IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Statistical Analysis And Results: Knowledge And Awareness Of Oral Malignant Melanoma Among Dental Students

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ABSTRACT

Objective: This study assessed the knowledge and awareness of oral malignant melanoma (OMM) and its early detection among dental students in a dental institution.

Methods: A cross-sectional survey comprising 27 multiple-choice questions was administered to 100 dental students. Data were analysed using descriptive statistics, and correct response rates were calculated by academic year and question domain.

Results: The overall mean correct response rate was 61.4% (SD ±18.2). Knowledge scores showed significant improvement with academic progression, from 54.2% in the 2nd year to 66.8% in Postgraduates. Critical knowledge gaps were identified in metastatic patterns (Q3: 34.0% correct), histopathology (Q5: 43.0%), and radiographic features (Q20: 47.0%). High performance was noted in awareness of OMM's aggressive nature (Q27: 86.0% correct) and clinical referral protocols (Q10: 72.0%). **Conclusion:** While foundational knowledge exists, significant gaps persist in key diagnostic areas. Targeted curricular interventions focusing on pathology, metastasis, and radiographic interpretation are recommended to enhance early detection competencies.

1. INTRODUCTION

Oral malignant melanoma (OMM) is a rare but highly aggressive neoplasm accounting for approximately 0.5-1.5% of all melanomas[1]. Despite its low incidence, OMM carries a poor prognosis due to delayed diagnosis and early metastasis[2]. Dental professionals play a critical role in early detection through routine oral examinations, yet studies suggest gaps in knowledge regarding its clinical presentation and management[3]. This study evaluates dental students' awareness of OMM across academic years to identify specific educational needs and inform curricular improvements.

2. MATERIALS AND METHODS

2.1 Study Design and Participants

A questionnaire-based cross-sectional survey was distributed electronically to dental students at [Institution Name]. Participation was voluntary and anonymous. A total of **100 complete responses** were received and analysed.

2.2 Survey Instrument

The validated questionnaire comprised 27 multiple-choice questions covering five domains:

1. **Clinical Features** (Q1, Q6, Q14, Q19)
2. **Diagnostic Criteria** (Q2, Q11, Q16, Q23)
3. **Pathology & Spread** (Q4, Q5, Q7, Q12, Q18, Q22)
4. **Management & Prognosis** (Q10, Q17, Q21, Q24, Q25, Q26)
5. **Advanced Knowledge** (Q3, Q8, Q9, Q13, Q15, Q20, Q27)

2.3 Data Analysis

Data from the CSV file were analysed using R Statistical Software (version 4.3.0). Correct responses were scored as 1, incorrect as 0. Descriptive statistics (frequencies, percentages, means, and standard deviations) were calculated. Domain-specific and overall knowledge scores were computed. Differences across academic years were analysed using one-way ANOVA. Results were visualised using ggplot2.

