Evaluation of the Awareness and Knowledge in Dental Practitioners Regarding Bisphosphonate and Bisphosphonate-Related Osteonecrosis of the Jaw: A Cross-Sectional Online Survey from Pakistan

Aiza Suhail Khan[1*], Tauqir-Ul-Islam[1], Syed Tahir Hussain[1] and Sana Khan[1]

[1]*Liaquat National Hospital and Medical College, Karachi, Pakistan*

Abstract

Background: Dental practitioners are often the first to recognize the symptoms of bisphosphonate-related osteonecrosis of the jaw (BRONJ), which include pain, exposed bone, or non-healing ulcers. Early symptoms should be identified to prevent the progression of complications.

Objective: To determine the awareness and knowledge of bisphosphonate (BP) and BRONJ among dental practitioners in Pakistan.

Methods: This was a cross-sectional online survey conducted by the Department of Dental and Maxillofacial, Liaquat National Hospital, from July 2025 to January 2026. A Google Docs (Inc) link was shared on various social media platforms. The study questionnaire included domains such as demographics, general knowledge, awareness of bisphosphonate medication, administration, oral health impact, and management of bisphosphonates.

Results: A total of 300 responses were analyzed. The mean age of participants was 35.2 ± 7.8 years. All of the participants had awareness of BP, as all of them knew that BP is a class of medication. The proportion of knowledge adequacy in the general awareness section was 10%. Adequate knowledge regarding the administration of bisphosphonate, duration, and dosage was 41%. Adequate knowledge regarding the BP impact on BRONJ was observed in 12.3% of respondents. The frequency of adequate knowledge regarding the management of patients taking BP medications was 76.3%.

Conclusion: The current survey suggests that, despite all participants having heard of bisphosphonates and BRONJ, their knowledge was limited. The findings indicate a strong need for targeted education programs to improve understanding of bisphosphonate treatment and its implications for the oral cavity.

Keywords: *Bisphosphonate, BRONJ, dental practitioner, MRONJ, maxillofacial surgery.*

INTRODUCTION

Bisphosphonates are a group of drugs commonly used to treat osteoporosis, Paget's disease, and bone cancer, including multiple myeloma and metastatic bone disease [1]. These medications prevent bone resorption by inhibiting osteoclast activity, thereby increasing bone density and reducing the risk of fractures. Bisphosphonates are generally available in two preparations: oral and intravenous, with their respective clinical applications [2]. Although bisphosphonates have changed the management of various bone disorders, they have been linked to complications, including a serious condition called Bisphosphonate-Related Osteonecrosis of the Jaw (BRONJ). This is a condition in which the bone tissue in the jaw dies, which occurs frequently after dental procedures such as extractions but may also occur spontaneously [3].

While the prevalence of BRONJ ranges from 1% to 12%, it is considered a severe issue in dental and medical practice [4]. Longer use of bisphosphonates, particularly intravenous bisphosphonates in cancer treatments, has been linked to an increased chance of developing BRONJ, according to research [5]. However, incidences of osteonecrosis have also been linked to oral bisphosphonates, which are typically recommended to treat osteoporosis [6].

Dental practitioners are often the first to recognize the symptoms of BRONJ, which include pain, exposed bone, or non-healing ulcers. Early symptoms should be identified at an early stage to prevent complications from progressing with timely detection. Nevertheless, without an adequate understanding of bisphosphonate therapy and its risks, dental professionals might not be prepared to address such cases [7]. Research in other areas indicates that a significant number of dentists may not feel confident in dealing with BRONJ or may be unfamiliar with the preventive measures required [8, 9]. It highlights the need for specialized educational programs to enhance dental practitioners' understanding of bisphosphonates, their oral implications, and BRONJ.

The American Association of Oral and Maxillofacial Surgeons (AAOMS) proposed staging and treatment plans in patients taking BPs [10]. These guidelines were primarily aimed at providing clinicians with a foundational knowledge of BPs, the clinical presentation, and risk factors for medication-related osteonecrosis of the jaw (MRONJ) or BRONJ, and, above all, the prevention

**Corresponding author:* *Aiza Suhail Khan, Liaquat National Hospital and Medical College, Karachi, Pakistan, Email: aizasuhail@gmail.com*
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and treatment of BRONJ. Regrettably, even with these guidelines, some studies have indicated that dentists' knowledge of treatment for patients undergoing BPs therapy is very poor [8, 9, 11].

