, had to be answered only by those who used matrix systems in their daily practice. In this case responders could choose multiple answers. The last two questions, about the used wedges and control X-ray request, had only one possible answer (figure 1).

While 4 respondents answered that they did not use matrices during teeth restoration, they were excluded from the following 4 questions regarding the matrix system usage in their daily practice.



Questionnaire about the used matrix systems during teeth restoration

1. **Your status :**
   - ☐ Dentistry student
   - ☐ Dentist with < 10 years experience
   - ☐ Dentist with 10-20 years experience
   - ☐ Dentist with >20 years experience

2. **Do you use dental matrices when restoring a tooth?**
   - ☐ Yes, because I consider it essential in establishing the right contact point
   - ☐ No, I do not think it is important

3. **What types of cavities according to Black's classification require the usage of matrix systems most often?**
   - ☐ Class II
   - ☐ Class III
   - ☐ Class IV
   - ☐ Class V

4. **In your experience, which system best restores the proximal convexity of the tooth and thus the interproximal contact point in the case of MO and OD cavities, respectively?**
   - ☐ Custom made systems (T band, Black)
   - ☐ Semi-circular matrices (Ivory)
   - ☐ Circular matrix systems (Nyström, Tofflemire)
   - ☐ Special spring system (Walser)
   - ☐ Automatrices (Supercap, MaximatPlus, AutoMatrix)
   - ☐ Sectional matrices (Palodent, Hawe Adapt, Quickmat, V-ring)

5. **In your experience, which system best restores the proximal convexity of the tooth and thus the interproximal contact point in the case of a MOD cavity?**
   - ☐ Circular systems (Nyström, Tofflemire)
   - ☐ Special spring system (Walser)
   - ☐ Automatirces (Supercap, MaximatPlus, AutoMatrix)
   - ☐ Sectional matrices (Palodent, Hawe Adapt, Quickmat, V-ring)

6. **In case of treating class III and IV Black which system do you use more often?**
   - ☐ Transparent matrix bands
   - ☐ Silicone template
   - ☐ Combined
   - ☐ Metal bands

7. **What kind of wedges do you use during restorations?**
   - ☐ I do not use wedges
   - ☐ Most often wooden wedges
   - ☐ Most often plastic wedges

8. **Do you take a follow-up X-ray after the restoration is done?**
   - ☐ Yes, in all cases
   - ☐ Only in special cases
   - ☐ No

Figure 1. The questionnaire about the matrix systems used during teeth restoration

The obtained data were then processed using Microsoft Excel and SSPS 20.0.0. Statistical analysis was performed using one-tailed ANOVA and Tukey/Kramer Test. Significance level was set at a value of $p<0.05$.

Results

The questionnaire was answered by 183 persons (73.2%).

According to figure 2, 48 questionnaires (26.23%) were completed by dentistry students, 51 questionnaires (27.87%) by dentists with under 10 years of experience. Forty-five questionnaires, 24.59 %, were answered by dentists with 10 to 20 years of experience, and only 39 questionnaires, 21.31%, by dentists with over 20 years of professional experience.