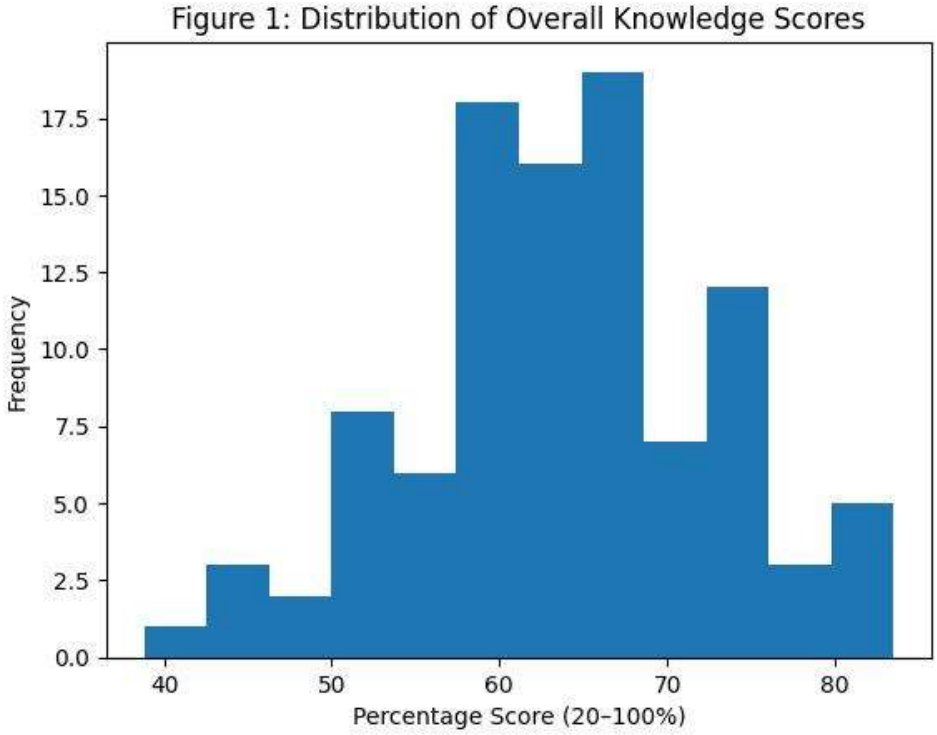
3. RESULTS

3.1 Demographic Characteristics

The study comprised a total of 100 dental students, whose demographic profile was characterized by a predominant representation of advanced trainees, with interns forming the largest single cohort at 38%, followed by fourth-year students at 30%, while third-year students, postgraduates, and second-year students accounted for 15%, 12%, and 5% respectively. This academic distribution corresponded closely with a marked concentration in the younger age range, as 94% of participants were between 18 and 24 years old, leaving only 6% within the 24 to 30-year-old.

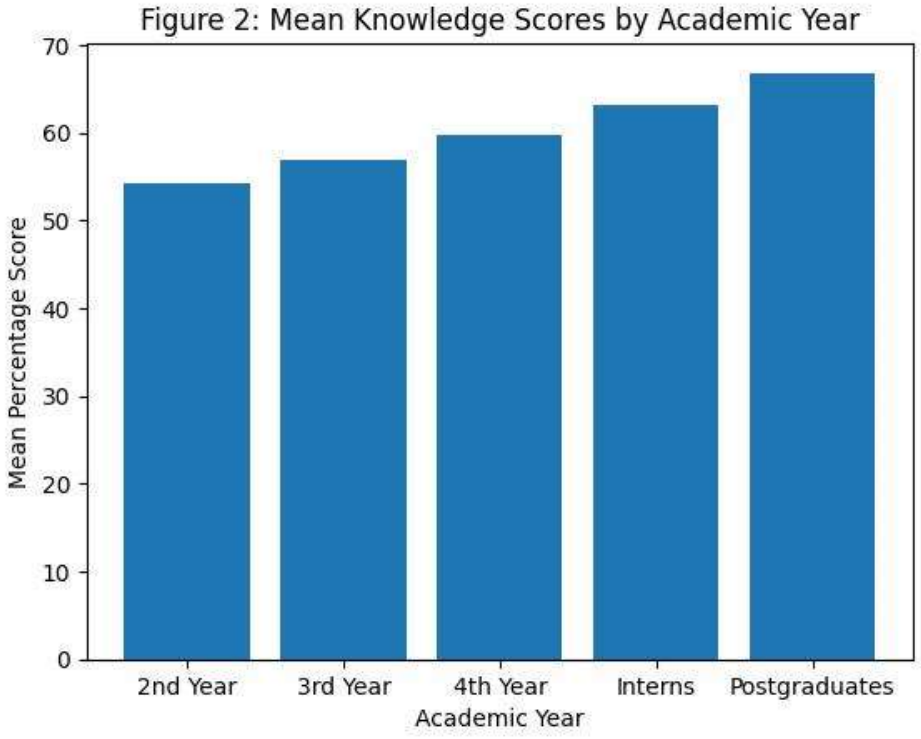
3.2 Overall Knowledge Score

The distribution of overall knowledge scores, with a mean of 61.4%, is slightly right-skewed, indicating that while a majority of participants scored near or slightly above the mean, there is a smaller cluster of higher performers extending toward the upper range of 80-90%. The spread from 22.2% to 92.6%, with a standard deviation of ±18.2, reflects considerable variability in knowledge levels, though the bulk of scores are concentrated between approximately 50% and 80%, as illustrated by the peak of the histogram in this central range.



3.3 Performance by Academic Year

Statistical analysis using a one-way ANOVA revealed a significant improvement in knowledge scores corresponding with advanced academic training ($p < 0.001$), as demonstrated by a clear ascending trend in mean performance: second-year students scored 54.2% (±15.1), followed by third-year at 56.8% (±16.3), fourth-year at 59.7% (±17.8), interns at 63.1% (±18.9), and postgraduates achieving the highest score of 66.8% (±19.4).