Although the use of bisphosphonates is increasing worldwide, few literature sources in Pakistan exist on dental practitioners' awareness and knowledge of bisphosphonates and bisphosphonate-induced jaw necrosis (BRONJ). Although other countries conducted studies to determine the level of knowledge and clinical practices about BRONJ [8, 9, 12, 13], there is little research of a similar kind in Pakistan. The absence of information on dental professionals' awareness of bisphosphonates and their effects on oral health creates a gap; therefore, this study aims to understand dental practitioners' current knowledge in Pakistan regarding bisphosphonates, their side effects, and the management of these side effects in dental practice.

METHODOLOGY

This cross-sectional online survey was conducted by the Department of Dental and Maxillofacial Surgery at Liaquat National Hospital from July 2025 to January 2026. The research was initiated upon obtaining formal approval from the Ethics Committee of Liaquat National Hospital, on institutional letterhead, bearing the reference number Ref: App # 1199-2025-LNH-ERC.

The inclusion criteria were licensed dental practitioners with at least 1 year of practice experience. Non-Pakistani dental practitioners and incomplete survey responses were excluded. The sample size was calculated using the OpenEpi online calculator, with p=16.8% [13] at a 95% confidence interval and a 5% margin of error, yielding a sample size of 215.

A Google Form survey link was developed and distributed across various social media groups for dental practitioners. The involvement was anonymous and voluntary. In the post, brief information about the study's purpose was provided, and the importance of participation was highlighted. The survey would not be completed without online consent, which must be provided before accessing the survey. This survey link remained active until we stopped receiving additional feedback to capture as many people as possible across the country.

The study questionnaire was self-designed and comprised five sections: demographics; general knowledge and awareness of bisphosphonate drugs; bisphosphonates, their administration, duration, and dosage; bisphosphonates' impact on BRONJ; and the management of patients taking bisphosphonates. The demographic section consisted of 6 questions: age, gender, years of experience, specialization, and the type of working sector and organization. The second category, general knowledge and awareness of bisphosphonate medications, assessed 4 questions: bisphosphonates as a type of medication; sources of knowledge; the most commonly prescribed BP; the most commonly used BP drugs; and how the drug works. These questions had binary responses (yes/no), unlike other questions, except for the knowledge source question, which was a multiple-response question. The participants were advised not to continue with the survey in case they were unaware of BP (were aware that BP is a class of medication) as a type of medication. The third component consisted of 3 items. The fourth component was constructed from 5 items assessing awareness of BRONJ, knowledge of its symptoms and risk factors, and the level of BP therapy associated with BRONJ. The fifth component, management of patients using BP, measured 5 items. The questions were scored, assigning a score of 1 to a correct answer and 0 to an incorrect answer. Thus, the total score for sections 2, 3, 4, and 5 was 5, 5, 16, and 5, respectively. Knowledge was considered adequate when the participant scored at least 80% of the total points under Bloom's criteria. The study questionnaire is provided as a supplementary file.

The knowledge-based component of the questionnaire was self-designed and was validated by the other two maxillofacial specialists who were not involved in the survey. Further, a pilot study was conducted with 30 participants to evaluate the questionnaire's reliability, which was found to be reliable (Cronbach's alpha = 0.78).

The data were imported into Microsoft Excel, which was then imported into SPSS version 27 for statistical analysis. Categorical data were reported as frequencies and percentages. The numerical variables were reported as means with standard deviations. Data was presented in tables and charts as appropriate. Participants' features were compared with knowledge status (adequate/non-adequate) using the chi-square test, with $p<0.05$ considered statistically significant.

RESULTS

Demographic Profile of the Participants

A total of 378 responses were received. 300 complete responses were analyzed. The mean age was 35.2 ± 7.8 years. Average working hours per day were 8.1 + 1.7 hours, and mean work experience was 9.8 + 4.5 years. More than half of the respondents were females (57.7%), employed in the private sector (60%), and in a teaching organization (76%). More than three-fourths of the respondents were in general dentistry (79.7%). Table **1** summarizes the demographic profile of the participants.

