

Assessment of Dental Materials' Catalogs Based on Safety and Protection Items in Dental School of Kerman

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Objectives Dental materials are potentially hazardous and can negatively affect the health of patients, dental staff, and the surrounding environment. Thus, it is important to be aware and comply with the information provided in the material safety data sheets (MSDSs). Therefore, it seems necessary to review the dental material safety sheets in order to determine their consistency with the standard safety items required for dental materials. This study aimed to evaluate the MSDSs of dental materials consumed in Kerman Dental School to determine their compliance with the standard safety items.

Methods In this cross-sectional study, 106 dental materials were selected from 12 clinical departments of Kerman Dental School. The MSDSs were assessed in order to determine their consistency with the standard safety items. Data were analyzed with SPSS version 21, and t-test was used for statistical analysis. Statistical significance level was set at $P < 0.05$.

Results Among the 15 items considered necessary according to the standard MSDSs, the item “necessary measures in case of possible leakage and spillage” had been least frequently stated in the assessed MSDSs. Also, the mean safety score of the materials with MSDSs was significantly higher compared with materials that had no MSDSs ($P = 0.0001$).

Conclusion Evaluation of the MSDSs of dental materials consumed in Kerman Dental School regarding the required standard items revealed that they did not meet the defined standard levels.

Keywords Safety; Dental Materials; Catalog

Introduction

Dental materials are potentially hazardous and can negatively affect the health of patients, dental staff, and the surrounding environment. Thus, material safety data sheets (MSDSs) are currently prepared to raise awareness about the potential hazards of dental materials, products, and equipment. Complying with the useful information provided in MSDSs can guarantee the patients' safety.¹ Accordingly, eco-friendly dentistry aims at adhering to instructions and laws associated with the use and disposal of excess dental materials to create a safe working environment and eventually to make the world a better place to live in.² In this respect, dentists also need to have enough knowledge about the safe disposal of biomedical waste and recycling of dental materials and products to minimize their environmental impact.³

The standards developed for dental materials have been defined by two international agencies namely the Fédération Dentaire Internationale (FDI: the World Dental Federation) and the International Organization for Standardization (ISO). Such standards are based on the major demands for dental materials and equipment on a daily basis and are practiced for evaluation, testing, control, risk review, and revision of the claims by the manufacturers and monitoring of labels for dental materials and products. Advances in dental materials in order to speed up the dental procedures increase patient comfort and compliance, and as a result, create better therapeutic outcomes.⁴

The guideline for each dental material, in the form of a chemical labeling, includes the following items: Name, address, and telephone number of the manufacturer or those in charge, product name or identifier, warnings and hazards, precautions, and pictogram.⁵

The growing production of new materials and products with various applications in dentistry has so far led to higher levels of awareness about their biological hazards and limits.⁶ For instance, allergic contact dermatitis from resin-modified glass ionomers also occurs despite the use of latex gloves. Therefore, dentists, dental support workers, and students should become far more aware of the possibility of hypersensitivity to dental materials.⁷

At present, the variety of brands and markets manufacturing dental materials and products is high, and all manufacturers must include warnings and hazards in MSDSs and on the labeling of their products. Many dental materials go against health, and put individuals such as dentists, nurses, dental support workers, students, and patients at risk. Therefore, this study aimed to evaluate the MSDSs of dental materials consumed in Kerman Dental School to determine their compliance with the standard safety items.

Methods and Materials

In this descriptive cross-sectional study, a total of 106 dental materials were evaluated in terms of their compliance with the safety standards determined by the World Health Organization (WHO). The standards for MSDSs included 15

items, as listed in Table 1.⁸

Table 1- Safety standard items in catalogs of dental materials and products

	Items
1	Product name: Information regarding the composition and ingredients of dental materials
2	Instructions for use
3	Storage: Observing maintenance in order to stabilize and prevent the reaction of materials
4	Physical (smell, appearance, evaporation point, etc.) and chemical (stability, reactivity, hazardous ingredients, etc.) properties
5	Toxicity (acute and chronic toxic effects, teratogenicity, carcinogenicity, etc.)
6	Considerations for contact with the skin or eyes, breathing, swallowing, etc. as well as medical emergencies in the event of accidental contact with the material
7	Considerations for the staff and patients (i.e., wearing gloves, glasses, shield, etc.) and control of exposure to materials, namely, giving information to staff to be exposed to materials for as little time as possible
8	Flammability and flash point: If yes, in what conditions the materials are inflamed
9	Ecological information (e.g., toxicity in soil, water, etc.): The impact that the material has on plants, animals, and the environment
10	Necessary measures in case of possible leakage and spillage
11	Considerations for transportation: Labels of material must show whether it is safe or hazardous
12	Considerations for disposal: Useful information explaining how to dispose the material
13	Name and address of the manufacturing company (country, city, street, postal code, and contact information)
14	Warnings and emergency considerations: Information about the potentials of materials in terms of their adverse effects on human health
15	Shelf life and expiration date of materials

The School of Dentistry of Kerman University of Medical Sciences, Iran, has 12 clinical departments and 18 material rooms. For this study, the researcher, who was a dental student, coordinated with the person in charge of the material rooms outside the clinical time to check the safety sheets and labels of the dental materials consumed in each department. Photographs were then taken from the catalogs of the dental materials and products. In cases where the catalogs were not available, MSDSs were retrieved and recorded through browsing the manufacturing companies' websites or reading the information on the box and packaging.