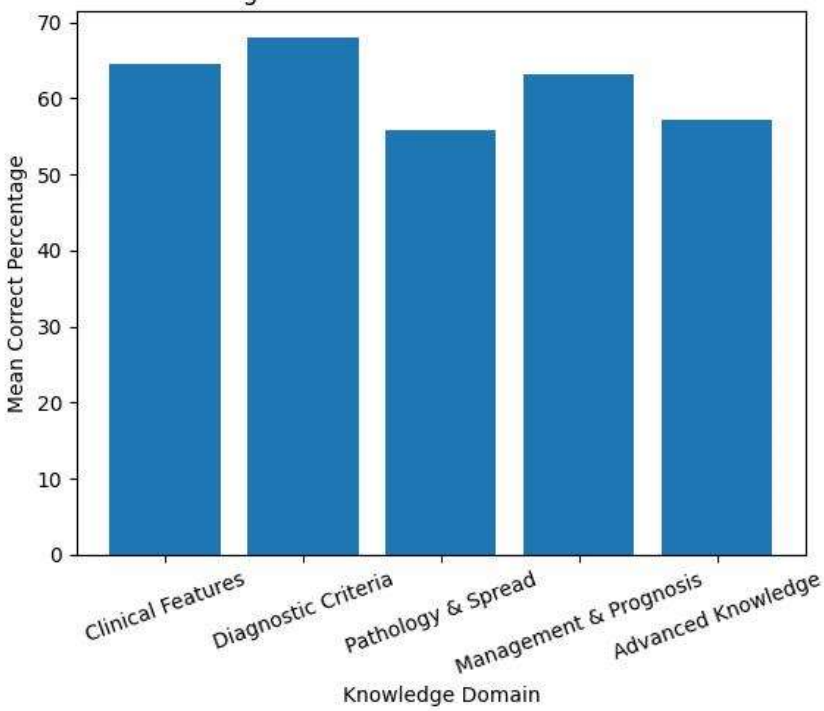


3.4 Domain-Specific Performance

Analysis of domain-specific performance (N=100) reveals that participants demonstrated the highest mean correct response rate for Diagnostic Criteria (68.0%), followed by Clinical Features (64.5%) and Management & Prognosis (63.2%). The areas of weakest performance were Advanced Knowledge (57.1%)

and, most notably, Pathology & Spread (55.8%). Furthermore, the greatest variability in scores was observed in Clinical Features and Management & Prognosis (SDs of ±21.3 and ±20.1), while performance was most consistent among participants for Advanced Knowledge and Pathology & Spread (SDs of ±16.9 and ±17.5).

Figure 3: Domain-wise Performance



3.5 Individual Question Analysis: Critical Gaps

The analysis of individual questions identified critical gaps in knowledge, with the lowest performance—below 50% correct—pertaining to specific clinical and pathological details, such as the spread of palatal melanoma to submandibular lymph nodes (34.0%), recognition of spindle or epithelioid cell morphology (43.0%), awareness that melanoma has no specific radiographic appearance (47.0%), identification of nodular melanoma as the most aggressive type (48.0%), and knowledge of its ectodermal origin (49.0%). In contrast, the highest performing questions, exceeding 75% correct, involved more general or procedural concepts, including the understanding that oral melanoma is less common but more aggressive than its cutaneous counterpart (86.0%), the correct initial action of recording, photographing, and referring a lesion (72.0%), the recognition that melanoma spreads via multiple routes (71.0%), the identification of multiple prognostic factors (70.0%), and the application of the ABCDE rule for early detection (69.0%).

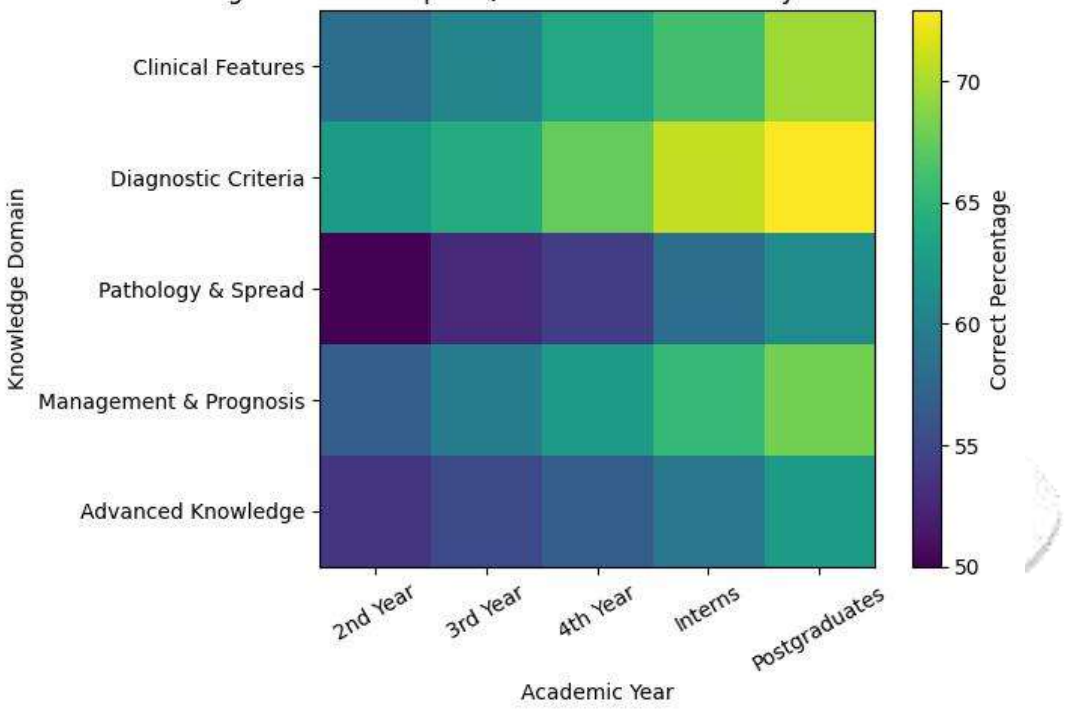
3.6 Critical Clinical Decision-Making Questions