Table 1: Summary of participants' demographic profile.

Variables	Groups	Frequency	Percentage
Age	<35 years	176	58.7
	≥35 years	124	41.3
Gender	Male	127	42.3
	Female	173	57.7

Variables	Groups	Frequency	Percentage
Department	General dentistry	239	79.7
	Orthodontics	11	3.7
	Prosthodontics	17	5.7
	Oral and maxillofacial	33	11.0
Working hours per day	≤8 hours	139	46.3
	>8 hours	161	53.7
Experience	≤5 years	199	66.3
	6 -10 years	51	17.0
	>10 years	50	16.7
Working sector	Public	80	26.7
	Private	180	60.0
	Both	40	13.3
Organization type	Teaching	228	76.0
	Non-teaching	72	24.0

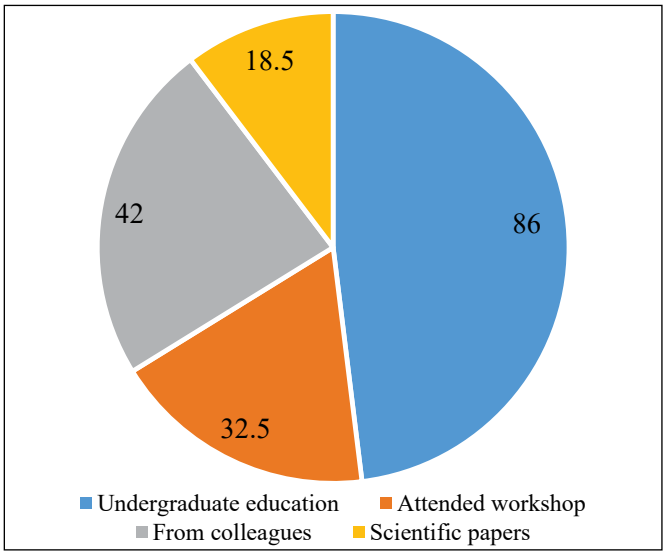


Fig. (1): Frequency of sources of knowledge of the study participants.

General Knowledge and Awareness of the Bisphosphonate Medications

Every one of the respondents had heard of BP and knew that it is a class of medication. The sources of knowledge are shown in Fig. **(1)**. The majority of participants (86%) were aware of BP in their dental school, and the smallest percentage (18.5%) was aware of BP through scientific research papers. The primary identified indication of BP was osteoporosis (66.7%), and the least was knowledge related to the use of cancer-related bone conditions (11%), Paget's disease (3%), and hypercalcemia (5%). The participants did not report any other indication. Almost half of the respondents (48%) said that BP inhibits osteoclast-mediated bone resorption, but others said they were not aware of this.

The proportion of knowledge adequacy for this section was 10%. The proportion of adequate knowledge was significantly higher among oral and maxillofacial surgeons (30.3%) than among dental practitioners from other departments, and the lowest proportion of adequate knowledge was observed among general dentists (5.9%) (p<0.001). Adequate knowledge for this section also varied by work experience, with a significantly higher proportion of knowledge among those with longer practice duration (p<0.001) (**Table 2**).

Table 2: Comparison of sociodemographic features with adequate general knowledge of bisphosphonate medications.

Variables	Categories	Adequate Knowledge		p-value
		Yes n(%)	No n(%)	
Age	<35 years	15(8.5)	161(91.5)	0.312
	≥35 years	15(12.1)	109(87.9)	
Gender	Male	16(12.6)	111(87.4)	0.368
	Female	14(8.1)	159(91.9)	
Department	General dentistry	14(5.9)	225(94.1)	*<0.001
	Orthodontics	2(18.2)	9(81.8)	
	Prosthodontics	4(23.5)	13(76.5)	
	Oral and maxillofacial	10(30.3)	23(69.7)	
Working hours per day	≤8 hours	15(10.8)	124(89.2)	0.742
	>8 hours	15(9.3)	146(90.7)	
Experience	≤5 years	4(2)	195(98)	*<0.001
	6 -10 years	11(21.6)	40(78.4)	
	>10 years	15(30)	35(70)	
Working sector	Public	7(8.8)	73(91.3)	0.312
	Private	19(10.6)	161(89.4)	
	Both	4(10)	36(90)	
Organization type	Teaching	19(8.3)	209(91.7)	0.085
	Non-teaching	11(15.3)	61(84.7)	

*Significant at p<0.05

Knowledge Regarding Administration of Bisphosphonate, Duration, and Dosage

Table **3** summarizes the frequency distribution of knowledge on BP administration, duration, and dosage. The majority of respondents indicated that the route of drug administration would be intravenous (43.7%), that the average duration of BP use would depend on the patient's condition (86.3%), and that they knew the potential risks of the treatment (95.3%).

