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Original Research Article

Evaluating undergraduate understanding of dental anatomy, histology and oral pathology: a survey-based study

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ABSTRACT

Background: Dentistry is a progressive field of medicine focused on studying, diagnosing, preventing, and treating diseases and disorders of the oral cavity and maxillofacial region. While an understanding of anatomy and histology is crucial for dental practice, dental students often view oral histology, oral anatomy, and oral pathology as less important for their careers and more difficult to grasp. However, a deeper knowledge of this subject enhances comprehension and aids in the diagnosis and treatment of cases. Still, there remains a gap in understanding and interest among students. This may be partly attributed to the perception that these subjects are non-clinical and offer limited opportunities for practical application. The study aims to assess undergraduate students' comprehension of dental anatomy/histology and oral pathology and identify specific areas where they encounter difficulties connecting with the subject matter.

Methods: This question-based cross-sectional study was conducted in the institute, and it included 116 undergraduate students.

Results: The Chi-square analysis revealed several significant associations between the academic year of students and their responses to questions related to oral pathology, dental anatomy, and forensic odontology.

Conclusions: The quality of education must be upheld, with a focus on creating a nurturing and supportive learning environment. This can be achieved through gathering student feedback and continuously refining the curriculum.

Keywords: Oral pathology, Dentistry, Dental anatomy, Dental histology

INTRODUCTION

Dentistry is a branch of medicine that focuses on the investigation, diagnosis, and treatment of diseases and disorders of the oral cavity and maxillofacial region.¹ The primary goal of higher/professional education, including dentistry, is to develop student's abilities and skills so they can become competent graduates.² The dentistry path is a 4-12 months possibility for dental educators to step by step broaden students' knowledge, skills, and attitudes, in hopes

of turning into in a position dentists upon graduation.³ In India, the undergraduate study of dentistry is referred to as Bachelor of Dental Surgery (BDS). The BDS program is typically a four-year curriculum that covers a wide range of dental and medical subjects including a one-year compulsory internship in all 9 specialties of dentistry. Over the years, some fundamentals of the tooth and supporting structures are required that are taught in the first year itself through the subject of dental anatomy, embryology, and oral histology which are fundamental courses in dental education. This provides a detailed

understanding of the structure, function, and development of teeth and oral tissues.⁴ Starting from the second-year subject of oral pathology starts and teaches a wide range of topics related to the study, diagnosis, and management of diseases and conditions like tumours affecting the oral and maxillofacial regions like disease identification, aetiology and pathogenesis, and histopathology. diagnostic techniques, disease classification, clinical manifestations, treatment planning of oral diseases.⁵ The Department of Oral Pathology plays a vital role in educating students in a unique and diverse branch of dentistry. Oral Pathology specializes in identifying and treating diseases impacting the oral and maxillofacial regions, as well as investigating the causes, processes, and effects of these diseases. Students in this discipline receive specialized training that allows them to professionally diagnose and treat oral diseases. This training enables them to rapidly make critical connections between diseases of the mouth and systemic diseases of the body. Oral Pathology combines expertise in histopathological diagnosis, which involves examining diseased tissues microscopically, with clinical diagnosis and assessment of treatment outcomes.¹ Forensic is derived from the Latin word *forum*, which means 'court of law.' Odontology implies 'the study of teeth.' Forensic odontology, therefore, has been defined by the Fédération Dentaire Internationale (FDI) as "that department of dentistry which, within the hobby of justice, offers with the right dealing with and exam of dental evidence, and with the right assessment and presentation of dental findings. Objectives of the undergraduate curriculum, at the end of the program, the dental graduate should: Have sound knowledge of the theoretical and practical aspects of forensic odontology, have an awareness of ethical obligations and legal responsibilities in routine practice and forensic casework, be competent in recognize forensic cases with dental applications when consulted by the police, forensic pathologists, lawyers and associated professionals, be competent in proper collection of dental evidence related to cases of identification, ethnic and sex differentiation, age estimation and bite marks, be able to assist in analysis, evaluation, and presentation of dental facts within the realm of law.² No doubt mastering this field requires spending extensive hours in the classroom studying samples under the microscope. Unfortunately, even though students today have easy access to electronic media like the internet and Google, which exposes them to the constantly evolving field of pathology. Despite having a good standardized academic curriculum and decent infrastructure, there still exists a gap between what students understand and what teachers can convey through training. As time progresses, changes become necessary.

