

To cite this article:

Kosewski Juliusz, Plona Sylwia, Mielczarek Agnieszka: Frequency and comparison of instrument lubrication procedures during composite resin modeling. Częstość i porównanie metod zwilżania narzędzi podczas modelowania kompozytów stomatologicznych.

Nowa Stomatol 2024;29(3):59-64. DOI: 10.25121/NS.2024.29.3.59

To link to this article:

<https://doi.org/10.25121/NS.2024.29.3.59>

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Frequency and comparison of instrument lubrication procedures during composite resin modeling

Częstość i porównanie metod zwilżania narzędzi podczas modelowania kompozytów stomatologicznych

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KEYWORDS

composite resins, dental restoration, modeling resin, instrument lubrication, composite modeling

SUMMARY

Introduction. Dental composite resins often pose challenges in modeling and adaptation due to their viscous consistency. Despite manufacturer recommendations, dentists commonly employ lubrication techniques using modeling resins, bonding agents, or alcohol. **Aim.** Aim of this study was to examine the usage and implications of instrument lubrication during dental composite restoration placement.

Material and methods. An online survey was conducted among Polish dental practitioners to assess their habits and gather information on instrument lubrication procedures.

Results. Out of 557 respondents (81.5% female, 18.5% male), 69.8% reported using instrument lubrication techniques, with dentists at 75% and dental students at 41%. Dentists primarily used dedicated modeling resins (64.5%), while students preferred total-etch adhesives (48%). Commonly wetted instruments included brushes (36%), microbrushes (35%), and metal tools (29%). Around 46% of respondents wiped off excess lubricant, mostly using a glove (40%) or dry gauze (40%).

Conclusions. The study revealed a significant correlation between career stage and instrument lubrication usage, indicating limited incorporation of the technique in dental education. However, the lack of standardization in lubrication substances and techniques poses challenges. While lubrication facilitates composite manipulation, it may also alter material properties and pose occupational risks, such as allergic reactions from methacrylate exposure during glove wiping. In summary, instrument lubrication is prevalent in dental practice, with potential implications for composite restoration outcomes.

SŁOWA KLUCZOWE

kompozyty stomatologiczne, wypełnienia stomatologiczne, żywice do modelowania, zwilżanie narzędzi, modelowanie kompozytu

STRESZCZENIE

Wstęp. Materiały kompozytowe często stanowią wyzwanie w modelowaniu i adaptacji ze względu na ich lepłą konsystencję. Pomimo zaleceń producentów, stomatolodzy często stosują techniki zwilżania narzędzi za pomocą żywic do modelowania, środków wiążących lub alkoholu.

Cel pracy. Celem badania było określenie częstości stosowania oraz szczegółów techniki zwilżania narzędzi podczas modelowania wypełnień kompozytowych.

Materiały i metody. Przeprowadzono ankietę online wśród polskich lekarzy dentyków i studentów stomatologii w celu zgromadzenia informacji dotyczących nawyków i procedur zwilżania narzędzi podczas modelowania kompozytów stomatologicznych.

Wyniki. Spośród 557 respondentów (81,5% kobiet, 18,5% mężczyzn) 69,8% potwierdziło stosowanie technik zwilżania narzędzi, przy czym wśród lekarzy dentyków odsetek ten wyniósł 75%, a wśród studentów stomatologii – 41%. Lekarze dentyści stosowali głównie dedykowane żywice do modelowania (64,5%), podczas gdy studenci preferowali systemy łączące Total-Etch (48%). Najczęściej zwilżane narzędzia to: pędzelki (36%), mikroaplikatory (35%) i narzędzia metalowe (29%). Około 46% ankietowanych wycierało nadmiar lubrykantu, najczęściej o rękawiczkę (40%) lub w suchą gazę (40%).

Wnioski. Badanie wykazało istotną korelację między etapem kariery a zwilżaniem narzędzi, wskazując na ograniczone uwzględnienie tej techniki w edukacji stomatologicznej. Brak standaryzacji substancji i technik zwilżania stanowi wyzwanie – podczas gdy technika ta ułatwia manipulację kompozytem, może również wpływać na właściwości materiału i stwarzać ryzyko zawodowe, takie jak reakcje alergiczne na metakrylany podczas wycierania nadmiarów o rękawiczkę.