The frequency of adequate knowledge regarding BP administration, duration, and dosage was 41%. The

Table 3: Knowledge related to drug administration, duration, and dosage.

Knowledge Items Related to Drug Administration, Duration, and Dosage	Frequency	Percentage
Possible routes of administration for bisphosphonates		
Oral	111	37.0
Intravenous (IV)	130	43.3
Subcutaneous	59	19.7
Others		
What is the typical duration of bisphosphonate therapy for patients?		
Short-term (less than 1 year)	17	5.7
Medium-term (1-3 years)	19	6.3
Long-term (more than 3 years)	5	1.7
Depending on the condition	259	86.3
Are You Familiar with any Potential Dose-Related Risks Associated with Bisphosphonates?		
Yes	286	95.3
No	14	4.7

Table 4: Comparison of sociodemographic features with adequate knowledge regarding bisphosphonate administration, duration, and dosage.

Variables	Categories	Adequate Knowledge		p-value
		Yes n(%)	No n(%)	
Age	<35 years	61(34.7)	115(65.3)	*0.008
	≥35 years	62(50)	62(50)	
Gender	Male	45(35.4)	82(64.6)	0.093
	Female	78(45.1)	95(54.9)	
Department	General dentistry	105(43.9)	134(56.1)	0.170
	Orthodontics	2(18.2)	9(81.8)	
	Prosthodontics	5(29.4)	12(70.6)	
	Oral and maxillofacial	11(33.3)	22(66.7)	
Working hours per day	≤8 hours	58(41.7)	81(58.3)	0.810
	>8 hours	65(40.4)	96(59.6)	
Experience	≤5 years	138(69.3)	61(30.7)	0.139
	6 -10 years	41(80.4)	10(19.6)	
	>10 years	44(80)	6(20)	
Working sector	Public	33(41.3)	47(58.8)	0.470
	Private	77(42.8)	103(57.2)	
	Both	13(32.5)	27(67.5)	
Organization type	Teaching	105(46.1)	123(53.9)	0.139
	Non-teaching	26(36.1)	46(63.9)	

*Significant at p<0.05

frequency of adequate knowledge was significantly higher among participants aged≥35 years (p=0.008). Other than age, none of the participants' features differed significantly between those with and without adequate knowledge (**Table 4**).

Knowledge Related to Bisphosphonate Influence on BRONJ

Table **5** summarizes the knowledge regarding the effect of bisphosphonates on BRONJ. Each participant had heard of BRONJ. Exposed necrotic bone was reported to be the most common symptom of BRONJ (92.3%). The majority of respondents (92.7%) indicated that the duration of bisphosphonate treatment is a risk factor for BRONJ. Almost two-thirds of participants believed that BRONJ is caused by long-term BP use (66%).

Table 5: Knowledge related to bisphosphate impact on BRONJ.

Knowledge Items Related to Bisphosphonate Impact on BRONJ	Frequency	Percentage
Have you ever heard of bisphosphonate-related osteonecrosis of the jaw (BRONJ)?		
Yes	300	100.0
No	0	0.0
Most common symptoms of BRONJ?		
Pain	55	18.3
Swelling	65	21.7
Exposed necrotic bone	277	92.3
Fistula formation	15	5.0
Pus discharge	13	4.3
Pathologic fractures	74	24.7
Non-healing ulcers	59	19.7
Risk factors for BRONJ		
Duration of bisphosphonate therapy	278	92.7
Type of bisphosphonate (oral *vs* intravenous)	68	22.7
History of dental extractions	102	34.0
Poor oral hygiene	40	13.3
Cancer therapy (chemotherapy, radiation)	78	26.0
Dental implants	37	12.3
Periodontal surgery	33	11.0
At what stage of bisphosphonate therapy do you think the risk of BRONJ is highest?		
Early stage (first few months)	15	5.0
Long-term use (several years)	198	66.0
After IV administration	29	9.7
During cancer treatment	58	19.3

Adequate knowledge of the BP impact on BRONJ was observed in 12.3% of respondents. Knowledge was significantly lower among general dentists as compared to dentists of other departments (p=0.015) (**Table 6**). Other demographic variables did not differ significantly between those with adequate/inadequate knowledge.

