

Date	Submitted	Accepted	Published
	6 th February 2024	4 th May 2024	31 st May 2024

KNOWLEDGE ON ORAL HEALTH AND PERIODONTAL STATUS AMONG TYPE II DIABETES MELLITUS (DM) PATIENTS IN LIBYA

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ABSTRACT

Diabetes mellitus (DM) is one of the common diseases in the world. Its dramatic increase annually is considered a global issue to the people, in which raising awareness about the disease and its complication is crucial. It has been well documented by the literature that smoking and DM are two major risk factors for periodontal disease. Knowledge of oral health is vital for type II DM patients and is a key factor in the treatment and prevention of periodontal disease. A cross-sectional study was conducted among three hundred diabetic patients in a Benghazi diabetic treatment center. The participants were 40.3% (n = 121) male and 59.7% (n = 179) female adults whose ages ranged from 16 to 80 years. Inclusion criteria included Libyan citizens diagnosed with type II DM. The participants were questioned through a structured questionnaire and followed by the examination of their oral status. Periodontal examination was performed by two periodontists using the following indices: plaque index (PI) and periodontal disease index (PDI). Knowledge about oral health and periodontal status for Libyan patients with type II DM was tested through eight core questions using a structured questionnaire. The results showed about half of the sample had poor knowledge regarding the condition and its detrimental effect on oral and general health. Only 31% of participants provided good knowledge about type II DM and its relationship to oral health and periodontal status. The P-value showed a significant relationship between the knowledge and PI and PDI indices. Participants with poor knowledge showed higher scores in both indices. A significant relation was found between PI, PDI and knowledge. As knowledge was fair, the lower the PI and PDI scores. To lessen diabetic complications and their deleterious effects on oral and general health, raising knowledge and awareness could be a solution. Multidisciplinary cooperation between the medical and dental staff could be implemented to increase public knowledge.

Key words: Oral health, Periodontal, Patients, Diabetes mellitus, Libya, Health awareness, Dentistry

INTRODUCTION

Diabetes mellitus is a group of chronic metabolic cellular disorders defined by hyperglycemia resulting from decreased insulin secretion, resistance of cells to the peripheral effects of insulin function, or both [1, 2, 3]. Type II DM is defined as high blood sugar as a result of increased pancreas secretion of insulin to stimulate insulin-resistant cells to respond [3]. Type II DM accounts for 90% of all occurrences; type I or immune-mediated diabetes, as well as gestational diabetes [1]. Diabetes mellitus is a risk factor for periodontitis, and diabetes usually occurs before periodontitis, leading to its etiology [2]. Hyperglycemia is a key factor in the development of diabetic complications [4]. Regarding the effect of diabetes on oral health, it causes a burning sensation in the mouth and changes in taste sensation, which can occur due to diabetic neuropathy [5]. Xerostomia is considered one of the most important and common oral manifestations of DM, and the cause of it is not precisely determined, but it may be the result of malfunctions and disorders in the salivary glands [6]. Moreover, dry mouth causes a rise in glucose in saliva, which increases its viscosity and leads to dental caries and oral infections [6]. Xerostomia is the subjective complaint of oral dryness that implies a change in the salivary composition and flow rate [7]. A dry mouth can cause fungal infection, periodontitis, peri-implantitis, potential caries and eventually tooth loss [8, 9, 10].

Smoking and DM, are two major risk factors for periodontal disease [11]. Diabetes Mellitus is well known for its effect on the periodontium. Tooth loss occurs due to two main reasons, either dental decay or the loss of supporting tissues by periodontal diseases. A study done on adults in Rhode Island showed that adults above the age of sixty who were smokers and presented with chronic illness either diabetes or hypertension had more than 8 missing teeth when compared to individuals who had no bad health behaviors and were free of systemic illness [12]. Also, another study found that uncontrolled diabetes caused more tooth loss in both type I and type II diabetes patients compared to groups with controlled or no diabetes [13]. In addition, a study in the United States, which included over 143 million found that diabetes and hyperglycemia are linked to edentulism, and tooth loss [14].