The study was approved by ethical committee of Kerman University of Medical Sciences (IR.KMU.REC.1398.278).

The data were imported to SPSS (version 21) and descriptive statistics were reported as frequency, percentage, mean, and standard deviation. With regard to inferential statistics, t-test was used to determine whether dental materials had safety sheets and to what extent they complied with the standard safety items required in a MSDS.

Results

Among 106 dental materials assessed, 57 had safety sheets but information about 49 materials was collected through browsing the manufacturing companies' website or reading the information on the box and packaging. The results indicated that dental materials used in different departments of Kerman Dental School received safety scores between 1 and 15.

Accordingly, glass ionomers (GC America), acrylic resins (AcroPars), phosphate cement (Ciments Hoffmann), 37% hydrochloric acid, and ethylenediaminetetraacetic acid (Morvabon Dental Company) obtained a safety score of 15, which was the highest score. On the other hand, green wax (Azarteb) acquired the lowest score with a safety score of 1. Table 2 illustrates how frequently each of the 15 standard items had been mentioned in the safety sheets of the assessed dental materials. Accordingly, the highest and the lowest frequency rates were related to "name and address of the manufacturing company (country, city, street, postal code, and contact information)" and "necessary measures in case of possible leakage and spillage" items, respectively.

Table 2- Frequency of 15 items listed in the catalogs or packages of dental materials used in the School of Dentistry of Kerman University of Medical Sciences

	Items	Number (Percentage)
1	Composition	81 (76.4)
2	Instructions for use	64 (60.4)
3	Storage	77 (72.6)
4	Physical and chemical properties	100 (94.3)
5	Toxicity	39 (36.8)
6	Considerations in case of contact with the skin or eyes, breathing, swallowing, etc.	48 (45.3)
7	Considerations for the staff and patients (i.e., wearing gloves, glasses, shield, etc.)	36 (34.0)
8	Flammability	30 (28.3)
9	Ecological information (e.g., toxicity in soil, water, etc.)	26 (24.5)
10	Necessary measures in case of possible leakage and spillage	13 (12.3)
11	Considerations for transportation	23 (21.7)
12	Considerations for disposal	22 (20.8)
13	Name and address of the manufacturing company (country, city, street, postal code, and contact information)	101 (95.3)
14	Warning considerations	63 (59.4)
15	Shelf life and expiration date of materials	75 (70.8)

In addition to the 15 items evaluated in the catalogs or on the packages and boxes, the dental materials were compared in terms of having MSDSs (Table 3). In this respect, the mean safety score of the materials with MSDSs was significantly higher than that of products without MSDS ($P=0.0001$).

Table 3- Comparison of the mean safety scores of dental materials in terms of MSDSs

Number (Percentage)	MSDSs	Mean± SD	P-value
80 (75.5)	No	5.600±2.36	0.0001
26 (24.5)	Yes	13.423±1.98	

SD: Standard deviation

Table 4 shows that the mean safety scores of dental materials made in Iran and those manufactured abroad were not significantly different ($P=0.85$).

Table 4- Comparison of the mean safety scores of dental materials based on their manufacturing country

Manufacturing country	Number (Percentage)	Mean± SD	P-value
Iran	52 (49.1)	7.442±4.26	0.85
Other countries	54 (50.9)	7.593±3.92	

SD: Standard deviation

Discussion

The high diversity of dental materials along with great improvements in various manufacturing brands and markets have all affected the quality of dental procedures. The key to achieve enough skills by experienced dentists is thus associated with the high quality of dental materials and products employed. Like any other professions in progress, waste products generated from dental procedures are potentially harmful and may negatively affect individuals and the surrounding environment. That is why MSDSs are provided in catalogs and packages of dental materials and products. Paying attention to these issues can thus minimize probable harm to those working in the field of dentistry as well as their surrounding environment. In addition to labels, dental materials are accompanied by MSDSs.

In the present study, 24.5% of the materials used in different departments of the School of Dentistry of Kerman University of Medical Sciences had such sheets. In this respect, a study by Tillberg et al. revealed that 29% of the total number of 482 dental materials examined had MSDSs.⁹ In a study by Oh et al, the importance of MSDSs to enhance awareness about the hazards of dental materials was further highlighted.¹ For dental materials, having MSDSs means having a higher safety score. Limited research in this area, including the present study, showed that a small number of dental materials and products have these specific safety data, which could be due to brief descriptions of the safety-related items in catalogs and brochures of dental materials, resulting in no consideration of a separate MSDS for each material by the manufacturing companies. It should be noted that the biocompatibility of dental materials recognized across the world needs to comply with the standards developed by the Food and Drug Administration, the American National Standards Institute, and the European Committee for Standardization.¹⁰

The study findings also demonstrated that approximately half of the dental materials used in the School of Dentistry of Kerman University of Medical Sciences had been made by the Iranian manufacturers and there was no difference between the Iranian and foreign made products in terms of safety scores. It can be acknowledged that domestic manufacturers attempt to include MSDSs in packaging of dental materials and products and try to produce materials in line with the globally defined safety standards. It should be noted that the use of MSDSs for dental materials and products is not merely related to their quality.