To the best of our knowledge, there are very few studies conducted to assess the understanding and comprehension of the subject among the students. Keeping this in mind, we attempted to assess the difficulties faced by dental students in the subject of Oral Pathology. The goal was to bridge the gap and create a more conducive learning environment for future dentists. In large group settings,

many students may feel hesitant to participate due to shyness. They often find smaller, informal settings more comfortable and conducive to engagement. A rigid classroom structure and a serious atmosphere can inhibit students from speaking up freely. This tendency is reported to be more common among Asian students, who are often perceived as more passive and inclined towards whole-class or individual work rather than group or pair activities. Hence, we conducted a questionnaire-based study using Google forms so that the students could easily participate.

METHODS

Study type

A descriptive cross-sectional survey was conducted using a closed-ended questionnaire.

Study place

According to the institute's ethical guidelines, the name of the institution cannot be disclosed.

Period of the study

The duration of the study was from April 2024 till June 2024.

Selection criteria of the patients

The participants consisted of 116 dental students. They were further categorized in three groups - group I: first-year students, group II: second- and third-year students, and group III: final year students and interns.

House surgeon and postgraduate students were excluded from the study. All participants were under no obligation to complete the questionnaire.

Procedure

The questionnaire took the form of multiple-choice questions designed to be simple. It was pre-tested to ensure precision, validity, consistency, and clarity of the questions. The questions offered two to four response alternatives and were divided into five sections: demographic details, individual approach towards oral pathology, understanding of the oral pathology department, understanding of oral pathology as a subject, and efforts and measures for improvement. The questionnaires were anonymous with no identifying information about the participants.

In essence, this was an anonymous survey aimed at assessing various aspects of the undergraduate dental curriculum related to oral pathology, using a pre-validated, multiple-choice questionnaire administered to a sample of 116 students across different years of study.

Statistical analysis

Chi-square analysis was done to find several associations between the academic year of students and their responses to questions related to oral pathology, dental anatomy, and forensic odontology.

RESULTS

The questionnaire was filled by 116 students out of which group I included first-year students 29 (26.1% of the total sample size) in number, group II included students of second and third-year students 65 in number (58.5% of the total sample size) and group III included final-year students and interns 17 in number (15.2% of total sample size).

The chi-square analysis revealed several significant associations between the academic year of students and their responses to questions related to oral pathology, dental anatomy, and forensic odontology.

Demographic details

The mean age of students is 21.97 with an SD of 1.89. 59.6% of participating students were female and 40.4% were males. 26.1% belongs to group I of first-year students, 58.5% belongs to group II of second and third-year students, and 15.2% of the total sample size is comprised of group III of final-year students and interns.

Individual approach towards oral pathology

A strong association was found between the year of study and students' confidence in their understanding of oral pathology concepts ($p=0.035$), with final-year students and interns demonstrating higher confidence compared to first- and second/third-year students. The majority of first-year students found learning oral pathology challenging. A higher percentage of second and third-year students were involved in group discussions (Table 1).

Understanding of oral pathology department

Interestingly, no significant associations were found between the academic year and students' opinions on the

necessity of dental anatomy knowledge for dentistry ($p=0.835$), nor the importance of oral pathology in disease prevention ($p=0.312$) (Table 2).

Understanding of oral pathology as subject

The belief that oral pathology should be integrated with general pathology approached significance but did not reach the threshold ($p=0.067$). The ability to name three oral diseases and describe their pathological mechanisms significantly differed between academic years, with interns showing the highest proficiency ($p<0.001$). Students' familiarity with key terminologies such as biopsy, fine needle aspiration cytology (FNAC), and immunohistochemistry (IHC) also varied significantly across academic years, with higher-year students being more knowledgeable ($p=0.044$). Additionally, in terms of diagnostic importance, students' perception of the significance of accurately diagnosing oral lesions differed significantly, with second/third-year students and interns more likely to rate this as extremely important compared to first-year students ($p=0.002$). Additionally, Forensic odontology knowledge was another area where significant differences were observed (Table 3).

