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Research Article

Prevention, Diagnosis and Management of Medication Related Osteonecrosis of the Jaw: Interdisciplinary Systematic Review of Dentists, Radiologists and Pharmacists Contributions

Ziad Nasser Almutawa[1]*, Nawaf Mansour Almutairi[2], Saleh Mohammed Alegayel[3], Saeed Jalal Albaqami[4], Anas Ibrahim Alhuzaimi[2], Ibrahim Mesfer Alqahtani[5], Khaled Hashim Alolimi[6], Faisal Ghaithan Alamri[6], Zainab Saad Alotaibi[7] and Samaher Mohammed Alhomaidhi[8]

[1]Restorative Dentist, Medical Services in Ministry of Interior, Saudi Arabia

[2]Periodontist, Medical Services in Ministry of Interior, Saudi Arabia

[3]General Dentist, Medical Services in Ministry of Interior, Saudi Arabia

[4]Endodontist, Alkharj Military Industries Corporation Hospital, Saudi Arabia

[5]Endodontist, Medical Services in Ministry of Interior, Saudi Arabia

[6]Radiology Specialists, Ministry of Interior, Public Security, Medical Services, Riyadh, Saudi Arabia

[7]Pharmacist, King Khalid University Hospital, Saudi Arabia

[8]Dentist, Security Forces Albaha, Saudi Arabia

***Corresponding Author:** Ziad Nasser Almutawa, Restorative Dentist, Medical Services in Ministry of Interior, Saudi Arabia.

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Abstract

Background: Medication related osteonecrosis of the jaw (MRONJ) is a serious complication of antiresorptive and antiangiogenic therapy. Effective prevention and management depend on coordinated care between dentists, radiologists and pharmacists, we aimed to review the roles of dentists, radiologists and pharmacists in the prevention, diagnosis and management of MRONJ, and summarize their knowledge, clinical practices and interdisciplinary collaboration.

Methods: A systematic search of electronic databases identified original studies reporting MRONJ related knowledge, attitudes, clinical practice, risk factors or outcomes in dentists, radiologists, pharmacists or mixed professional groups. Eligible designs included cross sectional surveys, qualitative studies and observational cohorts. Data were extracted on study characteristics, professional groups, MRONJ focus and main findings, and synthesised in line with PRISMA guidance.

Results: Eleven studies were included: eight cross sectional surveys of dental professionals or pharmacists, one qualitative interview study of general dental practitioners and two retrospective patient cohorts from Europe, the Middle East and Asia. Dental surveys showed high awareness of MRONJ and a gaps in recognising risk factors, clinical features and guideline-based management, as well as inconsistent documentation of antiresorptive therapy and communication with physicians. Cohort data indicated that absence of comprehensive dental care before antiresorptive or antiangiogenic therapy increased MRONJ risk and systemic factors such as chemotherapy, smoking and immunosuppression amplified risk.

Conclusions: included studies support pre treatment dental clearance, systematic medical and medication history taking, and structured pharmacist dentist collaboration, and future research should integrate radiologists into coordinated MRONJ care pathways.

Keywords: Medication Related Osteonecrosis of the Jaw; Bisphosphonates; Dentists; Radiologists; Pharmacists; Interdisciplinary Care

Introduction

Medication related osteonecrosis of the jaw (MRONJ) is a serious adverse effect of antiresorptive and antiangiogenic drugs used for osteoporosis, malignancy associated bone disease and other skeletal conditions [1]. Oncology dose intravenous bisphosphonates and denosumab are associated with an incidence of osteonecrosis of the jaw (ONJ) of 1 to 15%, whereas the incidence in osteoporosis is much lower, 0.001 to 0.01% [1]. Clinical manifestations range from asymptomatic exposed bone to painful infection, fistulae and pathologic fracture, and management is difficult [1,2].