In this study, 28.3% of the dental materials were flammable, 24.5% of them contained ecological information, and 12.3% of the products had mentioned necessary measures to be taken in case of possible leakage or spilling. Also, 21.7% of the materials included information regarding transportation and only 20.8% of them had cited considerations for disposal. In this regard, Sharma et al, further reported that proper disposal of dental materials was followed by only a small number of dentists, and infectious wastes were mostly collected along with non-infectious or domestic wastes.¹¹ Vanka et al, also expressed concerns about the impact of dental clinics on the environment and public health.¹² Furthermore, Geethapriya et al. concluded that dentistry could do damage to the environment because of the large amount of waste resulting from different dental procedures as well as excessive use of water and electricity.¹³ Management systems had been correspondingly considered for collection, segregation, sterilization, and disposal of all wastes in an eco-friendly manner. Ranjan et al, also found that dental students had insufficient knowledge about environmental management and disposal of biomedical wastes as well as recycling or reuse of dental materials and products.³ Accordingly, dentists, as health care professionals, need to dispose biomedical waste and recycle materials in a safe manner to reduce harm to the environment. Therefore, by providing MSDSs in the catalogs of dental materials based on the recommended standards and more importantly, considering these parameters when consuming the materials, we can protect the health of dental team members and the surrounding community.

Some limitations of the current study included lack of some catalogs and packages of the dental materials because of their disposal by the staff after unboxing, which was then resolved through calling the manufacturing companies or retrieving the required information from their websites.

Conclusion

Dental materials are in direct contact with individuals; thus, they can be hazardous to human health and do damage to the environment. Therefore, manufacturers of dental materials and products include MSDSs in their catalogs and packages. Adherence to the items mentioned in MSDSs by the staff and dentists can influence the quality of dental materials and

thus enhance the quality of dental treatments. Moreover, attention to toxicity, transportation, and storage of products can minimize the possible damage particularly allergy in working environments. Additionally, by raising awareness about the issues such as waste disposal management, measures taken during leakage and spillage, inflammability status, and ecological effects, the negative impacts on the environment can be minimized.

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Conflict of Interest

No Conflict of Interest Declared.

References

1. Oh N-R, Kim H-K, Cho M-J. The effects of recognition of material safety data sheets in dental hygienist. *J Digital Convergence*. 2017;15(2):215-23.
2. Dahl JE, Stenhagen Ida SR . Optimizing quality and safety of dental materials. *Eur J Oral Sci*. 2018;126(1):102-5.
3. Ranjan R, Pathak R, Singh DK, Jalaluddin M, Kore SA, Kore AR. Awareness about biomedical waste management and knowledge of effective recycling of dental materials among dental students. *J Int Soc Prev Community Dent* .2016;6(5):474-9..
4. US Food and Drug Administration. Laws, Regulations, Policies and Procedures for Drug Applications . <http://www.fda.gov/>. 2015.
5. Koshy K, Presutti M, Rosen MA. Implementing the Hazard Communication Standard final rule: Lessons learned. *J Chem Health Saf* . 2015;22(2):23-31.
6. Shahi S, Özcan M, Maleki Dizaj S, Sharifi S, Al-Haj Husain N, Eftekhari A, et al. A review on potential toxicity of dental material and screening their biocompatibility. *Toxicol Mech Methods*. 2019;29(5):368-77.
7. Buchanan GD, Tredoux S, Gamielidien MY. Allergic contact dermatitis from resin-modified glass ionomers. *J Conserv Dent* . 2019;22(3):310-12..
8. Bernstein JA. Material safety data sheets: are they reliable in identifying human hazards? . *J Allergy Clin Immunol* . 2002;110(1):35-8.
9. Tillberg A, Järholm B, Berglund A. Risks with dental materials. *Dent Mater J*. 2008;24(7):940-3.
10. Swetha B, Mathew S, Murthy BS, Shruthi N, Bhandi SH. Determination of biocompatibility: A review. *Int Dent Med J Adv Res*. 2015;1(1):1-6.
11. Sharma P, Badiyani BK, Kumar A. Review article on study about perception of health care waste management amongst dental professionals in Mathura district of Uttar Pradesh. *J Indian Dent Assoc* . 2019;13(6):30-6.
12. Vanka S, Wali O, Vanka A. Four A'S of eco-friendly dentistry. *Braz Oral Res*. 2019;33:e004.
13. Geethapriya N, Subbiya A, Anuradha B, Shobhana R. Green Dentistry an Innovative Approach: A Review. *Indian J Public Health Res Dev*. 2019;10(11): 2818-21.

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