Senior students, particularly those in their final year and interns, reported higher familiarity with forensic odontology ($p<0.001$), and more of them felt that the forensic odontology education provided in the BDS program was adequate for pursuing an independent career in the field ($p=0.022$).

Efforts and measures for improvement

The belief that oral pathologists should be recruited in cancer hospitals varied across years, with more senior students strongly supporting this notion ($p=0.014$) (Table 4).

Overall, these results indicate that as students advance through their academic years, their knowledge and confidence in oral pathology and forensic odontology improve, although some areas, like integration with general pathology, remain subjects of debate across years.

Table 1: Individual approach towards oral pathology.

Categories	N	Year			Chi square	P value
		First year, N (%)	Second/ third year, N (%)	Final year/ intern, N (%)		
Do you find learning oral pathology challenging?						
No, not challenging	7	0 (0)	4 (6.2)	3 (13.6)	10.801	0.095
Unsure	4	3 (10.7)	1 (1.5)	0 (0)		
Yes, somewhat challenging	83	18 (64.3)	49 (75.4)	16 (72.7)		
Yes, very challenging	21	7 (25)	11 (16.9)	3 (13.6)		
How often do you engage in discussions or group study sessions related to oral pathology?						
Always	9	4 (14.8)	3 (4.6)	2 (9.1)	6.155	0.63
Never	5	2 (7.4)	3 (4.6)	0 (0)		

Continued.

Categories	N	Year			Chi square	P value
		First year, N (%)	Second/ third year, N (%)	Final year/ intern, N (%)		
Often	20	3 (11.1)	12 (18.5)	5 (22.7)		
Rarely	29	5 (18.5)	19 (29.2)	5 (22.7)		
Sometimes	51	13 (48.1)	28 (43.1)	10 (45.5)		

Table 2: Understanding of oral pathology department.

Categories	N	Year			Chi square	P value
		First year, N (%)	Second/ third year, N (%)	Final year/ intern, N (%)		
On a scale of 1-5 how much do you understand oral pathology as a subject?						
1- Very poor	3	2 (6.9)	1 (1.5)	0 (0)	11.521	0.174
2- Poor	7	3 (10.3)	3 (4.6)	1 (4.5)		
3- Fair	32	9 (31)	21 (32.3)	2 (9.1)		
4- Good	57	10 (34.5)	33 (50.8)	14 (63.6)		
5- Excellent	17	5 (17.2)	7 (10.8)	5 (22.7)		
In your opinion, how important is the understanding of Dental Anatomy and Dental Histology in dentistry?						
Extremely important	56	14 (48.3)	34 (53.1)	8 (36.4)	4.235	0.835
Important	10	3 (10.3)	5 (7.8)	2 (9.1)		
Not important	1	0 (0)	1 (1.6)	0 (0)		
Somewhat important	2	0 (0)	1 (1.6)	1 (4.5)		
Very important	46	12 (41.4)	23 (35.9)	11 (50)		
Do you believe that understanding dental anatomy and dental histology is necessary for dentistry?						
No	1	0 (0)	1 (1.5)	0 (0)	0.791	0.673
Yes	115	29 (100)	64 (98.5)	22 (100)		
Do you see oral pathology as a bridging specialty between general dentistry and general pathology?						
No	2	1 (3.4)	1 (1.5)	0 (0)	6.421	0.17
Unsure	7	3 (10.3)	1 (1.5)	3 (13.6)		
Yes	107	25 (86.2)	63 (96.9)	19 (86.4)		
Do you think study of oral pathology contribute to your future practice as a dentist?						
Maybe	15	6 (21.4)	9 (13.8)	0 (0)	17.239	0.002
No	3	0 (0)	0 (0)	3 (13.6)		
Yes	97	22 (78.6)	56 (86.2)	19 (86.4)		

Table 3: Understanding of oral pathology as a subject.