Podsumowując, zwilżanie narzędzi jest powszechne w praktyce stomatologicznej, co może mieć potencjalne konsekwencje dla efektów leczenia przy użyciu odbudów kompozytowych.

INTRODUCTION

Dental composite resins possess a viscous consistency that can hinder the accurate modeling of anatomical contours and the proper adaptation of the material to the walls of cavities (1). To overcome the issue of the composite sticking to hand instruments, it has become common practice to lubricate the instruments with modeling resins, bonding agents, or alcohol (2-4). It's worth noting that this approach goes against the recommendations of most manufacturers, as it has the potential to alter the characteristics of the restorative material. Some authors even caution against this technique, as it may disrupt the composition of the modeled composite layer and affect the material's properties (5, 6).

Although known as a common practice, there is no precise scientific evidence regarding the extent of the use of the instrument lubrication technique by dentists.

AIM

Aim of the study was to gather the information about the prevalence and details of instrument lubrication technique among Polish dental practitioners and to assess their habits during composite restoration placement.

MATERIAL AND METHODS

An online survey was conducted among a group of Polish dentists and dental students, utilizing a non-interventional questionnaire to gather data on the prevalence of wetting tools during composite modeling in the dental community. The form contained of 7 questions, 3 questions – about the career stage, gender and whether the person wets the tools – were asked to each survey participant and

4 questions about the steps and materials used in the procedure were asked only to participants who confirmed to wet the tools. Questions and answers regarding the instrument lubrication technique can be seen in figure 1.

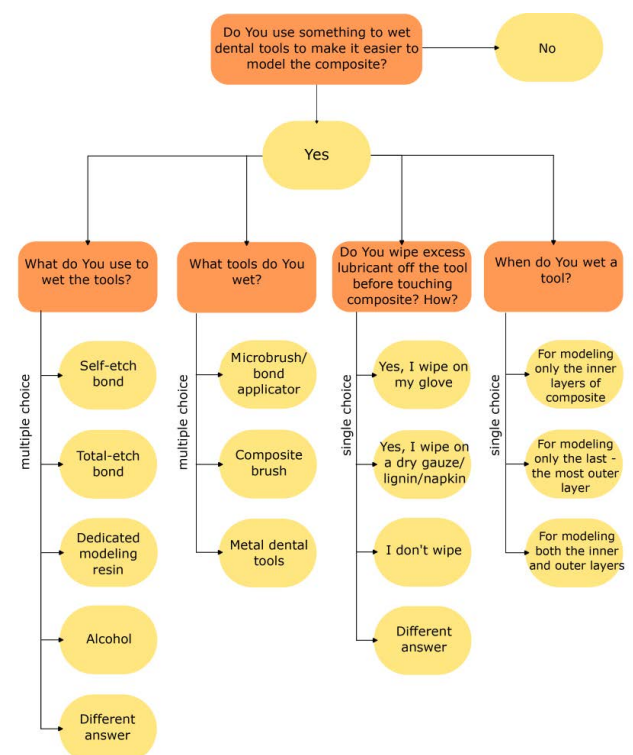


Fig. 1. Survey structure – questions regarding instrument lubrication technique

The survey was conducted online. Respondents who completed the online survey accessed the questionnaire via a link in an email, on Messenger or through Facebook groups dedicated to dentists and dental students. The data was collected by using a specially prepared Google Forms questionnaire. People who completed the survey did not have the opportunity to ask additional questions about the study.

The study included dental practitioners, consisting of two subgroups: dentists and dental students.

Respondents were required to spend approximately one minute to complete the questionnaire. The study did not involve any financial compensation for participants.

Results were then analyzed using PQ Stat (2023) statistical software (PQStat Software, Poland).

Ethical approval for this study was provided by the Ethical Committee of Medical University of Warsaw (decision AKBE/297/2023).