Several clinical trials and multiple systematic reviews have reported the susceptibility of diabetic patients to periodontal disease when compared to non-diabetic individuals [15,16]. The inflammatory process is started by the bacteria in the dental plaque. According to some hypotheses, prolonged hyperglycemia enhances inflammatory response. Periodontal disease in DM is caused by oxidant stress as a result of the effects of Advanced Glycation End products (AGEs), which result from the process of oxidation of fats and proteins accumulated in diabetic

tissues and plasma or are produced from non-enzymatic sugar [17]. In addition, AGEs interact and bind with localized cell plasma receptors located in the plasma membrane and produce Receptors or Advanced Glycation End Product, which affects macrophages and endothelial cells in the periodontal [8,18-21]. Collagen metabolism is hampered by an increase in collagenase activity combined with a decrease in collagen production. As a result, wound healing is delayed, and periodontal disease worsens [8]. High blood glucose leads to the stimulation of various functional proteins, such as collagen proteins, thus increasing the activity of collagenase, which leads to worsening the inflammatory state of the periodontal. Therefore, it has been suggested to treat inflammation such as chronic periodontitis by reducing collagen production, which may reduce insulin resistance and thus lower blood sugar levels [15, 22]. Patients with poor periodontal health are liable to develop type II DM [23]. It has been reported by many studies that diabetic patients with severe chronic periodontitis are more likely to suffer from cardio-renal complications two to three times more than diabetic patients with mild chronic periodontitis [15, 22, 23]. On the other hand, microvascular problems associated with diabetes are expected to be reduced by 35% for every 1%-point decline in glycated hemoglobin (HbA1c) levels. Additionally, a 1% absolute decrease in HbA1c levels may reduce the chance of any diabetes-related death by 21% [24]. The link between increased oral disease and pre-diabetes adds to the growing body of evidence that periodontal/oral pathology are early clinical symptoms of dysglycemia [25]. Therefore, the dental team may be the first to suspect diabetes.

Despite the considerable evidence linking oral health to diabetes, oral health knowledge is poor among both DM patients and health providers. Patients with diabetes are more informed about their higher risk of systemic complications than they are about oral complications [26, 27]. Moreover, maintaining good oral hygiene through oral self-care is also insufficient among diabetic patients [26-29]. Diabetes-related variables such as diabetes duration, fasting blood sugar (FBG), HbA1c, and diabetes self-management compliance are significantly connected with periodontal health in people with type II DM. Thus, in order to prevent diabetes-related complications and improve the quality of life, many studies recommended the importance of blood glucose regulation, diabetes self-care, as well as oral health knowledge [30, 31].

To handle potential oral consequences, the researchers strongly recommend an interdisciplinary approach of DM care specialists working alongside dental sector professionals. Oral health care professionals should be prepared to talk to patients about pre-diabetes and diabetes if they suspect oral conditions.

Despite diabetologists and oral and dental physicians being aware of the risks of type II DM in patients, Libyan diabetic patients are deficient in knowledge and awareness of these increased risks related to oral and gum diseases if they are not detected early and treated. Therefore, the main objective of the study was to evaluate the knowledge of Libyan patients with type II DM on oral health, periodontal status, and the risks of type II DM complications that lead to gingivitis.

MATERIALS AND METHODS

Study design and preparation

This cross-sectional clinical study, based on a cross-sectional design, was conducted using a survey based on a descriptive approach. The study included 300 people of both genders with type II DM who attended the Benghazi Diabetes Treatment Center in Libya from February 2020 to November 2020.

Study participants

The population of the study included type II DM patients attending the Benghazi Diabetes Treatment Center for treatment and follow-up of their health status. A random sample (n = 300 participants) was selected by reviewing the center's records, thus determining the sample that met the inclusion criteria. Data and information about participants were obtained from their records during the period specified for the study. Participating patients were male (n = 121) and female (n = 179) adults who were selected as a random sample and were aged from 16 to 80 years. The researchers contacted the participants to obtain their informed consent to participate in the study, explaining to them that their data were confidential and would not be shared without their consent. Participants were questioned and examined by periodontists from the Faculty of Dentistry at the University of Benghazi. Eligible participants were identified, specifically selecting every participant follow-up to the center who met the inclusion criteria (Libyans diagnosed with type II DM, aged 16 to 80 years). Exclusion criteria included pregnant women and patients under 18 years of age.