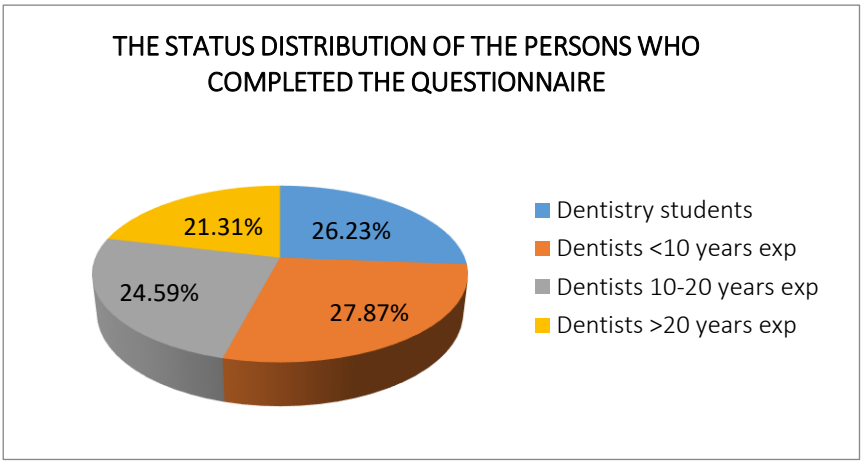


Figure 2. Status distribution of the persons who completed the questionnaire

Matrix systems in everyday restorative treatments are used by 180 students and doctors (97.78%), while 2.22%- 4 persons- do not use matrices during proximal wall restoration as they do not consider it to be important (figure 3). Two students, 1 doctor with less than 10-year experience and 1 doctor with an experience between 10-20 years do not use matrix systems in their practice so they omitted the questions regarding the matrix systems.

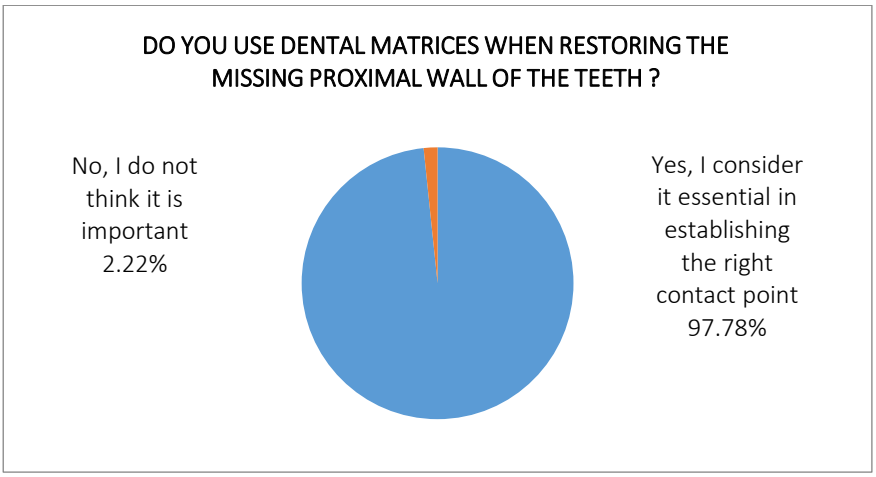


Figure 3. Percentage composition of the matrix system usage during restoration of missing proximal contact points

Of the respondents, 98.25 % use matrix systems during restoration of Class II Black cavities, followed by 68.02% for Class III Black cavities, 61.81% for Class IV Black cavities, and only 5.45% use matrices to restore the Class V Black cavities (figure 4).

