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# Classifying Completely Edentulous Patients Using the Prosthodontic Diagnostic Index

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## Abstract

**Objective**: To use the Prosthodontic Diagnostic Index (PDI) to assess and assign fully edentulous patients to students at a dental school in Basrah, Iraq. **Material and Methods**: This study was conducted on 300 completely edentulous patients who were treated at the teaching outpatient dental prosthetic clinic of a dental school in Basra city, republic of Iraq during the years 2022, 2023, and 2024. Based on the complexity of the diagnostic results, the edentulous patients were divided into four groups (Class I–IV). Maxillomandibular relationship, muscle attachments in the mandibular arch, residual ridge morphology of the maxillary arch, and mandibular bone height were measured in panoramic radiographs. **Results**: 7.5% of patients were categorized as Class IV when using the PDI classification. Out of the various PDI criteria, 10% of the patients had Class IV mandibular bone heights of 10 mm or below, whereas 15% of the patients had Class III mandibular bone heights of 11–15 mm. Class I was assigned to 65% of the patients based on the maxillary residual ridge morphology, and 25% of the patients were categorized as Class I or II according to their Type A mandibular muscle attachment requirements. 60% of the patients had a Class I maxillomandibular relationship). **Conclusion**: Class I (severely impaired) patients made up the bulk of the study's subjects. For undergraduate students to handle fewer complex cases (Class I and II) and prosthodontists or specialist centers to handle more complex cases (Class IV), it is necessary to classify edentulous patients based on PDI during the initial screening phase. This will prevent the need for expensive and time-consuming complete denture remakes.

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## Introduction

A chronic, irreversible condition, edentulism is the ultimate result of a complex process that includes biological variables (periodontal disease, pulpal pathology, trauma, and oral cancer) as well as patient-related ones (access to care, patient choices, treatment possibilities etc.) [1,4,10]. It affects overall health, nutrition, and chewing efficiency, which lowers the quality of life associated with oral health. "The state of being edentulous or lacking natural teeth or truly patient illness " is how the glossary of prosthodontic terminology describes edentulism [1]. A more accurate description would be "the physical state of the jaw(s) following removal of all erupted teeth and the condition of the supporting structures available for reconstructive or replacement therapies," as a fully edentulous person would need some kind of therapy. Complete loss of teeth can be seen as a handicap as it impairs several essential and typical human activities, including the capacity to talk and eat, two of life's most important responsibilities [2]. Accordingly, edentulism meets the World Health Organization's (WHO) definition of physical handicap and can be difficult for people who suffer from it [3,4]. It is still and will continue to be a major worldwide health care liability [5]. Because it is a global issue, there will thus be an increasing need for full denture prosthesis in the future [5,6]. Information gathered from many diagnostic tools must be categorized based on the complexity of the patient's therapy to create an appropriate treatment plan for an edentulous patient. An appropriate method of treatment planning among prosthodontists has always been hampered by the absence of a categorization system and referral [7,8]. To address all these questions and aid in treatment planning, the American College of Prosthodontists (ACP) developed a categorization system [9]. The PDI for totally edentulism (1999), partially edentulous patients (2002), and entirely dentate individuals (2004) are among the categories that McGarry TJ et al. developed [10-12]. Based on the severity of the oral problems observed during the initial diagnostic visit, these were used to identify individuals in need of prosthetic therapy [13]. As very few studies have been conducted on implementing the PDI on an edentulous population in a dental school, this study was carried out at teaching clinic of

Basrah Dental College, Department Prosthodontic dentistry and formed a classification system to answer all these queries and help in treatment planning.

## Material and Methods

From September 2022 to September 2024, a survey was carried out at the teaching clinics of the College of Dentistry in Basrah City, Republic of Iraq. After receiving consent from the patient and the Institutional Ethical Committee (the University of Basrah's examining and diagnostic department), the study was carried out. According to earlier research [7,14], 300 fully edentulous Iraqi patients of both sexes between 45 and 70 years of age were chosen using convenient sampling selection [7,14]. The patient was given written informed permission after being fully told of the aim of the comprehensive clinical and radiological assessment.

### Case exclusions

This study excluded all patients of who were completely edentulous but had maxillofacial defects, craniofacial abnormalities, bone grafts, or oral signs of systemic diseases (such as Crohn's disease, pemphigus vulgaris, or lupus erythematosus), wanted dental implants, had retained roots, or were weak and unable to handle the treatment.