RESULTS

Survey was completed by 557 people, including 454 women (81.5%) and 103 men (18.5%). Among the respondents, 389 individuals (69.8%) held the professional title of dentist, while 168 (30.2%) were dental students. When considering all the responses, 65% declared the use of the instrument wetting technique during composite work. Among dentists, this percentage was 75%, while among students it was 41% (fig. 2a,b). Fisher's exact test was used to determine if there is a correlation between career stage and the use of the instrument wetting technique. There was a statistically significant association between the two tested

variables (two tailed $p < 0.000001$). However, no statistically significant association was found between gender and instrument wetting using the same test (two tailed $p = 0.65$) (tab. 1).

The frequency of using different materials for instrument wetting is shown in fig. 3. Among the surveyed dentists, 64.5% declared using dedicated resins for modeling, 18.2% mentioned the use of total-etch adhesives, 15.2% used self-etch adhesives, and only 1.1% used alcohol. Among students, the most frequently declared wetting substance was total-etch adhesives (48%), followed by self-etch adhesives (26.5%), dedicated resins for modeling (24.5%), and alcohol (1%).

Fisher's exact test was used to determine if there was a significant association between career stage and substances used for instrument wetting. There was a statistically significant association between the two tested variables (two tailed $p < 0.000001$) (tab. 2).

Among the respondents 46% indicated wiping off excess wetting substance from the instrument before composite modeling using a glove, 40% wiped the instrument with a dry gauze, cotton roll, or napkin, 2% removed excess substance using an instrument tray (an answer added by the respondents). Excess wetting agent is not wiped off before composite modeling by 14.7% of respondents (fig. 4).

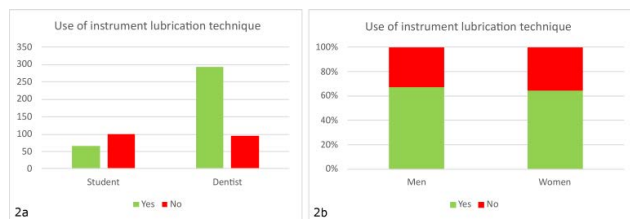


Fig. 2a, b. Responses regarding the use of instrument lubrication technique depending on the career stage (a) and gender (b)

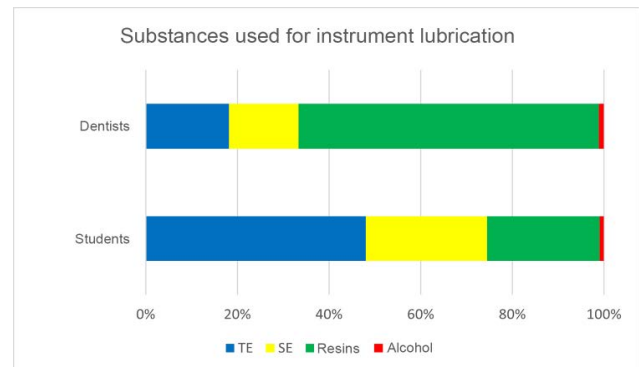


Fig. 3. Responses about the substances used for instrument lubrication depending on the career stage. TE – total etch bonds; SE – self-etch bonds; Resins – dedicated modeling resins

Tab. 1. Cross table presenting responses about the use of instrument lubrication technique depending on the career stage and gender

Use of lubricant	Career stage		
	Yes	No	Total
Students	67 (39.90%)	101 (60.10%)	168 (100%)
Dentists	293 (75.30%)	96 (24.70%)	389 (100%)
Total	360 (100%)	197 (100%)	557 (100%)
Fisher exact test two-tailed p value < 0.000001			
Gender	Career stage		
	Yes	No	Total
Men	69 (67%)	34 (33%)	103 (100%)
Women	291 (64.1%)	163 (35.9%)	454 (100%)
Total	360 (100%)	197 (100%)	557 (100%)
Fisher exact test two-tailed p value = 0.64832			

Tab. 2. Cross table presenting responses about the substances used for instrument lubrication depending on the career stage