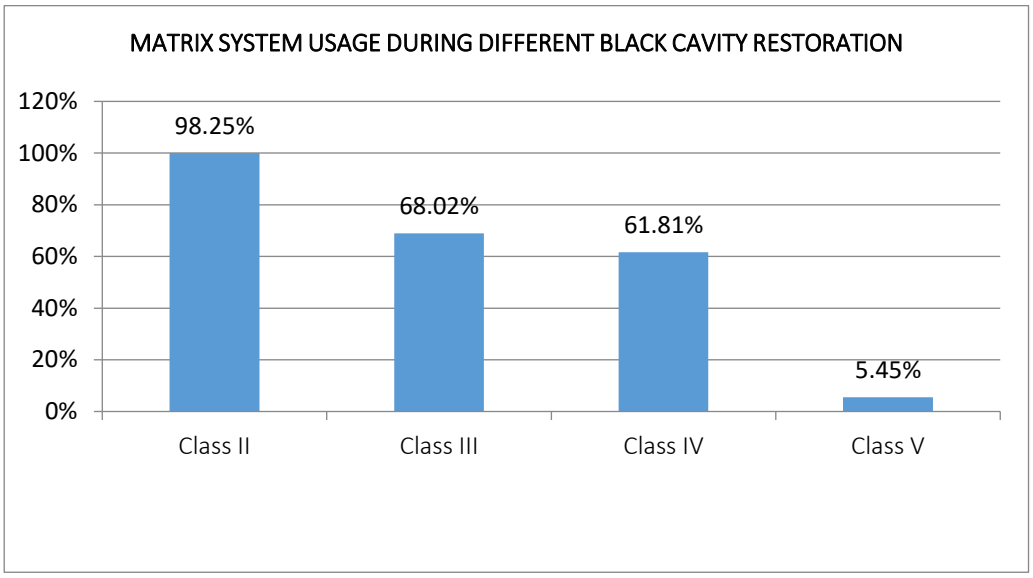


Figure 4. Matrix system usage during different Black cavity restoration

When restoring Class II cavities, dentists with more than 20 years of experience use matrix systems in 100% of the cases, followed by doctors with less than 10-year experience with 98%, doctors with an experience between 10-20 years-97.7% and students, 97.1%.

During Class III cavity restoration, matrix systems are used most frequently by doctors with less than 10-year experience (78.43%), followed by doctors with over 20-year experience and dentists with 10–20-year experience with 69.23% and 68.18%. Students use matrix systems when restoring frontal proximal cavity in only 56.25% of the cases.

In case of Class IV cavity restoration, matrix systems are used more frequently, in 70.59% by doctors with less than 10 years of experience, followed by dentists with more than 20 years of experience in 66.66%, dentists with 10-20 years of experience-60% and less frequently by students, in only 50% of the cases.

When restoring a class V Black cavity, matrix systems are rarely used - in 4.16% by students, 5.88% by doctors with less than 10-year experience, 6.66% by dentists with 10-20-year experience and 5.13% in case of doctors over 20-year experience (figure 5).

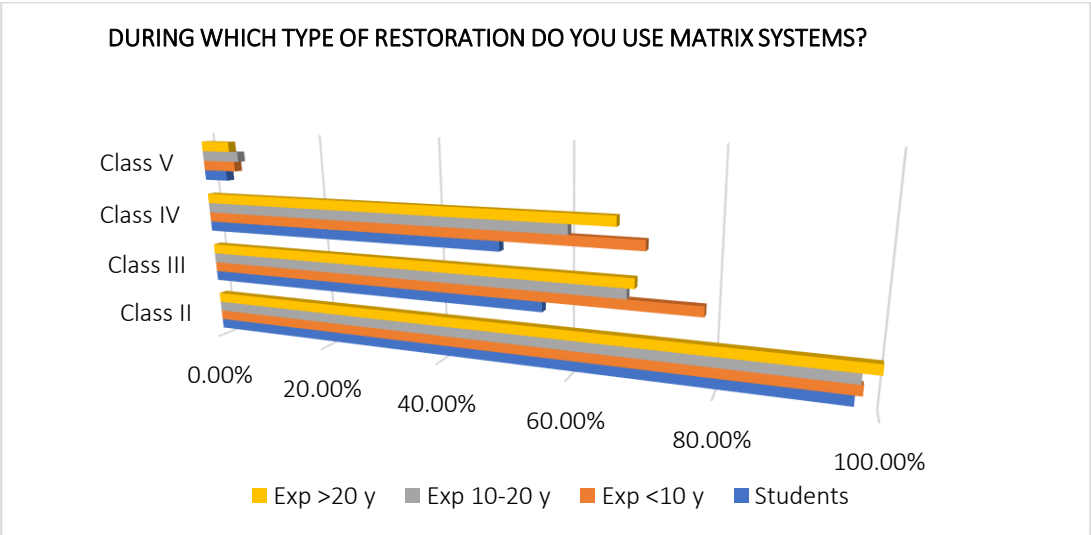


Figure 5. Distribution of the matrix system usage during different Black type cavity restoration in the 4 groups

Statistical analysis showed no significant differences between the 4 groups according to the matrix system usage frequency during restoration of different classes of cavities (figure 6).