Data collection

A structured questionnaire was used to look at several variables. The validity of the questionnaire as a tool for the study was verified by presenting it to a group of researchers, arbitrators, and specialists in a field related to the study, and the validity of the questionnaire to achieve the purpose of the study was reported. The stability of the tool (questionnaire) was verified and confirmed through the use of Cronbach's alpha coefficient test and the internal consistency of the study was verified, where the tool's reliability coefficient alpha was (96%) and this is an excellent stability factor. The questionnaire included three Sections. Section (A): the socio-demographic and personal data, medical history Section (B): consisted of

8 questions about knowledge of patients regarding cause of periodontal disease, risk factors of periodontal disease and the two-way relationship between diabetes and periodontitis. Section (C) included questions on oral-self-care habits and examination of oral manifestations. The questionnaire used close-ended questions. Single response questions were used and the authors constructed a special scoring system to assess knowledge. The total knowledge score was calculated by summing the scores of all questions yielding a total knowledge score ranging from 0 to 8, which was classified as good (=75% or 6-8 points), fair (50%-< 75% or 4-5 points) and poor (<50% or 0-3 points) levels of knowledge.

Periodontal examination

After completing the questionnaire, patients were examined using the mouth mirror and Michigan O probe with William's calibration. Periodontal status was assessed by using Plaque index (PI) [32] and Periodontal disease index (PDI) [33]. Plaque Index final score was calculated by adding scores of all examined teeth divided by their number. As for the PDI score, the highest score was recorded. The oral health examination includes recording observations regarding the number of missing teeth in the participating patients.

Statistical analysis

All answers of the questions were coded and analyzed using the Statistical Package for Social Sciences (SPSS) (Microsoft Windows version 18). Plaque Index and PDI scores were recorded and analyzed. After tabulating, coding and statistically analyzing the data, a test was performed to determine significance, and the significance level was set at $p \leq 0.05$. Frequencies and percentages were used to describe socio-demographic characteristics of various variables including oral health knowledge, periodontal conditions, and other health problems, and this data represents quantitative data. The qualitative data are described using bar charts. Statistical analysis of the data using the Chi-square test was used to verify the significant level of knowledge among patients about oral problems and periodontal conditions associated with type II DM.

Ethical Considerations

Before starting the current study, ethical approval was obtained by the Ethical Review Committee of the Benghazi Diabetes Center in Libya (No. ABD1453/2020). The objectives of the study were explained to the participating patients and their informed consent was obtained.

RESULTS AND DISCUSSION

Descriptive analysis of demographic characteristics of the study participants

The descriptive analysis of the demographic characteristics of participating patients (n = 300) is illustrated in Table 1. Regarding gender, more than half of the study



participants were female 59.7%, while 40.3% were male. Regarding age, 35.7% of the participants were aged between 51 and 60 years, followed by those aged between 61 and 70, 26.7%. Most participants 90% lived in Benghazi, while 10% lived outside of it. Among the participants, 18% completed their university education and obtained a bachelor's degree, 38.3% completed secondary, and 24.3% (n = 73) completed elementary, while 19.3% were illiterate and uneducated. There are cross-sectional studies conducted on the knowledge and awareness of diabetic patients regarding oral health, and they focused on important characteristics such as gender, age, nationality, and educational level [6,34]. These are the same characteristics that were focused on in this study due to their importance and impact on the level of knowledge about oral and periodontal problems in diabetic patients.

Xerostomia among participants with Type II DM

One of the common oral manifestations of diabetic patients is xerostomia. The results of participants suffering from the problem of xerostomia showed that about half of the sample 51% suffered from it, 39% did not suffer from xerostomia, and 10% did not have this problem recorded, as shown in Figure 1. Given the importance of diabetic patients' knowledge of the risks of xerostomia, this study focused on assessing the participating patients' knowledge about xerostomia, associated with type II DM. In addition, it is important to educate diabetic patients about the importance of saliva flow and its benefits. Among the benefits of saliva are washing and disinfecting the mouth, preventing the accumulation of plaque, and preserving the periodontal from inflammation. In addition, it contains antimicrobials that decrease when glucose in saliva rises, and thus infections of the mouth and periodontal appear [26].