### Evaluating criteria

The patient's medical and dental history, age, sex, address, and any pertinent clinical information (intraoral and extraoral) [7] were all documented in PDI worksheet by the dentist including the intraoral and extraoral-examination, every participant in this study received additional training about the four primary PDI diagnostic criteria. The four requirements are listed below.

### Bone height-mandible

The most straightforward objective criteria for the mandibular edentulous ridge is the identification and measurement of residual bone height. Alveolar bone loss is still described by Atwood in 1971 as a "chronic progressive, irreversible, and disabling process probably of multifactorial origin." The significance of different cofactors is still unclear. To minimize variability in radiographic techniques, the measurement should be made on the radiograph at that portion of the mandible of the least vertical crystal bone level and the base of the mandibular bone. The values assigned to each of the four types listed below are averages that have results of a radiographic survey of residual bone height measurement are the same variation in the radiographic techniques and magnification of panoramic machines had been used [15]. A measurement was made and the patient was classified as follows [7] (Figure 1):

Type I: (most favorable): residual bone height measured at the mandible's minimum vertical height of 21 mm or more.
Type II: residual bone height, measured at the mandible's lowest vertical height, is 16 to 20 mm.
Type III: residual alveolar bone height, measured at the mandible's lowest vertical height, is between 11 and 15 mm.
Type IV: residual vertical bone height at the mandibular minimum vertical height of 10 mm or less.

### Residual ridge morphology-maxilla only

Since radiography cannot accurately evaluate the maxillary residual bone height, residual ridge morphology is the objective criteria for the maxilla. Following a logical sequence, the categorizations system describes how musculature and remaining ridge morphology affect a maxillary denture [7] (Figure 2), it could be classified to:

Type A (the most advantageous kind)
- A vestibular depth in the anterior labial and posterior buccal regions that prevents the denture base from moving vertically or horizontally.
- The denture base cannot shift vertically or horizontally due to the palatal anatomy.
- Adequate definition of tuberosity to prevent denture base movement in both vertical and horizontal directions.
- The denture base's posterior extension is established by a well-defined hamular notch.
- No exostoses or tori are present [8].

Type B
- The posterior buccal vestibule is lost.
- The denture base cannot move vertically or horizontally due to the anatomy of the palate.
- The posterior extension of the denture base cannot be clearly recognized because to the poorly defined tuberosity and hamular notch.
- The denture base's elongation. Lateral exostoses and/or maxillary palatal tori are rounded and do not interfere with denture stability [9].

Type C
- The anterior labial vestibule is lost.
- The shape of the palate vault provides little resistance to the denture base's vertical and horizontal mobility.
- Lateral exostoses with bony undercuts and/or maxillary palatal tori that do not impact the denture base's posterior extension.
- A hyperplastic, movable anterior ridge provides the denture foundation with the least amount of rigidity and support.
- During mandibular opening, the coronoid process reduces the post-malar space [10].

Type D
- Loss of the vestibules in the anterior labial and posterior buccal regions.
- The denture base can shift both vertically and horizontally according to the anatomy of the palate.
- Lateral exostoses (rounded or undercut) and/or maxillary palatal tori that obstruct the denture's posterior border.
- A redundant, hyperplastic anterior ridge.
- A noticeable frontal nasal spine [11].

### Muscle attachments (only mandible)

The most crucial factors affecting a mandibular denture's functionality are its position and the impact of muscle attachment. It is challenging to measure these traits. The categorizations system describes how muscle input affects a mandibular denture in a rational manner. After examining the patient, the doctor chooses the category that best describes the mandibular muscle attachments. [12], it could be classified to:

Type A (most advantageous)
- All areas have an attached mucosal basis free from excessive muscle impingement during normal operation.

Type B
- From canine to canine, the mucosal base is attached in every area save the labial.
- Attachment of the mentalis muscle close to the alveolar vestibule ridge crest.

Type C
- All areas save the anterior buccal and lingual vestibules—canine to canine—have an attached mucosal base.
- Attachments of the genioglossus and mentalis muscles close to the alveolar ridge crest [12].

Type D
- Only the posterior lingual area has an attached mucosal base.
- In every other area, the mucosal base is separated.

Type E
- No mucosa is connected in any area [13].