Expected values	Students	Doctors 10y exp	Doctors 10-20y exp	Doctors >20y exp
100 100 100 100	97.1 56.25 50 4.16	98 78.43 70.59 5.88	97.7 68.18 60 6.66	100 69.23 66.66 5.13
Skewness:	-0.194636	-1.493339	-0.896119	-1.101232
Excess kurtosis:	1.387382	2.671302	1.745393	2.17268
Normality	0.992	0.4256	0.9139	0.6573
Outliers				
Mean	51.8775	63.225	58.135	60.255
S	38.05557	39.92988	37.9449	39.74924

p=0.9794

Figure 6. Statistical analysis of the distribution of matrix system usage during restoration of different Black type cavities in the 4 groups

According to figure 7, the system that best forms the interproximal contact point and most faithfully returns the anatomical contour of the tooth is the sectional matrix system and this represents 35.6% (94 answers), followed by semicircular systems in 25.76% (68 answers), the third in circular system which is 14.78% (39 answers), automatrices 14.01% (37 answers), special spring systems 6.06% (16 answers) and the last one is custom made systems in 3.7% of the cases (10 answers).

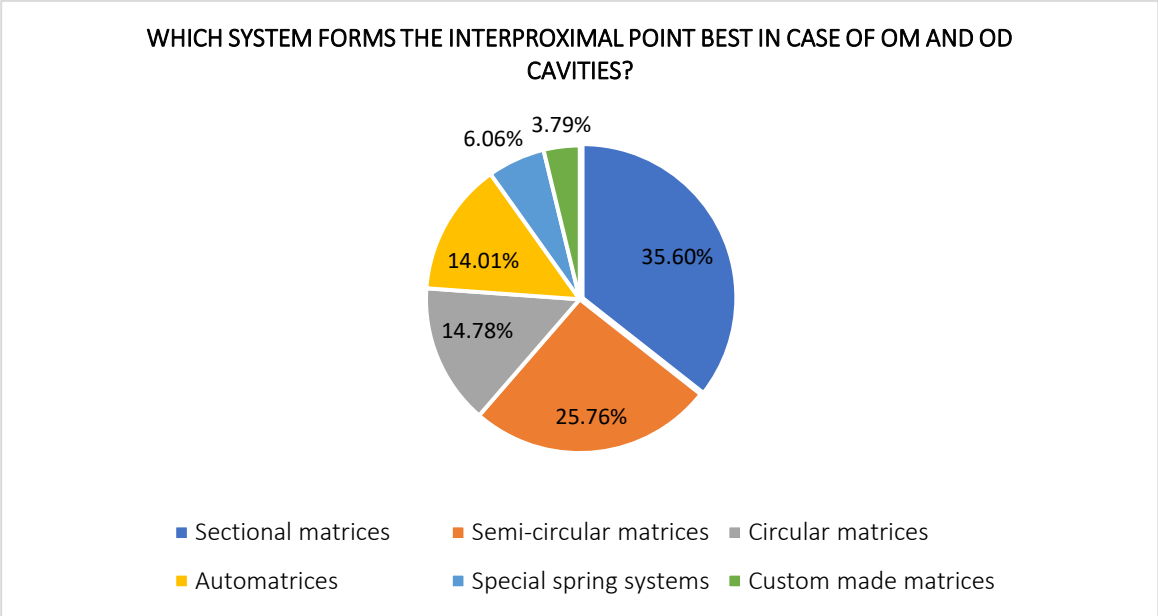


Figure 7. Answer distribution about the matrix system which forms the best interproximal contact point when restoring OM and OD cavities

According to figure 8, the most commonly used system for MOD cavities is circular in 36.32% and sectioned in 34.90%. automatrices are used in 22.18% and less used is the special spring system, which reached 6.60%.