The pathophysiology of MRONJ is multifactorial, include suppression of bone turnover, local infection, angiogenesis inhibition and immune dysregulation, with dental extractions and other dento alveolar surgery as major local triggers [1,3]. A systematic review and meta analysis of 14 pharmacogenetic studies suggests that genetic polymorphisms CYP2C8 rs1934951 in multiple myeloma and VEGF rs3025039, modulate individual susceptibility to MRONJ [3]. These biological and genetic insights indicate the need for personalized risk assessment integrated in medical and dental care.

Management strategies is heterogeneous, with no accepted gold standard. A large systematic review of 97 studies reported that minimally invasive surgery, medical therapy and a wide range of adjunctive approaches, laser, hyperbaric oxygen, growth factors and ozone, have all been used, with variation in outcomes [2]. Recent work explored teriparatide as an adjunct; a meta analysis of 111 MRONJ cases found that teriparatide, when combined with antibiotics or surgery, was associated with good resolution rates [4]. Experimental animal data suggest that combining surgical resection with platelet rich fibrin and photobiomodulation optimise wound healing and bone regeneration in MRONJ lesions [5].

A systematic review with meta analysis in cancer patients showed that pre treatment dental assessment and completion of necessary dental care reduced MRONJ incidence by 77%, most primary studies had unclear risk of bias [6]. Another meta analysis focused on extractions reported MRONJ rates of 3.2% in oncology patients versus 0.15% in osteoporosis patients, and found that adjusted extraction protocols lowered risk [7]. The aim of this systematic review is to synthesise articles on the roles of dentists, radiologists and pharmacists in the prevention, diagnosis and management of MRONJ, including their knowledge, clinical practices and interdisciplinary strategies, in order to inform integrated care pathways.

Methods

Study design and reporting

This systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) statement. The review focused on original empirical studies describing prevention, early detection and management of MRONJ (MRONJ) in relation to the roles of dentists, radiologists, pharmacists and other oral health professionals.

Eligibility criteria

We included peer reviewed original studies that investigated MRONJ or bisphosphonate, antiresorptive associated osteonecrosis of the jaws in humans; reported data on knowledge, attitudes, practices, risk factors, or clinical outcomes relevant to MRONJ prevention or management; involved at least one professional group of interest (dentists, dental specialists, oral and maxillofacial surgeons, radiologists, pharmacists or mixed interdisciplinary teams); used an observational, survey, qualitative or cohort design. Narrative reviews, editorials, letters, conference abstracts without full data, animal studies and case reports were excluded. No restrictions were applied on country or healthcare setting.

Information sources and search strategy

We systematically searched electronic databases (MEDLINE, Scopus, Web of Science) from 2010 to 2025. The search combined controlled vocabulary and free text terms related to MRONJ and professional roles, using Boolean operators: MRONJ; osteonecrosis of the jaw; MRONJ; BRONJ; dentist; oral surgeon; radiologist; pharmacist; interdisciplinary; multidisciplinary. Reference lists of included articles were also screened to identify additional eligible studies.

Study selection

All records identified through the electronic database search were imported into a reference manager and duplicates were removed. Titles and abstracts were screened for the eligibility criteria, and full texts of srelevant articles were obtained and assessed for inclusion. Reasons for exclusion at the full text stage

were recorded. The study selection process summarized in a PRISMA 2020 flow diagram (Figure 1).

Data extraction and data items

We extracted the following data: first author, year of publication, country, study design, setting and professional group, sample size, and main MRONJ related focus. We also recorded key quantitative findings and main qualitative themes where applicable. Data were cross checked against the original articles for accuracy. We performed a qualitative synthesis of the findings, structured by professional group and type of outcome.