### Maxillomandibular relationship

The classification of the maxillomandibular relationship characterizes the position of the artificial teeth in relation to the residual ridge and/or to opposing dentition. Examine the patient and assign a class as follows [14] (Figure 3):

Class 1 (most favorable)

Maxillomandibular relation allows tooth position that has normal articulation with the teeth supported by the residual ridge.

Class II
Maxillomandibular relation requires tooth position outside the normal ridge relation to attain esthetics, phonetics, and articulation (e.g., anterior or posterior tooth position is not supported by the residual ridge; anterior vertical and/or horizontal overlap exceeds the principles of fully balanced articulation) [15].

Class III
Maxillomandibular relation requires tooth position outside the normal ridge relation to attain esthetics, phonetics, and articulation (i.e. cross bite-anterior or posterior tooth position is not supported by the residual ridge). [16].

## Results

The study found that, of the 122 patients, (40.6%) were between the ages of 51 and 60 years old, and 57% were male. The first PDI criterion, mandibular bone height, is displayed in Table 1. 180 (60%) of the patients showed Class I symptoms, 45 (15%) showed ClassII, and III symptoms, 30 (10%) showed Class IV symptoms.

The result of the study appeared significant changes in relation to the maxillary residual ridge's morphology, it was displayed in Table2. 195 patients (65%) were categorized as type A, whereas the majority of 45 patients (15%) were categorized as type B, 60 patients (20%) belonged to type C, while zero belonged to type D. The result of the study appeared significant changes in relation to the maxillary Residual ridge morphology.

The mandibular arch's muscle attachment is displayed in Table3. There were 75 type A patients (25%) with enough connected mucosa, 135 patients (45%) Type B (no attached buccal mucosa), 45 patients (15%) Type C, and 15 patients (5%) Type D. 30 patients were Type E (10%).

The maxillomandibular connection is displayed in Table 4. 180 patients (60%) were Class I, 90 patients (30%) were Class II, and 30 patients (10%) were Class III.

The PDI's general categorizations showed that 7.5% of the patients belonged to Class IV, 21.25% of the patient belonged to Class III, 26.25% of the patient belonged to Class II, and 45% of the patients were Class I. According to the results, 28.75% of the patients were sent to specialist centers or assigned to expert prosthodontists and 71.25% were treated by fifth-year students at the dental school.

## Discussion

The study's dentistry school is situated in a low-income person at large city, which is also home to many entirely edentulous expatriate groups with low socioeconomic backgrounds and neglected oral health [17,18]. As a result, there are many different nations with a wide variety of intricate clinical situations of edentulism depending on the anatomy of each person and altered by a few other variables such systemic illness, psychological issues, and the requirement for full dentures [19]. As a result, undergraduate students have access to a sizable patient base for full denture training; these numbers are comparable to those documented in other nations [20,21]. The American College of Prosthodontists (ACP) developed PDI, which is beneficial to prosthodontists who are required to diagnose and arrange treatments for every patient. When it comes to treating edentulous individuals, there are several benefits to using a structured categorizations system like PDI [7,22]. The primary benefit of employing PDI is the screening that can be done in a dental school, which yields an accurate patient classification that can be used to assign patients to students for treatment or to refer patients to a specialist based on the case's complexity [7,23]. According to the study's authors, most patients had mandibular bone heights in Class I (60%) as determined by OPG; however, Shaik S et al. reported that most patients were in Class I (39.4%) [24], while Ntala PC et al. demonstrated that most patients were in Class IV (42.7%) [7.25]. The remaining three parameters such as maxillary residual ridge morphology, mandibular muscle attachments, and maxillomandibular relationships have not been compared in any research. Most of the patients in our study (28.75) of the patients were classified as complex (Class III and IV). This is comparable to research by Ntala PC et al. in Greece, where they found that (56.4%) of the patient were referred to specialist dentist [7,26], Mazurat RD and Mazurat NM in Canada, who found that (64.5%) of the patient considered as difficult cases [27], and Elfadil S et al. in Ireland, who found that (69%) of the patient must be referred [28]. The majority in Pakistan's Class I and II categories (57%) were only reported by Chaudary MAU et al. [27]. The authors discovered that the most common factor determining the complexity of the cases was mandibular ridge height, which is comparable to the study by Ntala PC et al., [7]. Mazurat RD and Mazurat NM reported that the most common factors for classifying the cases as the complex were the ridge height and muscle attachments in the mandibular arch [28]. Students in college of dentistry university of basrah at their fifth year were assigned to PDI Class I patients. Since PDI Class I and classII patients were the most numerous, prosthodontists treated these Classes patients while teaching assistants under the supervision of prosthodontic staff. Since postgraduate students were not present, some patients were referred to specialist centers. Chaudary MAU et al., who assigned undergraduate students to Class I, are comparable to our study. Class IV was handled by professionals, whereas Class II and Class III were given to postgraduate students [27]. However, most of the complicated Class III and IV cases might be handled by undergraduate students under the close supervision of professionals, according to Ntala PC et al., Mazurat RD, and Mazurat NM [7,28]. As a result, outpatient screening clinics must employ PDI early on. The proper distribution of patients, especially those with a poor prognosis, will be made possible by the gathering of all data (radiographic, clinical, physical, and medical) and categorizations based on PDI [27]. Class III cases can be addressed by postgraduate students under the guidance of staff members or specialized clinics/units; however, prosthodontists often handle complicated cases like Class IV [28].