Used lubricant \ Career stage	TE	SE	Resins	Alcohol	Total
Students	49 (48.04%)	27 (26.47%)	25 (24.51%)	1 (0.98%)	102 (100%)
Dentists	66 (18.18%)	55 (15.15%)	238 (65.56%)	4 (1.10%)	363 (100%)
Total	115 (24.73%)	82 (17.63%)	259 (55.70%)	5 (1.10%)	465 (100%)

Fisher exact test two-tailed p value < 0.000001

TE – total etch bonds; SE – self-etch bonds; Resins – dedicated modeling resins

Tab. 3. Cross table presenting responses about wiping excess lubricant from instrument depending on the career stage

Instrument wiping \ Career stage	Yes, gauze	Yes, glove	Yes, instrument tray	No	Total
Student	27 (40.30%)	26 (38.81%)	3 (4.48%)	11 (16.42%)	67 (100%)
Dentist	116 (39.59%)	140 (47.78%)	6 (2.05%)	42 (10.58%)	293 (100%)
Total	143 (39.72%)	166 (46.11%)	9 (2.50%)	53 (14.72%)	360 (100%)

Fisher exact test two-tailed p value = 0.228221

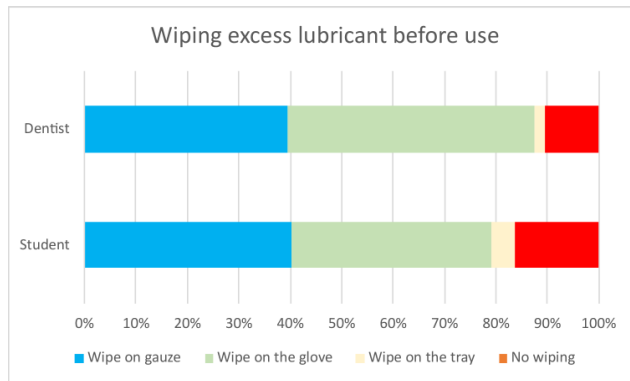


Fig. 4. Responses about wiping excess lubricant from instrument depending on the career stage

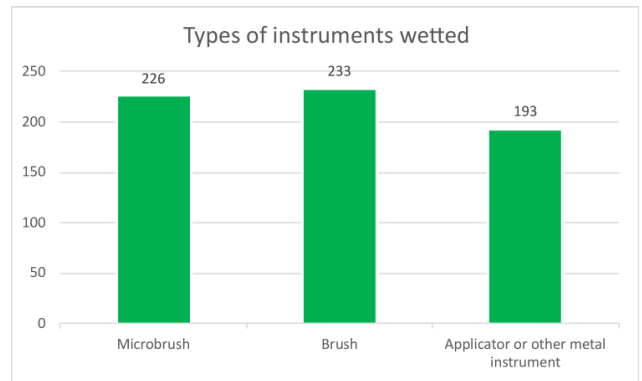


Fig. 5. Frequency of using the instrument lubrication technique depending on the type of tool used

Fisher's exact test was used to determine if there was a significant association between career stage and wiping off excess lubricant. There was not a statistically significant association between career stage and wiping off excess lubricant (two tailed $p = 0.23$) (tab. 3).

Among the most frequently wetted instruments mentioned by the respondents were brushes (233 answers), microbrushes (226 answers) and applicators or other metal tools (193 answers) (fig. 5).

More than a half (59%) of the individuals reported using a wetted instrument only for modeling the outermost, final layer of the composite, while only 2% stated modeling only the internal layers. For modeling both internal and external layers of the composite a wetted instrument was used by 39% (fig. 6).

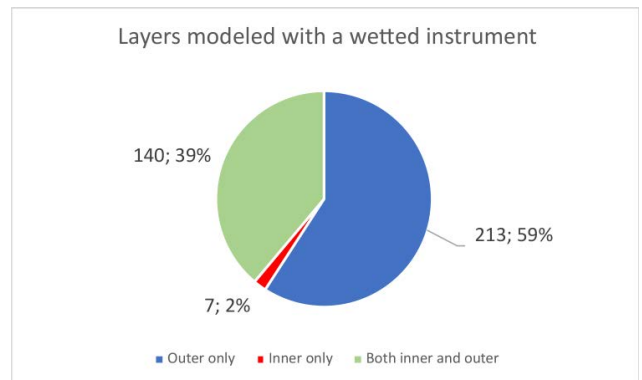


Fig. 6. Frequency of modeling individual layers of the composite with a wet tool

DISCUSSION

Conducted study, suggests the extent of using the instrument wetting technique during composite modeling. Despite numerous studies addressing this issue and its individual aspects, the estimated frequency of using this