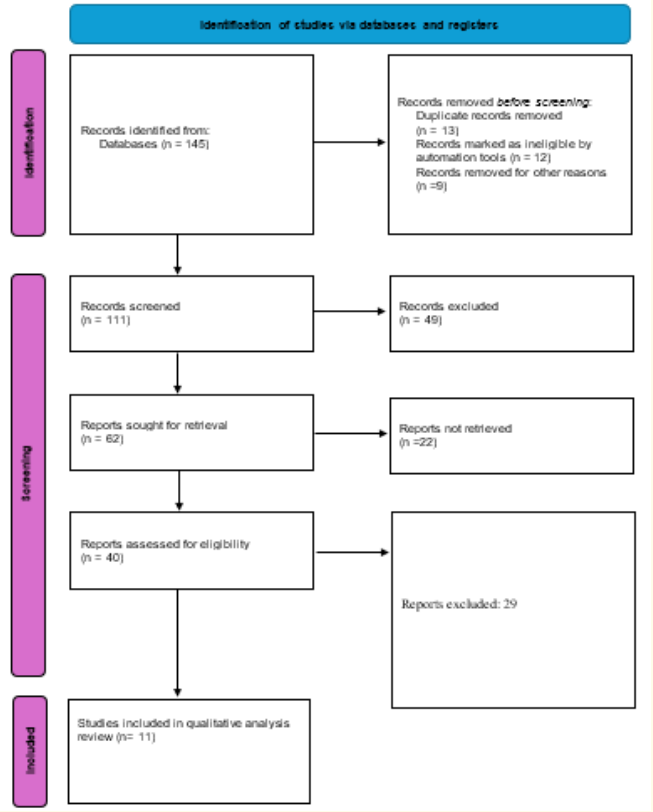

Figure 1: PRISMA consort chart.

Results

We include eleven original studies, eight cross sectional surveys of dental professionals or pharmacists, one qualitative study of general dental practitioners and two retrospective patient cohorts [8-18]. Studies were conducted in Saudi Arabia, Korea, Malaysia and Japan.

Questionnaire studies showed high awareness of MRONJ and a clear gaps in detailed knowledge. In Spain, only about half of students and two thirds of dentists reported good knowledge of bisphosphonate associated osteonecrosis, and a third in each group knew how to treat established disease [12]. In Saudi Arabia, most respondents had heard of MRONJ but fewer than half recognised risk factors and clinical features [17]. In Poland, almost all respondents recognised the term MRONJ, and only half understood bisphosphonate persistence [10]. A national Croatian survey found comparable deficits in recognising complications and risk factors, and most dentists wished to receive further education [9].

In Asturias, public dentists, private dentists and students differed significantly in their performance on MRONJ-related clinical scenarios, with students often outperforming private practitioners [11]. Korean dentists reported frequent contact with MRONJ cases, and two thirds documented bone modifying agents, and many did not request referral letters or individualise drug holidays [18]. Qualitative interviews with 15 UK GDPs found awareness of MRONJ risk and limited multidisciplinary working about shared responsibilities for prevention [16].

Three studies centred on patient cohorts and pharmacists; in one study 11 of 75 patients (14.7%) developed MRONJ, and absence of dental care before therapy was associated with increased risk (odds ratio 8.64; 95% CI 1.27 to 58.62) [13]. An a cohort of 434 patients on antiresorptive drugs identified chemotherapy, smoking and immunosuppressive drugs as significant risk factors [8]. Pharmacist recommendations for dental examinations in 790 bisphosphonate treated outpatients increased dental visits and strengthened continued care with a family dentist [14]. A hospital survey showed that 90% of pharmacists were aware of MRONJ, but oral assessments were infrequent and half reported difficulties collaborating with dentists [15]. Characteristics of the included studies and main findings were presented in tables 1 and 2.

Discussion

The findings of this review show that, in multiple countries and professional groups, awareness of MRONJ is high but knowledge,