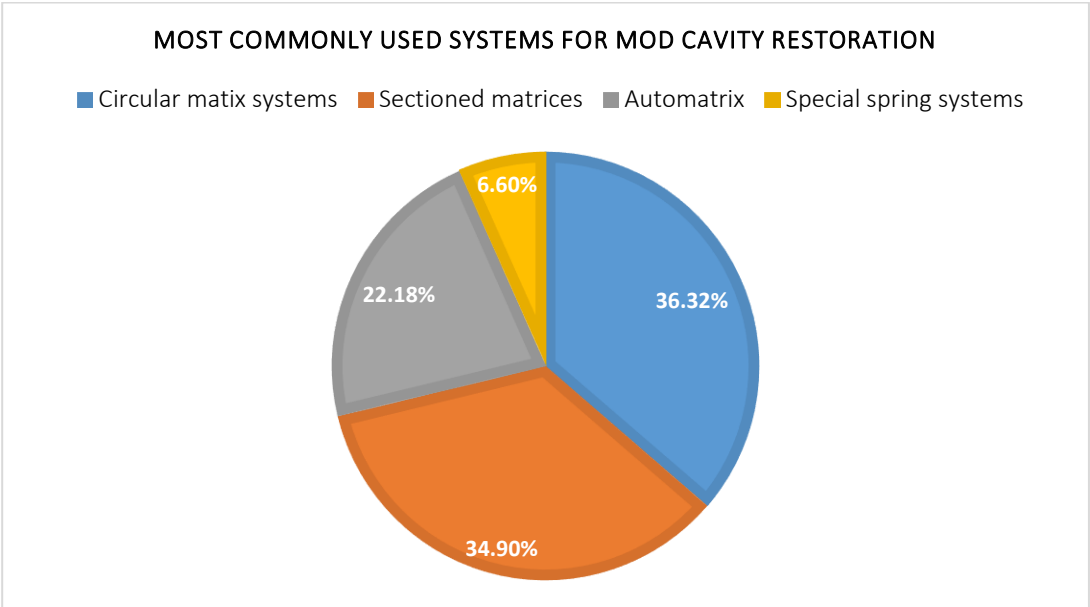


Figure 8. Most commonly used matrix systems for MOD cavity restoration

In case of restoring type III and IV cavities according to Black, celluloid matrices are most often used in 75.51%, followed by mock-ups in 14.79%. A combination of transparent sticker and silicone mock-up is used in 6.63% and less used are the metal matrices in 3.07% (figure 9). As shown in figure 10, 68.3% use a wooden wedge, 26.7% a plastic wedge, and 5% no wedge during the making of the fillings.