technique in practice, as well as details regarding the instruments and substances used, were previously unknown (7). The differentiation between licensed dentists and dental students aimed to capture the stage of education when this technique begins to be used. The significant correlation

between career stage and the use of the technique suggests that it is not routinely taught during dental studies, which is consistent with certain recommendations found in the literature (8). The fact that the majority of surveyed dentists use the technique indicates that they likely learn it through postgraduate education or informal exchange of experiences with other dentists.

The lack of standardization of the technique results in significant discrepancies in its application details, which are particularly noticeable when comparing the most frequently used substances by students and dentists. Among dentists, the most commonly used lubricant was dedicated modeling resins, which aligns with the recommendations proposed by composite material manufacturers and is supported by the smaller impact on reducing the mechanical parameters of the composite compared to bonding systems (9). Among students, more respondents declared using bonding systems, both self-etch and etch-and-rinse. The use of bonding systems can negatively affect certain properties of composites, as they contain hydrophilic particles in addition to the organic matrix to enable bonding to dentin (5, 10, 11). The less frequent use of dedicated resins by students may result from a lack of knowledge and guidelines in textbooks, as well as limited access to appropriate materials during clinical training and taught practices (12). The use of bonding systems was also reported by dentists, which may be driven by a desire to use materials that are already used in previous stages of composite restoration. Regardless of the substance used, the possible alteration of material parameters should not be ignored, as it could result in a worse clinical outcome. Studies indicate a decrease in the surface microhardness of the composite after modeling with bonding systems and certain resins, as well as a decrease in the bond strength between composite layers (5, 13, 14).

Looking at the standard process of composite restoration and its subsequent mechanical finishing, and occlusal or brushing wear, it is possible that the resin-rich surface layer of the composite will be removed and will not affect the remaining restoration (15, 16). However, in the case of modeling with a lubricated instrument an internal restoration layer, as reported by over one-third of the respondents, will contain modified composite even after mechanical finishing.

Another aspect of the technique that may impact the final restoration is the amount of lubricating substance introduced between the layers of the composite. Manufacturers emphasize the need to remove excess resin from the instrument before modeling, which is consistent with most of responses. Nearly 90% of respondents declared wiping off the excess lubricant from the instrument. Half of these individuals reported wiping off the excess into a gloved hand. Although it allows for the removal of excess resin from the instrument, it poses a real risk of skin exposure to methacrylates and their derivatives. Low molecular weight molecules present in bonding systems and unfilled resins can penetrate the glove material within a few minutes and reach the skin, potentially leading to allergic reactions such as skin rashes described in the literature (17, 18). Additionally, various contaminants can be present on the surface of gloves, which we want to avoid introducing into the composite (19).

CONCLUSIONS

Taking into account the presented results of the survey, it can be concluded that the instrument lubrication technique is widely used in clinical practice, both by practicing dentists and students. The instrument lubrication technique is executed in various ways, not always following the guidelines suggested by composite material manufacturers. Moreover, the lack of standardized information regarding this method may lead to its incorrect application, especially among students during their education.

Regardless of the education stage, a significant percentage of practitioners are at risk of developing allergic skin reactions due to exposure to methacrylates while wiping resin on glove surface.

Further research is necessary to develop detailed guidelines for the application of the instrument lubrication technique, along with a precise assessment of its impact on composite parameters and overall restorations using different materials.

The conducted study has its limitations, originating from the design of the online survey and its limited scope to Polish respondents. However, it is the first study that approximately demonstrates the extent of the use of the instrument lubrication technique and emphasizes the need for further research on this topic.

KONFLIKT INTERESÓW

Brak konfliktu interesów

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nadesłano:

5.08.2024

zaakceptowano do druku:

26.08.2024