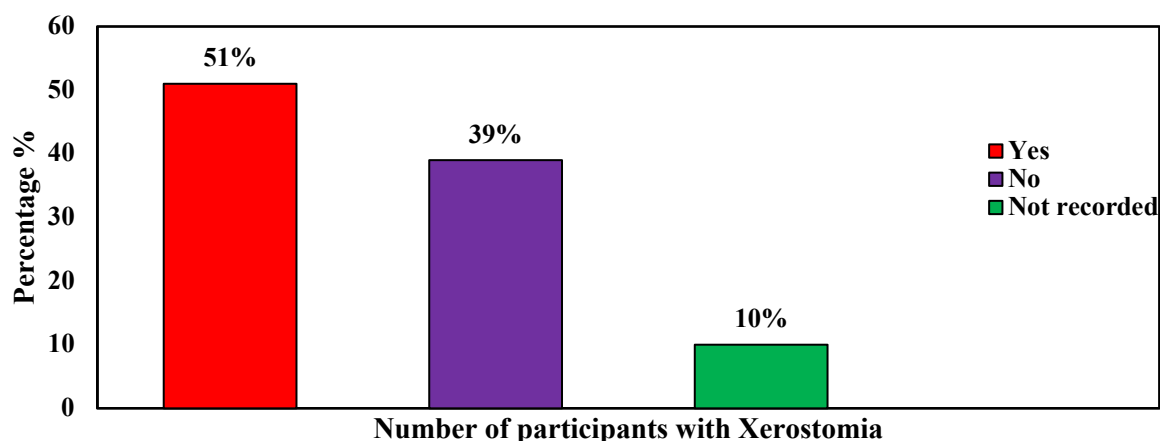


Figure 1: Distribution of participants with xerostomia

Complications experienced by participants with type II diabetes

Patients with uncontrolled diabetes were further asked about any complications due to their diabetic status. The results indicated that more than half of the participants did not suffer from complications (55.6%), followed by those who suffered from neurological and eye problems, 21% and 18.7%, respectively, while a few of them (4%) suffered from both problems (Figure 2). This study is consistent with the issue of attention to and identification of complications suffered by diabetic patients in a study conducted by Alhuwais *et al.* [6] in Kuwait, where they found that patients were more aware and knowledgeable about systemic complications compared to oral complications associated with diabetes. However, it was concluded from previous researches that diabetic individuals have more knowledge about the systemic complications associated with the disease rather than their increased susceptibility to oral disease [26, 27].

Patients' knowledge of the complications of diabetes, especially oral complications, is important because a lack of awareness and knowledge about them has a negative and significant impact on the health of the mouth and periodontal. Therefore, attention must be paid to educating patients about the risks of various complications associated with diabetes.

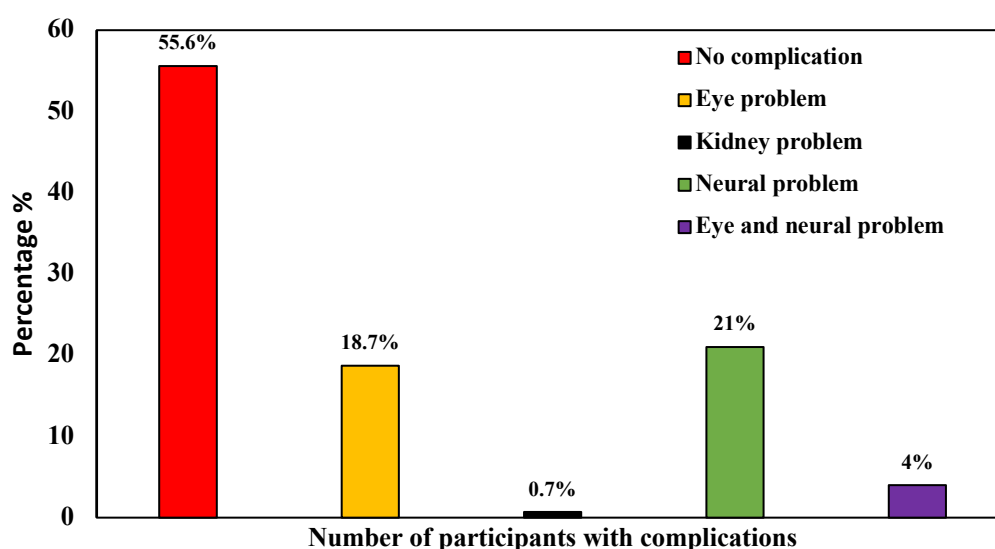


Figure 2: Distribution of participants with complications of type II diabetic

Assessment of participants' knowledge about oral systemic complications

Knowledge about diabetes and its relation to other systemic conditions were assessed by asking patients eight questions (Table 2). In our study, only 29% knew about dental plaque, and 64.6% of participants mentioned that they could prevent periodontal disease. More than half, 59.3% of the participants were aware of periodontal disease symptoms and only 2.8% could not mention two symptoms