## Conclusions

Most of the edentulous patients screened in the dental school using the PDI were categorized as Class I, which is a most common category, the treatment had to be provided by the assistance of specialists. Thus, the PDI classification system can help to identify patients who are most likely to require treatment by referred to a specialist. PDI provides a basis from which an accurate diagnosis can be obtained along with proper treatment planning. For easy and suitable networks between dental professionals, PDI has certain terminologies that help in establishing a proper channel of communication. These standardized indices can be useful for dental professionals during their private practice, as they allow better communication between specialists and dentists. The authors have successfully implemented the PDI system at Basrah dental School and are still able to screen, assign, treat, and refer totally edentulous patients depending on their complexity.

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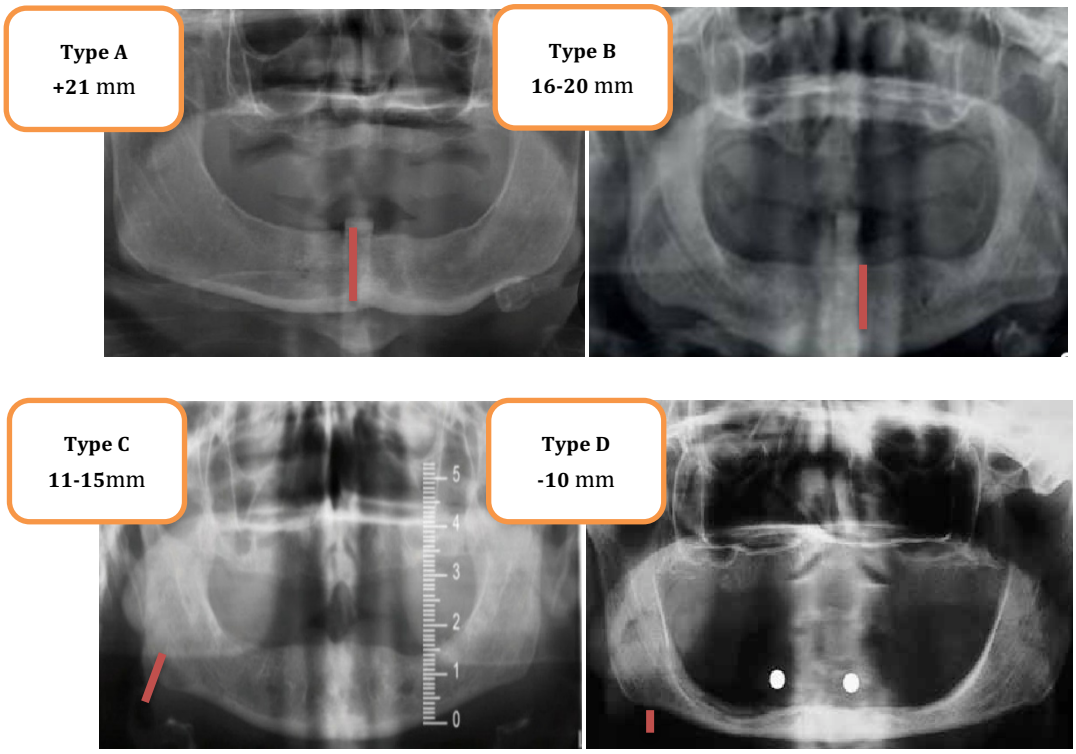


Figure 1. Mandibular residual ridge bone height.