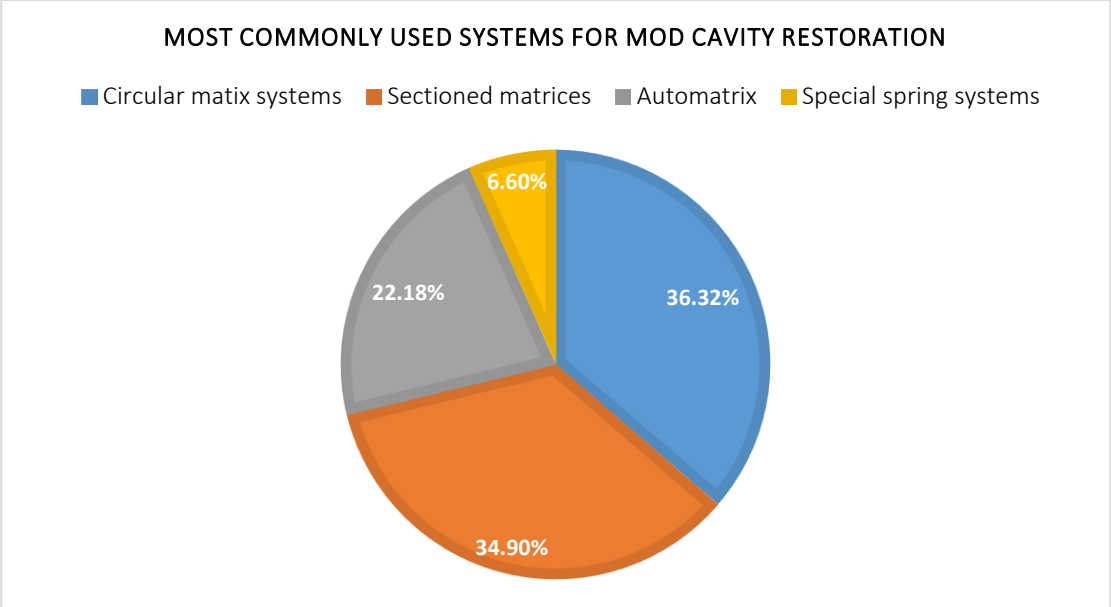


Figure 9. The used matrix systems for class III and class IV Black cavity restoration

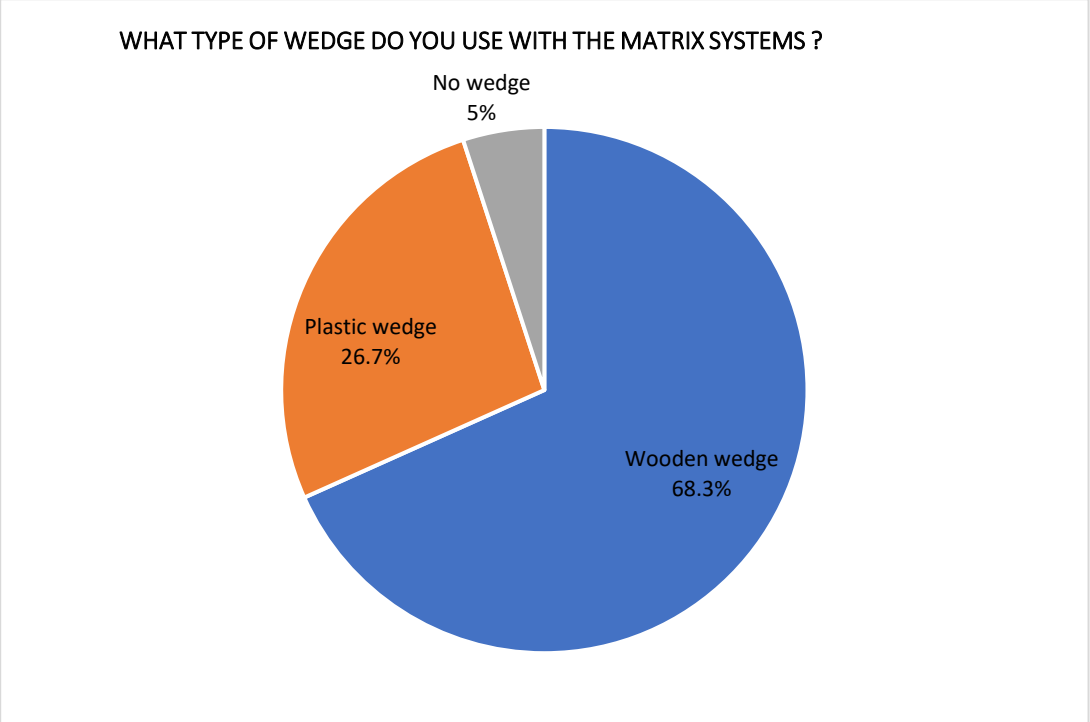


Figure 10. The used wedge types during restoration

Figure 11 shows that 49.2% take control X-rays only in exceptional cases, 47.5% do not take control X-rays, and 3.3% take control X-rays in all cases.