for periodontitis. This result was consistent with the results of a study conducted in Sharjah, UAE as the majority of the participants, 70% were aware of symptoms of periodontal disease [26]. In this study, the proportion of participants who were aware of the relationship between diabetes and periodontal diseases was about 63 %. This result agreed with the results of Jansson *et al.* [35], which found that 66% of diabetic patients in the periodontal disease group knew that diabetes may affect oral health. In this study, the percentage of patient participants who had knowledge that periodontal disease is related to diabetes was higher compared to the results of previous studies, where the percentages obtained were 17.0% to 41.6% [27, 36, 37, 38]. This is an area where education could be valuable in changing perceptions regarding the harmful effects of periodontal diseases on diabetics. Diabetic patients need to know that the dentist should be included in their health care team. Eighty Two Percent of the patients in this study believed that extra care of oral hygiene is needed for diabetic patients but only half of them knew that periodontal treatment could improve their glycemic control.

Furthermore, this study demonstrated that about 44.7% of the patients had poor knowledge about periodontal disease and its relationship with systemic disease. About 31% of diabetic individuals had a good knowledge about type II DM and its relationship to oral health and periodontal status, while 24.3% of the respondents indicated fair knowledge (Table 3). This result is consistent with the results of a study conducted by Allen *et al.* [26] in Ireland, where they found that only 33% of participants were aware that diabetes may increase the risk of periodontal disease, while most of them were aware of various medical complications affecting different body systems, such as heart disease, eyes, circulation problems, and kidney disease. Similar results were reported in a study conducted by Ismaeil and Ali in Abha [34], Saudi Arabia. They found that 52.3% of participating patients had no knowledge about oral diseases associated with diabetes, 46.1% of them knew that diabetes causes tooth decay and 46.4% of them knew diabetes affects the periodontal. According to these results, the level of knowledge in patients about oral health was deficient. Patients were asked if they encountered any health problems (Table 4). The majority of the individuals had hypertension and a coinciding illness.

Regarding the relationship between the Plaque Index (PI), Periodontal Disease Index (PDI), and knowledge, the results shown in Table 5 related to the correlation analysis showed a statistically significant relationship between PI, PDI and knowledge ($p < 0.01$), and since knowledge is fair, scores decreased PI and PDI (Table 5). Further correlation analysis was done between different study variables including PI and PDI, years of having diabetes, missing teeth and smoking. The results showed there was a significant correlation between PI and PDI at $p < 0.001$

as shown in Table 6. Surprisingly, the results indicated that there was a significant correlation between smoking and missing teeth with PI but not with PDI. The PDI did not show any correlation with the various variables. Periodontal disease index had a significant relation with the number of years being diabetic. Therefore, diabetic patients should be informed that, through preventive oral health measures, periodontal diseases can be minimized or avoided and diabetic control outcomes could be improved.

When the respondents were asked about the association between periodontal disease and systemic disease about 51% responded that chronic periodontitis is a risk factor for systemic diseases. However, the majority 56.3% did not know that the presence of diabetes with periodontal disease increases the risk for ischemic heart disease or cardiovascular accident. Only 40 diabetic patients were smokers and most of them tried to quit smoking in the past. A significant correlation was found between smoking and missing teeth with PI which confirm the results of the previous studies [13, 14].

Finally, the results of the study demonstrated that there is a relationship between type II DM, periodontal disease, and oral health. These results support that there is an ancient relationship between DM and gingivitis, which is the most common oral complication of DM worldwide [39]. Also, the results of the current study showed that people with diabetes had more severe periodontal diseases.