Categories	N	Year			Chi square	P value
		First year, N (%)	Second/ third year, N (%)	Final year/ intern, N (%)		
Do you believe oral pathology should be integrated or collaborated with general pathology?						
No	26	3 (10.3)	15 (23.1)	8 (36.4)	8.777	0.067
Unsure	21	9 (31)	11 (16.9)	1 (4.5)		
Yes	69	17 (58.6)	39 (60)	13 (59.1)		
Are you familiar with these terminologies: biopsy, FNAC, IHC, cytology, punch biopsy?						
No	13	7 (24.1)	6 (9.4)	0 (0)	9.801	0.044
Unsure	5	2 (6.9)	3 (4.7)	0 (0)		
Yes	97	20 (69)	55 (85.9)	22 (100)		
Do you think diagnosing oral lesions precisely is important?						
Extremely important	42	7 (24.1)	27 (41.5)	8 (36.4)	20.5	0.002
Important	36	18 (62.1)	14 (21.5)	4 (18.2)		
Somewhat important	2	1 (3.4)	1 (1.5)	0 (0)		
Very important	36	3 (10.3)	23 (35.4)	10 (45.5)		
Do you believe oral pathologist have a role in final diagnosis?						
No	1	0 (0)	1 (1.5)	0 (0)	7.549	0.11

Continued.

Categories	N	Year			Chi square	P value
		First year, N (%)	Second/ third year, N (%)	Final year/ intern, N (%)		
Unsure	11	6 (20.7)	5 (7.7)	0 (0)	9.375	0.312
Yes	104	23 (79.3)	59 (90.8)	22 (100)		
How important do you think oral pathology is in the prevention of oral diseases?						
Extremely important	46	13 (44.8)	25 (38.5)	8 (36.4)		
Important	24	9 (31)	12 (18.5)	3 (13.6)		
Not important	1	1 (3.4)	0 (0)	0 (0)	1.052	0.591
Somewhat important	4	0 (0)	3 (4.6)	1 (4.5)		
Very important	41	6 (20.7)	25 (38.5)	10 (45.5)		
Do you believe early disease detection by oral pathologist leads to better prognosis?						
Unsure	4	1 (3.4)	3 (4.6)	0 (0)		
Yes	112	28 (96.6)	62 (95.4)	22 (100)	13.52	0.035
How confident are you in your understanding of oral pathology concepts as a subject?						
Confident	55	12 (41.4)	29 (44.6)	14 (63.6)		
Neutral	39	7 (24.1)	29 (44.6)	3 (13.6)		
Not confident	4	2 (6.9)	1 (1.5)	1 (4.5)		
Very confident	18	8 (27.6)	6 (9.2)	4 (18.2)	4.064	0.668
How confident are you in you in implementing the knowledge of oral pathology concepts in dental clinics?						
Confident	50	12 (42.9)	26 (40)	12 (54.5)		
Neutral	42	9 (32.1)	28 (43.1)	5 (22.7)		
Not confident	5	1 (3.6)	3 (4.6)	1 (4.5)		
Very confident	18	6 (21.4)	8 (12.3)	4 (18.2)	26.911	<0.001
Can you name three oral diseases and their pathological mechanisms?						
No	24	15 (55.6)	9 (14.1)	0 (0)		
Yes	89	12 (44.4)	55 (85.9)	22 (100)	19.518	0.001
Can you differentiate between normal oral mucosa and pathological mucosa microscopically?						
Maybe	34	10 (35.7)	22 (33.8)	2 (9.1)		
No	25	12 (42.9)	10 (15.4)	3 (13.6)		
Yes	56	6 (21.4)	33 (50.8)	17 (77.3)		
Have you ever encountered any challenges in applying oral pathology knowledge to clinical cases?						
No	29	6 (21.4)	17 (26.6)	6 (27.3)	5.905	0.206
Unsure	41	14 (50)	23 (35.9)	4 (18.2)		
Yes	44	8 (28.6)	24 (37.5)	12 (54.5)		
Do you believe that the level of forensic odontology education provided in BDS program is adequate for pursuing an independent career in the field?						
I'm not sure	29	13 (44.8)	14 (21.9)	2 (9.1)	11.476	0.022
No, additional training is necessary	48	6 (20.7)	30 (46.9)	12 (54.5)		
Yes, I believe it is sufficient for an independent career	38	10 (34.5)	20 (31.2)	8 (36.4)		
How useful is the knowledge of forensic odontology imparted at BDS level to be implemented in crime investigation?						
Not very useful	5	0 (0)	4 (6.3)	1 (4.5)	2.324	0.676
Somewhat useful	45	11 (37.9)	26 (41.3)	8 (36.4)		
Verv useful	64	18 (62.1)	33 (52.4)	13 (59.1)		

Table 4: Efforts and measures for improvement.

