



## A Survey on Knowledge Awareness about Bonwill Theory among Dental Students

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### ABSTRACT

**Background:** Bonwill's theory is a fundamental concept in prosthodontics. However, the level of knowledge and awareness among dental students regarding this theory remains unclear.

**Objective:** To assess the knowledge and awareness of Bonwill's theory among dental students.

**Methods:** A cross-sectional study was conducted among 150 dental students. A structured questionnaire was administered to assess their knowledge of Bonwill's triangle, its significance, and related concepts.

**Results:** The study revealed significant gaps in the understanding of Bonwill's theory, particularly in its clinical applications and the underlying principles. A substantial proportion of students demonstrated confusion regarding the definition, origin, and significance of the theory.

**Conclusion:** The findings emphasize the need for enhanced education and training in occlusion and prosthodontics, particularly focusing on Bonwill's theory

**Keywords:** Bonwill's Theory, Dental Students, Knowledge Assessment, Occlusion, Prosthodontics.

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### Introduction

The Bonwill Theory, introduced by Dr. Edward Bonwill in the late 19th century, is a foundational concept in prosthodontics and occlusion that focuses on the principles of mandibular movement and its relationship to the maxilla.<sup>1</sup> The Bonwill Theory highlights the concept of an equilateral triangle, measuring 100 mm (4 inches), formed by lines connecting the medial contact point of the mandibular incisors and the centers of the mandibular condyles. Based on measurements from 6,000 skulls and 4,000 living individuals, Bonwill proposed that variations in the size of this triangle significantly impact cusp angulations in complete dentures.<sup>2</sup> This principle has clinical applications in prosthetics and has influenced the construction of average articulators, as well as Monson's spherical theory. Monson extended Bonwill's observations by integrating the triangular framework into a spherical model, where the condylar path and occlusal plane form a curve within an 8-inch sphere.<sup>3</sup> The sphere's center represents the common center of mandibular motion and aligns with the apices of Bonwill's triangle.<sup>4</sup> The theory is not only crucial for prosthodontic applications but also holds anthropological significance in understanding mandibular morphology. This theory plays a crucial role in understanding the biomechanics of the jaw, which is essential for the accurate design and fabrication of dentures, as well as for achieving proper occlusal relationships in dentistry.<sup>5</sup> However, the level of knowledge and awareness regarding this theory among dental students has not been extensively studied. This survey aims to assess the knowledge and awareness of Bonwill Theory among dental students

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### Materials and Methods

This cross-sectional study aimed to evaluate the knowledge and awareness of Bonwill's theory among dental students. Conducted over a one-month period from September to October 2024, the research included data collection, statistical analysis, and report preparation. The participants comprised dental students from a private dental college. Approval for the study was obtained from the Department of Prosthodontics, Crown and Bridge, with ethical clearance granted by the Institutional Review Board. A convenience sample of 150 students was selected, and demographic details were recorded. A structured questionnaire containing 16 questions was administered via Google Forms, with informed consent obtained to maintain confidentiality and privacy. Participants were briefed on the questions to encourage accurate and thoughtful responses. Data collected through Google Forms were organized into an Excel spreadsheet and analyzed using IBM SPSS Statistics for Windows, Version 26.0 (Armonk, NY: IBM Corp.). Descriptive statistics, including frequencies and percentages, were calculated for all participant responses. Cross-tabulations were used to compare responses across different educational

levels, and Pearson's chi-square test was employed to assess statistical significance. A p-value of less than 0.05 was considered statistically significant in this study.