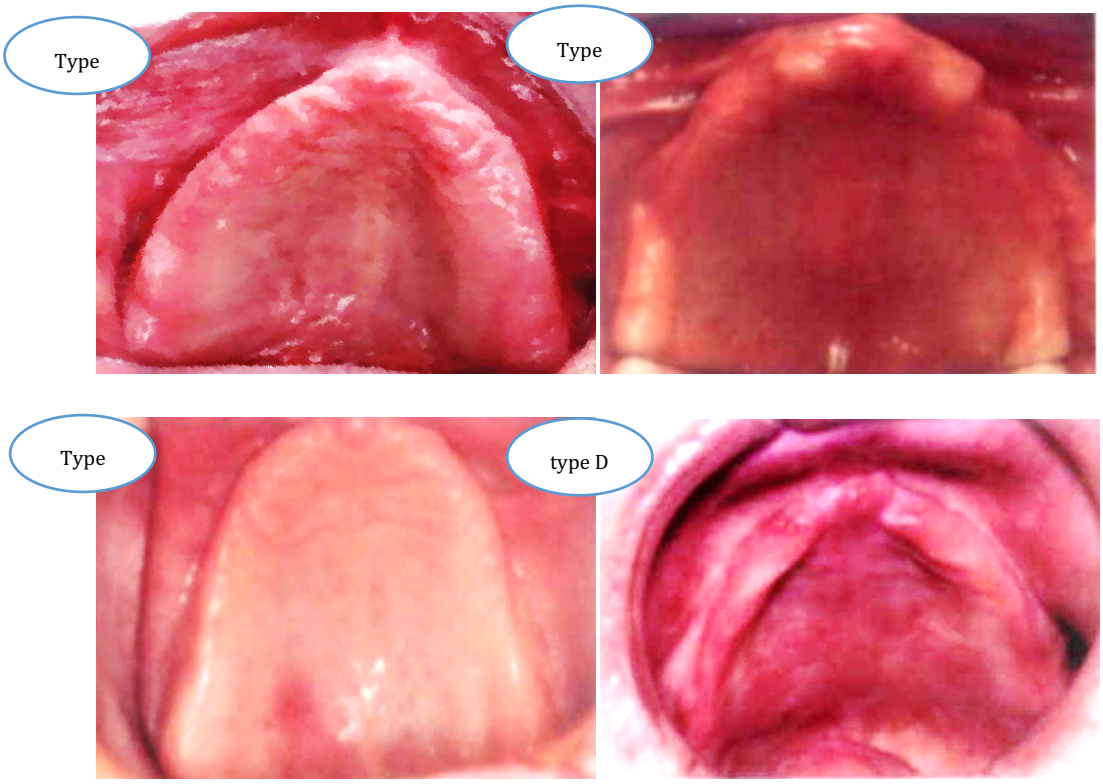


Figure 2. Maxillary residual ridge morphology.

Table 1. Mandibular residual ridge bone height.

| Total patient number 300 | | |
|---|---|---|
| Mandibular RRH | Bone height-mandible | Number patients |
| Type I | 60% | 180 |
| Type II | 15% | 45 |
| Type III | 15% | 45 |
| Type IV | 10% | 30 |

Table 2. Residual ridge morphology-maxilla only.

| Total patient number 300 | | |
|---|---|---|
| RR morphology | Residual ridge morphology-maxilla only | Number patients |
| Type A | 65% | 195 |
| Type B | 15% | 45 |
| Type C | 20% | 60 |
| Type D | 0% | |

Table 3. Mandibular arch's muscle attachment.

| Total patient number 300 | | |
|---|---|---|
| M attachment | Muscle Attachments:(only mandible) | Number patients |
| Type A | 25% | 75 |
| Type B | 45% | 135 |
| Type C | 15% | 45 |
| Type D | 5% | 15 |
| Type E | 10% | 30 |

Table 4. Maxillary mandibular relationship.

| Total patient number 300 | | |
|---|---|---|
| Skeletal class. | Maxillomandibular Relationship | Number patients |
| Class I | 60% | 180 |
| Class II | 30% | 90 |
| Class III | 10% | 30 |