Table 6: Comparison of sociodemographic features with adequate knowledge regarding the impact of bisphosphonates on BRONJ.

Variables	Categories	Adequate knowledge		p-value
		Yes n(%)	No n(%)	
Age	<35 years	22(12.5)	154(87.5)	0.914
	≥35 years	15(12.1)	109(87.9)	
Gender	Male	19(15)	108(85)	0.230
	Female	18(10.4)	155(89.6)	
Department	General dentistry	22(9.2)	217(90.8)	*0.015
	Orthodontics	3(27.3)	8(72.7)	
	Prosthodontics	4(23.5)	13(76.5)	
	Oral and maxillofacial	8(24.2)	25(75.8)	
Working hours per day	≤8 hours	15(10.8)	124(89.2)	0.510
	>8 hours	22(13.7)	139(86.3)	
Experience	≤5 years	24(12.1)	175(87.9)	0.868
	6 -10 years	7(13.7)	44(86.3)	
	>10 years	6(12)	44(88)	
Working sector	Public	8(10)	72(90)	0.846
	Private	25(13.9)	155(86.1)	
	Both	4(10)	36(90)	
Organization type	Teaching	29(12.7)	199(87.3)	0.934
	Non-teaching	8(11.1)	64(88.9)	

*Significant at p<0.05

Knowledge Regarding Patient Management Taking Bisphosphonate

The knowledge regarding management for patients taking bisphosphonates is indicated in Table **7**. All table participants recognized the need for dental practitioners in the prevention of BRONJ. Almost one-fifth of respondents (17.3%) indicated that they knew specific guidelines or protocols for treating patients on bisphosphonates.

Table 7: Knowledge related to management of patients taking bisphosphonates.

Knowledge Items Related to Management of Patients Taking Bisphosphonates	Frequency	Percentage
Do you believe dental practitioners should play a role in preventing BRONJ?		
Yes	300	100
No	0	0
Are you aware of any specific guidelines or protocols for managing patients on bisphosphonates?		
Yes	52	17.3
No	248	82.7
Bisphosphonate use should be specifically enquired about during medical history taking due to its clinical implications		
True	290	96.7
False	10	3.3
Patients receiving bisphosphonates require special considerations during dental extractions due to the risk of medication-related osteonecrosis of the jaw.		
True	225	75
False	75	25
Which of the following are recommended considerations when performing dental surgery in patients receiving bisphosphonates?		
No modifications are needed	13	4.3
Prescribing antibiotics and minimizing invasive surgical trauma	262	87.3
Only increase local anesthesia	7	2.3
Avoid any dental treatment completely	18	6.0

The frequency of adequate knowledge regarding the management of patients taking BP medications was 76.3%. Oral and maxillofacial surgeons were likely to have more adequate knowledge than other departments (p<0.001). Frequency of adequate knowledge was also higher among those working more than 8 hours (p<0.001) and employed in teaching institutes (p<0.001) (**Table 8**).

Table 8: Comparison of sociodemographic features with adequate knowledge related to the management of patients taking bisphosphonate medications.