Citation	Country	Setting	Design	Sample	Main focus
Lopez Jornet., *et al*. 2010 [12]	Spain	Dentists and final year dental students	Questionnaire survey	120 (60 students, 60 dentists)	Knowledge and attitudes on bisphosphonate associated osteonecrosis of the jaw
Escobedo., *et al*. 2018 [11]	Spain	Public dentists, private dentists, final year students	Cross sectional questionnaire	206 (32 public, 136 private dentists, 38 students)	MRONJ knowledge, attitudes and clinical decision making
Sturrock., *et al*. 2019 [16]	United Kingdom	General dental practitioners in primary care	Qualitative semi structured interviews	15 GDPs	Perceptions of MRONJ risk and multidisciplinary prevention
Al Maweri., *et al*. 2020 [17]	Saudi Arabia	General dentists and specialists	Web based cross sectional survey	607 dentists (60.7% of 1000 invited)	Knowledge and opinions on bisphosphonates and MRONJ
Han., *et al*. 2021 [18]	Korea	General dentists and specialists in an online community	Online questionnaire	1000 dentists	Awareness, record keeping and drug holiday practice for MRONJ risk
Teslak., *et al*. 2021 [10]	Poland	Dentists and senior dental students	Online questionnaire	203 respondents (dentists and students)	Awareness of MRONJ and bisphosphonate persistence
Mirelli., *et al*. 2022 [8]	Italy	Hospital dental unit, University of Milan	Retrospective cohort	434 patients on antiresorptive drugs	MRONJ incidence and systemic risk factors in dental patients
Bival., *et al*. 2023 [9]	Croatia	Doctors of dental medicine nationwide	Anonymous questionnaire	458 DDMs	National knowledge of antiresorptive therapy and MRONJ
Alblazi., *et al*. 2024 [13]	Malaysia	University hospital, oncology , osteoporosis patients	Retrospective chart review	75 patients on antiresorptive, antiangiogenic drugs	Association between comprehensive dental care and MRONJ occurrence
Watanabe., *et al*. 2025 [14]	Japan	University hospital pharmacy, bisphosphonate treated outpatients	Observational before-after study	790 outpatients taking oral bisphosphonates	Effect of pharmacist recommendation on dental visit rates and family dentist uptake
Sano., *et al*. 2025 [15]	Japan	Designated community cancer care hospital pharmacy	Web based cross sectional survey	65 pharmacists (51 responses)	Pharmacists' MRONJ awareness, practice and collaboration with dentists

Table 1: Characteristics of the included studies.

Study	MRONJ focus	Key findings	Interdisciplinary implication
Lopez Jornet., *et al*. 2010 [12]	Knowledge of BP associated osteonecrosis	Only 50% of students and 68.36% of dentists had up to date knowledge, around one third in each group knew how to manage ONJ.	Early evidence of major educational gaps in MRONJ management among both students and practising dentists.
Escobedo., *et al*. 2018 [11]	MRONJ knowledge and guideline based practice	Public and private dentists and students differed in clinical case scores, with final year students often outperforming private dentists on surgical scenarios.	Shows need for ongoing MRONJ training, particularly for experienced private dentists performing extractions and implant surgery.