Categories	N	Year			Chi square	P value
		First year, N (%)	Second/ third year, N (%)	Final year/ intern, N (%)		
Do you believe oral pathologist should be recruited in cancer hospitals?						
No	3	2 (6.9)	1 (1.5)	0 (0)	12.526	0.014
Unsure	3	3 (10.3)	0 (0)	0 (0)		

Continued.

Categories	N	Year			Chi square	P value
		First year, N (%)	Second/ third year, N (%)	Final year/ intern, N (%)		
Yes	110	24 (82.8)	64 (98.5)	22 (100)		
What are your thoughts on future perspective of oral pathology?						
Optimistic	89	20 (69)	50 (78.1)	19 (86.4)	6.175	0.186
Pessimistic	5	2 (6.9)	1 (1.6)	2 (9.1)		
Unsure	21	7 (24.1)	13 (20.3)	1 (4.5)		
Do you think improvements could be made to enhance the teaching of oral pathology in BDS curriculum?						
Maybe	21	7 (24.1)	14 (21.5)	0 (0)	6.982	0.137
No	1	0 (0)	1 (1.5)	0 (0)		
Yes	94	22 (75.9)	50 (76.9)	22 (100)		
Do you plan to continue learning and improving your understanding of oral pathology throughout your career?						
Maybe	26	7 (24.1)	16 (24.6)	3 (13.6)	1.651	0.8
No	8	2 (6.9)	5 (7.7)	1 (4.5)		
Yes	82	20 (69)	44 (67.7)	18 (81.8)		
Do you believe that the level of forensic odontology education provided in BDS program is adequate for pursuing an independent career in the field?						
I'm not sure	29	13 (44.8)	14 (21.9)	2 (9.1)	11.476	0.022
No, additional training is necessary	48	6 (20.7)	30 (46.9)	12 (54.5)		
Yes, I believe it is sufficient for an independent career	38	10 (34.5)	20 (31.2)	8 (36.4)		

DISCUSSION

Regular evaluation of teaching and assessment methods is crucial for identifying and addressing issues at their root. Numerous studies highlight key factors that influence dentistry students' career choices, including financial security, independence, specialization, job satisfaction, status, and a desire to contribute to public welfare. One less commonly chosen post-graduate path for those who have completed their BDS is oral pathology and histology. Although the subject can be perceived as disheartening, if changes were made to the way oral pathology is taught, it could motivate more dental graduates to specialize in this field.⁶ Given the large number of dental colleges in India, it is clear that the country produces the highest number of dental graduates.³ Understanding pathological conditions at a microscopic level forms a strong foundation for dental education, making it essential for students to develop an interest in oral pathology. This branch plays a vital role in preparing students for careers in hospitals and academic settings by equipping them with the skills needed for direct patient care. Therefore, dental institutions must emphasize its importance at the undergraduate level.¹

This study aimed to identify the challenges students face with Oral Pathology as part of their curriculum. We also assessed the difficulty level of understanding both the theoretical and practical aspects of the subject through a questionnaire. The primary goal was to quantify the obstacles students encounter when trying to interpret pathological microscopic slides. The findings revealed the percentage of students who were able to grasp the subject, as well as those who struggled. With a response rate of

90% and a sufficiently large sample size, the study divided students into three batches, each showing different results.

Many students may feel shy and hesitant to participate in formal, large group settings, but they often feel more comfortable engaging in smaller, informal environments. A strict classroom structure and serious atmosphere can discourage open communication and self-expression.⁷

In a cross-sectional study conducted by Mahapatra et al regarding the concerns of oral pathology as a subject among undergrads, they concluded that 83% of the participants attended classes, 90% found the topics covered to be useful, 97% reported that the classes were taken to provide an in-depth view of the subject, 71% faced difficulties in understanding the topics in theory classes.¹ 46% attended seminars, 68% viewed more than 4 slides on average in one practical class, and 80% faced difficulties in identifying the slide. Their data concluded, that if certain measures were taken so as to engage the students' interests, then this subject would prove to be a much better scope of learning for the budding dentists.

Another study by Acharya et al assesses the challenges that dental students face in understanding the topics of dental anatomy histology, and oral pathology and to find solutions to overcome them.³ They concluded that the degree of dentistry students' understanding of the subjects is satisfactory, but there are still some gaps in the student's understanding and interest in these subjects.