CONCLUSION, AND RECOMMENDATIONS FOR DEVELOPMENT

The current study concluded that the level of knowledge about the impact of type II DM on the health of the mouth and periodontal among patients in Benghazi was somewhat low, and this may be the result of their educational level being low and therefore their lack of interest in oral health. Furthermore, a significant relationship was found between PI, PDI and knowledge. Because knowledge was fair, PI and PDI scores decreased. This may indicate a lack of oral health information from physicians and dentists, as well as the participants with lower levels of education. To promote good oral health and reduce the risk of oral diseases and periodontal complications, increasing the level of knowledge is crucial. Therefore, health care professionals must explain to diabetic patients the necessity of knowing and providing them with information regarding oral and periodontal diseases associated with diabetes to avoid deterioration of their health condition as a result of lack of awareness and knowledge.

Conflicts of interest

The authors declare no conflict of interest.



Data availability

Data is available on reasonable request from (Logien Al Ghazal),
elghazallogien@gmail.com

Consent to participate

Verbal consent was gained from the patients.

Funding

This research is not funded.

Authorship

Ghadah and Logien contributed to data collection, statistical analysis, results, discussion, draft and final writing. Each author has read and approved the final manuscript as submitted and agreed to be accountable for all aspects of the work.
(provide initials of all authors and their roles)

Table 1: Descriptive analysis of the participating patients' demographic characteristics

Variables	Categorization	Frequency (n)	Percentage (%)
Gender	Male	121	40.3%
	Female	179	59.7%
Age	≤20	5	1.7%
	21-30	9	3%
	31- 40	13	4.3%
	41-50	68	22.6%
	51-60	107	35.7%
	61-70	80	26.7%
	>70	18	6%
Residency	Benghazi	270	90%
	Outside Benghazi	30	10%
Education	Illiterate	58	19.3%
	Elementary school	73	24.3%
	Secondary	115	38.3%
	University	54	18%

Table 2: Questions to assess participants knowledge

Q1.	You know what dental plaque means?
Q2.	Do you think that periodontal disease is preventable?
Q3.	Are you aware of symptoms of periodontal disease?
Q4.	Do you think there is an association between diabetes and periodontal disease?
Q5.	Do you have an idea that chronic periodontitis is a risk factor for systemic disease?
Q6.	Do you know that diabetes with periodontal disease increases the risk for IHD and CVA?
Q7.	Do you think that extra care of oral hygiene is needed for diabetic patients?
Q8.	Do you know that treatment of P.D improve your systemic control ?

Table 3: Determine participants' knowledge levels about oral health and periodontal status

Level of knowledge	Frequency (n)	Percentage (%)
Poor	134	44.7%
Fair	73	24.3%
Good	93	31%

Using a Likert scale or questionnaire

Table 4: Distribution of participants with other health problems

Other health problems	Frequency (n)	Percentage (%)
No health problem	135	45%
Hypertension	104	34.7%
ICP	2	0.7%
Others	59	19.6%
Total	300	100%

Table 5: Correlation between PI, PDI and Knowledge

Variables	N			Pearson's correlation coefficient r			P value		
	PI	PDI	Knowledge	PI	PDI	Knowledge	PI	PDI	Knowledge
PI	294	293	294	1	0.614**	-0.207**	----	0.000	0.000
PDI	293	293	293	0.614**	1	-0.419**	0.000	----	0.000
knowledge	294	293	300	-0.207**	-0.419**	1	0.000	0.000	----

Table 6: Correlation between study variables

Variables	N					Pearson's correlation coefficient r					P value				
	Years of diabetes	Missing teeth	PI	PDI	Smoking	Years of diabetes	Missing teeth	PI	PDI	Smoking	Years of diabetes	Missing teeth	PI	PDI	Smoking
Years of diabetes	300	297	294	293	299	1	0.090	0.050	0.153*	0.118*	-----	.121	.392	.009	.042
Missing teeth	297	297	293	292	296	0.090	1	0.230*	0.071	-0.042	0.121	----	.000	.227	.471
PI	294	293	294	293	293	0.050	0.230**	1	0.614*	-.156**	.392	.000	----	.000	.007
PDI	293	292	293	293	292	0.153**	0.071	0.614*	1	-.096	.009	.227	.000	----	.102
Smoking	299	296	293	292	299	0.118*	-.042	-.156**	-.096	1	.042	.471	.007	.102	----

**Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

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