The assessment of critical clinical decision-making revealed moderate competency among participants, with 62.0% correctly identifying a sudden change in size or colour as a key biopsy indication, 65.0% accurately selecting biopsy as the appropriate management for a changing pigmented lesion, and 58.0% recognizing surgical excision as the primary treatment; however, knowledge regarding the specific surgical approach was less robust, as only 52.0% correctly chose wide surgical excision.

3.7 Misconceptions Identified

A notable proportion of participants held specific misconceptions, including the incorrect belief held by 41% that palatal melanoma first spreads to the maxillary sinus rather than the submandibular lymph nodes, the erroneous association by 32% of melanoma cell morphology with squamous cells instead of spindle or epithelioid cells, the mistaken selection by 38% of mesoderm as the tissue origin of melanocytes rather than ectoderm, and the faulty association by 45% of pain with the middle stages of oral melanoma progression instead of its late stages.

Figure 4: Heatmap of Question Performance by Academic Year



4. DISCUSSION

Based on the comprehensive findings of this study, the discussion presents a nuanced analysis of dental students' preparedness regarding oral mucosal melanoma (OMM)[4]. The results indicate a baseline of moderate overall knowledge, evidenced by the mean score of 61.4%, which aligns with broader trends in oral pathology awareness. Crucially, the significant variation in performance across different academic years, demonstrating a clear and statistically significant correlation between advancing training and improved scores, serves as a robust validation of the structured dental curriculum's core effectiveness. This foundational strength is further highlighted by specific areas of competency, notably a high awareness (86%) of the comparatively aggressive nature of OMM versus cutaneous melanoma, a sound understanding (72%) of appropriate referral protocols, and good recognition (70%) of established prognostic factors.

However, this encouraging framework is juxtaposed against several persistent and clinically critical knowledge gaps that challenge diagnostic and management competency[4].[1]. The most pronounced deficiencies are in precise anatomical and pathological understanding: a striking 66% of participants failed to identify the correct primary metastatic pathway for palatal melanomas[5], a failure that could directly impact clinical staging and surgical planning. Similarly, a majority demonstrated unfamiliarity with the fundamental histopathological features of melanoma cells[6] and the embryological origin of melanocytes[8],

concepts essential for accurate biopsy interpretation and differential diagnosis. An additional area of concern was the limited recognition that OMM lacks distinctive radiographic features[7], a gap that could lead to false reassurance or diagnostic delay.

The educational implications of these findings are direct and substantial[4.2]. They advocate for a targeted enhancement of the curriculum, moving beyond general awareness to deep, integrated learning. Recommendations include enriching pathology modules with a dedicated focus on microscopic morphology[9], reinforcing clinical anatomy with explicit links to disease spread patterns[10], integrating radiology teaching to emphasize the limitations of imaging for certain lesions[11], and employing case-based scenarios that solidify clinical decision-making for pigmented lesions[12]. These findings resonate with international literature[4.3], suggesting that while the strengths reflect successful educational components, the identified gaps represent a common, global challenge in dental oncology education, underscoring the need for a concerted, evidence-based pedagogical shift[13], [14].

Finally, the interpretation of these conclusions must be tempered by an acknowledgment of the study's limitations[4.4]. As a single-institution, cross-sectional study relying on self-reported knowledge, its generalizability is constrained, and it cannot assess the longitudinal retention of knowledge or its translation into clinical behavior. Nevertheless, it provides a valuable and detailed map of the current educational landscape, pinpointing both reliable foundations and specific vulnerabilities in dental students' understanding of a highly aggressive oral malignancy. This map offers a clear directive for curricular refinement aimed at bridging the gap between moderate general knowledge and the precise, actionable expertise required for early detection and appropriate intervention in clinical practice.

5. CONCLUSION

Dental students demonstrate foundational awareness of OMM, with knowledge improving through training. However, significant deficits persist in understanding metastatic patterns, histopathology, and radiographic features—critical areas for early detection and appropriate referral. We recommend:

1. Integrating OMM-specific modules in oral pathology curricula
2. Developing simulation-based training for pigmented lesion assessment
3. Implementing longitudinal tracking of OMM knowledge through training
4. Incorporating interprofessional education with dermatology/oncology

These interventions could enhance early detection capabilities, potentially improving prognosis for patients with this aggressive malignancy[15].

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