Sturrock., *et al*. 2019 [16]	GDPs' perceptions of multidisciplinary prevention	GDPs recognised MRONJ risk but described limited collaboration, poor information flow and unclear shared responsibilities.	Highlights the requirement for structured communication pathways between dentists, physicians and pharmacists.
Al Maweri., *et al*. 2020 [17]	National knowledge of MRONJ in Saudi dentists	70% had heard of BRONJ, MRONJ, but less than half recognised main risk factors and clinical features, many were unsure about management.	Supports large scale continuing education and closer cooperation with medical prescribers for patients at risk.
Han., *et al*. 2021 [18]	Documentation and drug holiday decisions	29.3% of dentists had treated MRONJ, 65.0% documented bone modifying agents, 59.1% requested referral letters and 53.3% did not tailor drug holidays by drug.	Demonstrates inconsistent record keeping and shared decision making, calling for agreed protocols on MRONJ risk documentation and drug holidays.
Teslak., *et al*. 2021 [10]	Awareness of MRONJ and bisphosphonate persistence	94.6% knew the term MRONJ, but only 51.5% knew how long bisphosphonates persist, oral and maxillofacial surgeons had the highest knowledge.	Shows that detailed knowledge is concentrated among specialists and needs to be expanded to the wider dental workforce and students.
Mirelli., *et al*. 2022 [8]	Clinical risk factors in patients on antiresorptive drugs	Among 434 patients, chemotherapy, smoking and immunosuppressive drugs were confirmed as important risk factors, MRONJ was more frequent in osteoporotic patients with immunodeficiency.	Emphasises detailed medical history and coordination with oncologists and physicians when planning invasive dental treatment.
Bival., *et al*. 2023 [9]	Croatian dentists' awareness of AR, BF therapy and MRONJ	36.68% did not know MRONJ is the main complication of AR, BF therapy, over half could not identify major risk factors, 93.89% wished additional education.	Indicates large national knowledge gaps and supports structured MRONJ education programmes across dental services.
Alblazi., *et al*. 2024 [13]	Comprehensive dental care (CDC) and MRONJ occurrence	MRONJ occurred in 11, 75 patients (14.7%), lack of CDC before therapy was associated with higher MRONJ risk (odds ratio 8.64, 95% CI 1.27–58.62).	Supports integrating pre treatment dental clearance and ongoing CDC into oncology and osteoporosis pathways, with radiology central to diagnosis and follow up.
Watanabe., *et al*. 2025 [14]	Pharmacist initiated dental referrals in bisphosphonate users	Recommending dental visits to 790 outpatients increased dental visit rates from 46.2% to 67.6% and improved retention of a family dentist.	Shows that pharmacists can substantially improve linkage to dental care, contributing to earlier detection and prevention of MRONJ.
Sano., *et al*. 2025 [15]	Pharmacists' MRONJ awareness and collaboration	Response rate was 78.5% (51, 65), about 90% were aware of MRONJ, but oral assessments were infrequent and nearly half reported difficulty collaborating with dentists.	Reveals a knowledge-practice gap and the need for formal referral and communication systems between pharmacy and dental services.

Table 2: Key findings of the included studies and interdisciplinary implications.

risk documentation and interdisciplinary practice is not consistent. Surveys of dentists in Spain, Saudi Arabia, Poland and Croatia showed a deficits in recognising risk factors, clinical features and management despite frequent exposure to at risk patients [9-12,17].

Our study found that implementation of evidence based preventive strategies is far from optimal. In Malaysia, lack of comprehensive dental care before antiresorptive or antiangiogenic therapy increased MRONJ risk [13], supporting data in cancer patients where pretreatment dental interventions reduced incidence by three quarters [6]. An Italian cohort found that chemotherapy, smoking and immunosuppressive drugs were significant clinical risk factors [8]. These clinical data were in line with pharmacogenetic evidence that specific polymorphisms in CYP2C8 and VEGF modulate susceptibility to MRONJ [3], this support the need for tailored, interdisciplinary risk assessment.

A controlled before after study showed that simple pharmacist initiated recommendations increased dental attendance and continuity with a family dentist in bisphosphonate users [14], operationalising guideline calls for prevention in medical settings [1]. A parallel survey in a cancer centre found that all pharmacists knew about MRONJ, and only a minority routinely assessed oral status or contacted dentists, and many reported practical barriers to collaboration [15]. These findings are relevant given network meta analytic data which suggest that drug holidays for oral bisphosphonates not reduce MRONJ risk, and temporary discontinuation of intravenous bisphosphonates or denosumab is unlikely to confer benefit [19].

Radiology was underrepresented in primary studies despite being central to diagnosis, staging and follow up in statements [1]. Advanced imaging and image guided assessment underpin newer local and regenerative approaches, surgery combined with platelet rich fibrin and photobiomodulation, or adjunctive teriparatide protocols [2,4,5]. Future research should incorporate radiologists within interdisciplinary study designs, evaluate structured dentist, radiologist, and pharmacist care pathways, and link professional level knowledge outcomes with hard clinical outcomes such as MRONJ incidence and healing.

Conclusion

We found that awareness of medication related osteonecrosis of the jaw is high in dentists and pharmacists, important gaps persist in detailed knowledge, documentation of antiresorptive therapy and implementation of guideline based preventive strategies. Our study underscores the protective value of comprehensive pre treatment dental care and careful consideration of systemic risk factors. Future articles should evaluate structured, interdisciplinary pathways that integrate dentists, radiologists and pharmacists, and link professional practice changes to MRONJ incidence and clinical outcomes.

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