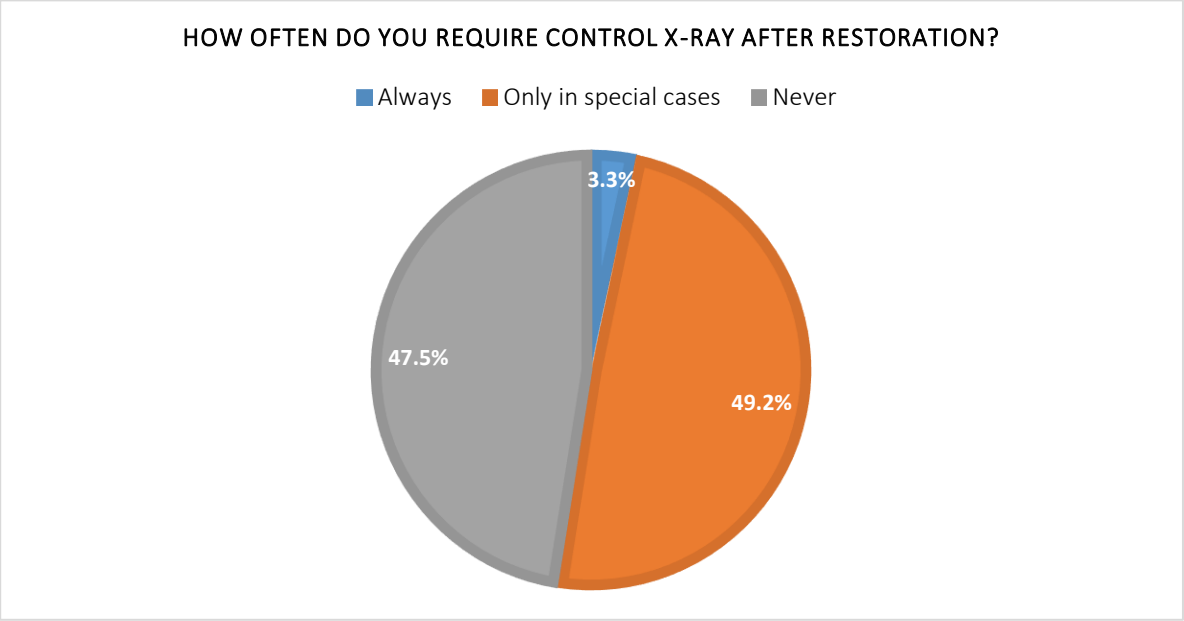


Figure 11. Frequency of requiring control x-ray after simple caries treatment

Discussions

Based on the processed questionnaires, it can be stated that 97.78% of the dentists in Mureş and Harghita counties and the fourth, fifth, and sixth year students of the Faculty of Dentistry studying at the George Emil Palade University of Medicine, Pharmacy, Science, and Technology of Târgu Mureş who completed the questionnaire consider the use of matrix systems important during restoration of missing proximal wall.

For Black cavity types, most of the respondents use a matrix system for the Class II cavity and least for the Class V cavity.

The systems considered to form the best interproximal contact points and most faithfully return the anatomical convexity of the tooth in MO and OD cavities are the sectional matrix systems, followed by semicircular systems, and the circular system. The less used matrices are custom made ones.

Similar results were stated by Loomans et al. where sectional systems were compared with circular systems [8].

According to Hua et al., sectional matrix systems formed better contact points and better end strips than the circular systems [9]. Sadaf et al. found in their research that using a sectional matrix band system is considered rather than using a circumferential matrix band system [10]. The results are similar to what we found in our research.

The best system for MOD cavities proved to be the circular system followed by the sectioned ones. There is no significant difference between the two types of systems, but we believe that we obtained false results here because the sectional system is not as well known among dental students as it is among practicing dentists. This is due to the fact that there is no sectioned system available at the faculty of dentistry, thereby students are unfamiliar with it and have no experience in using it.

Similar results were found by Wirsching et al. in their study where MO, OD, and MOD cavities were examined. The results showed that for the 2-surface cavities there was a significant difference between sectioned and circular systems in favor of the sectioned one, but, in contrast for the 3-surface cavities, there was no significant difference between the two types of vignettes [11]. We found comparable

results to our findings in other studies as well [12,13].

The most commonly used systems for Black Type III and Type IV cavities are transparent matrices, followed by a combination of transparent matrix and silicone template, and least often metal matrices.