Variables	Categories	Adequate Knowledge		p-value
		Yes n(%)	No n(%)	
Age	<35 years	134(76.1)	42(23.9)	0.974
	≥35 years	95(76.6)	29(23.4)	
Gender	Male	88(69.3)	39(30.7)	0.278
	Female	141(81.5)	32(18.5)	
Department	General dentistry	191(79.9)	48(20.1)	0.003
	Orthodontics	4(36.4)	7(63.6)	
	Prosthodontics	6(35.3)	11(64.7)	
	Oral and maxillofacial	28(84.8)	5(15.2)	
Working hours per day	≤8 hours	78(56.1)	61(43.9)	*<0.001
	>8 hours	151(93.8)	10(6.2)	
Experience	≤5 years	147(73.9)	52(26.1)	0.664
	6 -10 years	41(80.4)	10(19.6)	
	>10 years	41(82)	9(18)	
Working sector	Public	60(75)	20(25)	0.210
	Private	141(78.3)	39(21.7)	
	Both	28(70)	12(30)	
Organization type	Teaching	161(70.6)	67(29.4)	*<0.001
	Non-teaching	68(94.4)	4(5.6)	

*Significant at p<0.05

DISCUSSION

Interestingly, all the participants had heard about BP and had knowledge that it is a type of drug that is being used in dentistry. A recent survey in Pakistan found that all participants were aware that BP medications are currently used in dentistry [14]. We observed that undergraduate education is a primary source of knowledge, consistent with other studies [13, 15]. The inclusion of bisphosphonates and their oral implications, BRONJ/MRONJ, in the dental undergraduate curriculum that is currently being taught to dental undergraduates may have made it possible for all participants to be aware of the term. The majority of studies also pointed to undergraduate courses as their primary source of information, making this fact evident. Scientific papers and the internet were also mentioned among other cited sources of knowledge. Additionally, continuing dental education sessions are included in this study's knowledge of bisphosphonates. Our study considers the knowledge distribution to be consistent with previous similar studies [16, 17].

Although intravenous administration followed by oral administration was the most commonly reported route in this study, almost one-fifth of respondents chose the subcutaneous route. It is important to note that no known bisphosphonates have been used by the subcutaneous route, unlike other antiresorptive agents such as denosumab. This finding is unique, as the available studies evaluating dentists' knowledge of bisphosphonates did not report subcutaneous administration as a chosen route [13, 18, 19]. The inclusion of various response options could be one reason, since those who were less knowledgeable than others might have chosen answers by chance. A third possible scenario is a misunderstanding of bisphosphonates and other antiresorptive drugs, indicative of a more general lack of pharmacological knowledge among dental professionals.

The length of therapies using drugs and the mode of administration are also risk factors that doctors are supposed to consider to avoid BRONJ. In this survey, approximately one-fifth of respondents selected an incorrect response for the subcutaneous route for BP delivery, and a few also had an incorrect response regarding the duration of BP treatment (13.7%). The result is comparable to a survey conducted in the UAE, which indicated that, in general, 13.3% of participants, 9% of endodontists, 7.5% of prosthodontists, and 10.4% of orthodontists failed to provide a satisfactory response regarding the route of drug administration

[20]. A survey in another study in South Korea showed that only two-thirds of dentists considered the duration of bisphosphonate use in the patients they treated [21], suggesting that dental practitioners are not accounting for duration of use in their treatment decision-making. They have inadequate knowledge of the importance of treatment duration and its associated detrimental effects.

It is worth noting that all survey respondents had heard of BRONJ. Nonetheless, despite being informed about BRONJ/MRONJ, their understanding of its symptoms and risk factors was not impressive. Most participants correctly identified the most evident characteristics of BRONJ, including the symptom of exposed necrotic bone and the timing of bisphosphonate treatment outcomes, as risk factors. Conversely, they responded less to symptoms they regularly see or that are symptomatic of other disorders, such as pain, swelling, and pus discharge. Equally, fewer respondents reported similar experiences with factors that frequently occur in their practice, including poor oral health, cancer treatment, dental implants, and periodontal surgery. This is not unexpected and, unlike similar studies in the past, knowledge gaps in BRONJ were reported among dental practitioners and other doctors [8, 9, 22].

The other knowledge gap was also significant, as the interviewed participants were asked at what stages of BP therapy patients are at a higher risk of BRONJ. Two-thirds of them found out that the long-term BP therapy increases the risk of BRONJ. This response was anticipated amid the overall interpretation that years-long usage of any drug or treatment tends to become a risk factor in most cases for the occurrence of other diseases. However, a more worrying fact to come out here was that only about one-fifth of the individuals quoted that during cancer treatment, the risk of BRONJ is greater. Merely a quarter of them quoted this as a risk factor of BRONJ, which is an alarming knowledge gap, given that the cancer patients undergoing radiotherapy are a cohort that poses the greatest risk of developing BRONJ.