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## Results

A total of 150 dental students participated in this study, representing various years of study. Among the participants, 23.3% (35 students) were first-year students, while 34.7% (52 students) were second-year students, making them the largest group. Third-year and fourth-year students each accounted for 10.7% (16 students each), and 20.7% (31 students) were interns. Regarding the definition of Bonwill's triangle, a notable percentage (22%) selected "all of the above," while smaller groups identified it as a triangle based on Bonwill's theory (9.3%), a triangle formed by the contact points of mandibular central incisors and the right and left condyles (4%), or an imaginary equilateral triangle involving mandibular condyles (5.3%), with a significant p-value of 0.002 indicating variation among study groups. On the origin of the concept, 30.7% correctly attributed it to Dr. William Gibson Arlington Bonwill, while a minority chose incorrect options such as Dr. George Monsoon (1.3%) or Dr. Rupert E. Hall (0%), and the p-value here was 0.267. Regarding its prosthodontic significance, the majority (18%) acknowledged its multifaceted importance, including aiding in achieving proper occlusion, tooth arrangement on articulators, and denture design, with a p-value of 0.003. For why the mean value articulator is termed a three-point articulator, 18% identified the correct explanation involving two condylar points and the midpoint of the central incisor in orienting casts, supported by a highly significant p-value of 0.000. The theory to which the mean value articulator conforms saw 33.3% associating it with Bonwill's theory, and the p-value was 0.016. Regarding its classification under GPT, 27.3% placed it in Class 2 with a p-value of 0.010. On incisal table angulation, 16.7% chose 9-12 degrees, yielding a p-value of 0.029. For intercondylar distance, 18% selected 9-12 cm, supported by a p-value of 0.003. The condylar guidance angulation of 33 degrees was chosen by 20.7%, achieving a highly significant p-value of 0.001. On the diameter of the sphere in spherical theory, 29.3% correctly identified it as 8 inches, with a p-value of 0.024, while for conical theory angulation, 29.3% associated it with 45 degrees, with a p-value of 0.002. Regarding the points forming Bonwill's triangle, 28% accurately identified two condylar points and the midpoint of the mandibular central incisor, with a significant p-value of 0.000. On the approximate measure of Bonwill's triangle, 24.7% chose 4 inches, with a p-value of 0.046. Instruments used to measure Bonwill's triangle saw 22% selecting both scale and Vernier caliper, supported by a p-value of 0.000. Finally, on its applicability, 21.3% indicated its use in both dentulous and edentulous patients, with a significant p-value of 0.005.

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## Discussion

Our study findings align with the existing literature highlighting gaps in dental students' knowledge and awareness of Bonwill's theory of occlusion. This theory, which describes an equilateral triangle formed by specific anatomical landmarks, is fundamental in understanding occlusal relationships and serves as a cornerstone for many prosthodontic principles. However, similar to the trends identified in previous studies, our results also reveal significant variability in comprehension among respondents. For instance, the literature emphasizes the importance of Bonwill's triangle in ensuring proper occlusion and symmetrical arch form, essential for functional prosthodontics (Nikolopoulou, 2019).<sup>7</sup> However, only 22% of participants in our study correctly identified its definition as encompassing all relevant aspects, while many selected incomplete or incorrect options. This mirrors findings from Sales et al. (2021)<sup>8</sup> and Moksha & Drisya (2018)<sup>9</sup>, which underscore moderate to low scores on occlusion knowledge assessments among dental students and professionals, indicating a pervasive knowledge gap. Additionally, the literature points out that a lack of comprehensive understanding of occlusion among students can lead to improper treatment planning and execution (Sales et al., 2021).<sup>8</sup> Our study's results reinforce this, as only a minority demonstrated accurate knowledge of essential prosthodontic applications, such as the correct angulation of condylar guidance (20.7%), the intercondylar distance (18%), and the applicability of Bonwill's triangle in clinical scenarios (21.3%). These findings emphasize the need for robust and focused education on these concepts. Educational recommendations from previous studies stress integrating comprehensive occlusion training into dental curricula, with an emphasis on practical applications and case studies (Ribeiro-Dasilva et al., 2017; Moksha & Drisya, 2018).<sup>10</sup> Our study aligns with these recommendations, as the significant variation in knowledge across years of study (evidenced by p-values) suggests that the existing curriculum may not adequately reinforce these critical concepts throughout the academic journey. The comparison between our findings and the literature highlights a consistent pattern of knowledge gaps in Bonwill's theory and related occlusion concepts among dental students. Addressing these gaps through enhanced curricular focus, practical training, and regular assessments is vital to ensure students acquire the foundational knowledge needed for competent clinical practice. This systemic issue in dental education requires urgent attention to improve the quality of future dental practitioners and patient care.

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## Conclusion

In conclusion, the results illustrate that while many students have a foundational understanding of Bonwill's triangle and its applications, significant gaps exist in specific areas. The variation across study years indicates that curriculum enhancements and targeted teaching strategies are needed to ensure a thorough comprehension of these essential prosthodontic concepts. Emphasizing the practical and theoretical aspects of Bonwill's theory in educational programs could bridge these gaps, fostering a deeper understanding among future dental professionals.

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