For the Class V cavity according to Black, most of the persons who completed the questionnaire do not use any system or perhaps very rarely. Here again, we may come across false results because there is no possibility to use matrices among dentistry students for V-class cavities.

Wedging is considered to be essential during proximal wall restoration [14]. Regarding the use of wedges, most people use wooden wedges during proximal wall restoration, followed by plastic wedges. Only a small percentage of those who completed the survey do not use any wedges.

Opinions are divided on control X-rays also. Almost half of the dentists and students require control X-rays only in exceptional cases, the other half do not routinely take control X-rays. Control X-rays are required after simple caries treatment in all cases only by few persons.

Conclusions

1. Sectioned matrix systems are most commonly used during MO and OD Black Class II cavity restoration.

2. For MOD cavities, circular and sectional systems are used most frequently.

3. Celluloid matrices are most commonly used for Class III and IV Black cavities restoration.

4. For Class V Black cavity restoration matrix systems are used only rarely.

5. The most commonly used wedge is the wooden wedge.

6. A higher importance should be given to follow-up X-rays after tooth restoration.

Conflict of interest: None to declare.

References

1. Borojevic Owens BM, Phebus JJ. An evidence-based review of dental matrix systems. General dentistry.2015, pp 64-70.
2. Fazekas Á: Megtartó fogászat és endodoncia,Semmelweis Ed.Budapest. 2006, pp 10-12.
3. Marlynda A.A Historical Review of Dental Matrices. Malaysian Dental Journal 2011; 33(2): 1-7.
4. Kubo S, Kawasaki A, Hayashi Y. Factors associated with the longevity of resin composite restorations. Dent Mater J. 2011; 30(3):374-383.
5. Saber MH, Loomans BA, El Zohairy A, Dörfer CE, El-Badrawy W. Evaluation of proximal contact tightness of Class II resin composite restorations. Oper Dent. 2010; 35(1):37-43.
6. Owens BM, Phebus JG. An evidence-based review of dental matrix systems. Gen Dent. 2016; 64(5):64-70.
7. Shaalan OO.Evaluation of Matrix Band Systems for Posterior Proximal Restorations among Egyptian Dentists: A Cross-Sectional SurveyActa Stomatol Croat. 2020; 54(4): 392–400.
8. Loomans BAC, Opdam NJM, Roeters FJM, Bronkhorst EM, Burgersdijk RCW. Comparison of Proximal Contacts of Class II Resin Composite Restorations In Vitro. Operative Dentistry. 2006; 31(6):688-693.
9. Kou Qiang HX, Za Zhi YX.A clinical study of Palodent posterior teeth matrix system. West China Journal of Stomatology. 2009; 27(1):44-8.
10. Sadaf DE, Ahmad MZ, Gaikwad RN, Arjumand B. Comparison of two different matrix band systems in restoring two surface cavities in posterior teeth done by senior undergraduate students at Qassim University, Saudi Arabia: A randomized controlled clinical trial. Indian J Dent Res. 2018; 29(4):459-464.
11. Wirsching E, Loomans BA, Klaiber B, Dörfer CE. Influence of matrix systems on proximal contact tightness of 2- and 3-surface posterior composite restorations in vivo. J Dent. 2011; 39(5):386-90.
12. De la Peña VA, García RP, García RP. Sectional matrix: Step-by-step directions for their clinical use. Br dent J. 2016; 220(1):11-4.
13. Almushayti M, Arjumand B. Operators' Ease and Satisfaction in Restoring Class II Cavities With Sectional Matrix Versus Circumferential Matrix System at Qassim University Dental Clinics. Cureus.2022; 14(1):e20957.
14. Peumans M, Venuti P, Politano G, Van Meerbeek B. Effective Protocol for Daily High-quality Direct Posterior Composite Restorations. The Interdental

Anatomy of the Class-2 Composite Restoration. J Adhes Dent. 2021; 23(1):21-34.

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Received: April 21, 2022 / Accepted: May 20, 2022