According to the results of Hosseini et al in 2014 on investigation of student's opinion about oral and maxillofacial pathology course in Masshad school of

dentistry it was seen that 63.2% of students had complete to relative satisfaction with the theoretical pathology course, and 81.6% had complete to relative satisfaction with the practical pathology course.⁸ Students mentioned the diagnosis of oral diseases as the main application of this course.

In 2011, Sivamalai et al investigated teaching pathology using online digital microscope based on feedbacks of 53 medical students of James Cook University in their fourth and fifth years.⁹

Most studies about dentistry curriculum are conducted on professional institutions, alumni, faculty members, educational officials and dentists. There are few studies focusing on opinions of dentistry students. Henzi et al. investigated curriculum of some dental schools of North America in 2007.¹⁰

Tamgadge et al proposed an innovative and bold initiative to enhance student learning by incorporating 3D animation technology into the teaching of Oral Pathology. This student-centric approach has the potential to revitalize the subject, positioning it as one of the most appealing and sought-after branches in dentistry.¹¹

A study conducted by Mojabi in 2002 at Ghazvin Dental School revealed that 43.3% of students expressed satisfaction with the pathology department.¹² In a study by Semyari et al in 2003 most students had more issues in the theoretical courses of restorative than in practical courses.¹²

In a study conducted by Talebi et al in 2010, 67% of students reported that the question-and-answer method was more effective than traditional teaching methods for clinical pathology. Furthermore, 36.5% preferred group discussions over lectures, although 30% expressed dissatisfaction with the group discussion format.¹³

In a 2009 study by Delaram et al, 57.6% of participating faculty members used a combination of lecturing and the question-and-answer method in patient treatment education. Additionally, 10.8% relied solely on lectures, while the remaining faculty employed a mix of teaching strategies, including student-led lectures, group discussions, problem-solving activities, ward rounds, and practical training.¹⁴

This study provided valuable insights into students' difficulties and apprehensions. One innovative approach to improve learning outcomes is the digitalization of slides. Several studies have indicated that students find digital slides more accessible and relatable compared to traditional glass slides.¹⁵

In this study, most students considered textbooks to be the best source of knowledge. However, there remain gaps in students' understanding and awareness of the subject, even though dental students should generally possess a

sufficient grasp of it. This could be attributed to the perception that the subject has limited practical application, leading students to view it as non-clinical. Therefore, efforts must be made to create a supportive learning environment that upholds educational standards, which can be achieved through student feedback and curriculum updates by educational institutions.⁵ It is important to recognize that oral pathology is a unique field where research and practice intersect. A definitive histologic diagnosis is reached after oral pathologists have examined the patients clinically, investigated the issue, and determined its cause. This process provides a unique opportunity to conduct research and directly apply it to clinical practice.⁶

Limitations

One limitation of the study is the relatively small and institution-specific student sample, which may affect the generalizability of the findings. Including a larger and more diverse group of students from multiple institutions could enhance the validity of the results.

Additionally, the study could benefit from revised inclusion criteria and a broader range of question formats.

The lack of participation from postgraduate students is another limitation; a comparison between undergraduate and postgraduate responses could provide deeper insights. Incorporating such elements in future research may help in better evaluating the outcomes and could support potential integration into the academic curriculum.

CONCLUSION

The quality of education must be maintained, and efforts should focus on fostering a supportive learning environment. This can be accomplished through student feedback and curriculum redesign. By making simple adjustments, such as incorporating modern technologies like digital microscopes, these challenges can be addressed, resulting in a more engaging and organized learning experience for students. The present study found that students were generally well-oriented in Dental Anatomy, Histology, and Oral Pathology.

However, they faced challenges in fully grasping these subjects. By incorporating newer technologies and digital microscopy, these difficulties could be addressed, making the learning environment more engaging and organized for students. Raising awareness of this specialty early in the BDS curriculum could help generate interest and encourage students to consider it as a potential career path. By introducing changes to the curriculum and teaching methods, learning could become more engaging and comprehensive for future dental professionals. Adapting to modern teaching trends and applying new technologies will undoubtedly motivate students, enhancing both their knowledge and practical skills.

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