In this research, positive responses were recorded when subjects were evaluated regarding the role dental practitioners play in preventing BRONJ. In particular, the majority of respondents emphasized the importance of asking whether the patient is taking bisphosphonates during medical history-taking, using special care when performing dental procedures to minimize the risk of drug-induced osteonecrosis of the jaw, and prescribing antibiotics to lessen the trauma of invasive surgery. This area of the survey showed rather higher knowledge than in several previous studies [4, 8, 9, 22]. The methodological possibility of this difference is that many previous surveys dentists had completed by analyzing their actual clinical practice. In contrast, the current study rates knowledge using structured statements with true/false answers. Such a strategy might have helped identify preventive measures correctly, even among participants who might not always apply them in their everyday clinical settings.

The results of the current research indicate that, despite the majority of study participants being aware of bisphosphonates, few knew any of the existing protocols or guidelines for treating patients on bisphosphonate therapy. This is in accordance with prior surveys indicating a gap in dental practitioners' knowledge of BRONJ/MRONJ prevention and of delivering patient care according to guidelines [12, 23, 24]. This kind of scenario underscores the urgent need for structured learning and ongoing education to refresh and strengthen dentists' knowledge and clinical experience in the use of bisphosphonate therapy.

It is important to note that in this study, the lowest level of knowledge was demonstrated for general awareness at 10% and the effects of bisphosphonates on BRONJ at 12.3%, while at least 41% of subjects provided correct answers to 80% of the items regarding the administration, duration, and dosing of bisphosphonates. In contrast, a much higher level of knowledge was seen in the management domain (76.3%). This apparent disparity between the low levels of knowledge in almost every domain other than management with a high number of correct responses in the management domain may be due to the questions themselves; the management questions were much more direct and resulted in higher numbers of correct responses, likely because the focus was on the clinical steps involved with management (*i.e.*, recording a patient's prior medication history of bisphosphonates, taking special precautions when developing the treatment plan, *etc.*). The remaining domains contained concept-based multiple-choice questions that required an understanding of the theoretical basis of bisphosphonate use, such as how bisphosphonates work or the typical length of bisphosphonate therapy. These questions required more in-depth knowledge of the topic to be answered correctly, which explains the lower proportion of adequate knowledge for those domains.

This study has certain limitations. Even though the questionnaire was self-designed and validated, and its reliability was checked using Cronbach's alpha, the results are based solely on knowledge assessment and not on actual clinical practice. The research was conducted using a small sample of dental practitioners, which might not be entirely representative of all dentists in Pakistan, especially in rural or underrepresented areas. Besides, although the knowledge-rating questions were multiple-choice, some participants might have guessed the answers, potentially overestimating the number of correct answers. Although these were the limitations, the study offers valuable insights into the gaps in awareness and knowledge of bisphosphonates and BRONJ among dental practitioners across Pakistan.

CONCLUSION

The current survey suggests that, despite all participants having heard of bisphosphonates and BRONJ, their knowledge was limited. The findings indicate a strong need for targeted education programs to improve understanding of bisphosphonate treatment and its implications for the oral cavity.

ETHICS APPROVAL

The study was approved by the Ethics Committee of Liaquat National Hospital (Ref: App # 1199-2025-LNH-ERC). All procedures performed in studies involving human participants followed the ethical standards of the institutional and/or national research committee and the Declaration of Helsinki.

CONSENT FOR PUBLICATION

All participants completed an online consent form before responding to the survey.

AVAILABILITY OF DATA

All of the data collected is presented within this manuscript.

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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Declared none.

AUTHORS' CONTRIBUTION

ASK conceptualized the study. ASK, TUI, TH, designed the study protocol. ASK and SK identified forums for data collection and monitored the responses. SK cleaned the collected data, performed analyses, interpreted the results, and wrote up the results. ASK, TH, and SK prepared an initial draft of the manuscript. TUI critically reviewed and revised the initial draft.

All authors have read and approved the final manuscript.

SUPPLEMENTARY MATERIAL

Supplementary material is available on the journal's website.

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