TOPICS OF INTEREST

Classification System for Complete Edentulism

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The American College of Prosthodontists has developed a classification system for complete edentulism based on diagnostic findings. These guidelines may help practitioners determine appropriate treatments for their patients. Four categories are defined, ranging from Class I to Class IV, with Class I representing an uncomplicated clinical situation and a Class IV patient representing the most complex and higher-risk situation. Each class is differentiated by specific diagnostic criteria. This system is designed for use by dental professionals who are involved in the diagnosis of patients requiring treatment for complete edentulism. Potential benefits of the system include: 1) better patient care, 2) improved professional communication, 3) more appropriate insurance reimbursement, 4) a better screening tool to assist dental school admission clinics, and 5) standardized criteria for outcomes assessment.

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COMPLETELY EDENTULOUS PATIENTS exhibit a broad range of physical variations and health concerns. Classifying all edentulous patients as a single diagnostic group is insensitive to the multiple levels of physical variation and the differing treatment procedures required to restore function and comfort. A graduated classification of complete edentulism has been developed that describes varying levels of loss of denture-supporting structures.

This article defines complete edentulism as follows: 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. The condition of edentulism, for the purpose of this article, is divided into four levels according to specific diagnostic criteria.

The absence of organized diagnostic criteria for complete edentulism has been a long-standing impediment to effective care for patients. Recognition of the diverse nature, scope, and degree of complete edentulism, although thoroughly described in the dental literature, has not been organized to efficiently guide dental educators, general dentists, prosthodontists, and third-party payers in providing the appropriate treatment for each patient. A system for facilitating patient identification is needed to improve patient treatment outcomes.

The American College of Prosthodontists (ACP) recognized its responsibility to the public and the profession to correct this dilemma. The Subcommittee on Prosthodontic Classification was formed in 1995 and charged with developing classification systems for prosthodontic patients. Timely implementation of this system will benefit patients, clinicians, and educators. The classification system for complete edentulism is presented in the following sections.

Development of the Classification System

A classification system has been successfully used to assess periodontal status for more than 20 years.[1] Recently, the American Association of Endodontists devised an evaluation system for determining endodontic risk factors.[2] These factors serve as guidelines to determine when patients with advanced treatment needs should be referred for consultation with a specialist. The classification system for complete edentulism will establish separate diagnostic entities for four levels of edentulism, ranked according to degree of difficulty of treatment.

A review of the prosthodontic literature was used to identify the many variables associated with complete edentulism. A questionnaire was then constructed to categorize the 89 variables identified. The questionnaire that was circulated within the subcommittee asked for comments and literature citations to support inclusion of a variable into a diagnostic system. The data collected via this questionnaire were formatted into a new survey instrument that differentiated variables into four subclasses:

1. Physical findings;

2. Prosthetic history;

3. Pharmaceutical history;

4. Systemic disease evaluation.

The variables in these four subclasses of variables were further evaluated to determine their importance in relation to:

● Educational requirement: What additional clinical skill or knowledge is necessary to manage this variable?

● Clinical responsibility: Is this variable most significant to the patient, practitioner, or the dental laboratory technician?

● Clinical technique modification: Will this variable require a change in conventional five-step technique, and could this variable have a significant effect on patient satisfaction?

● Clinical and laboratory time requirement: Will this variable require additional time by the practitioner, clinical staff, and/or the dental laboratory technician?

● Overall clinical significance: Will this variable require advanced education to manage?

The subcommittee established a ranking of individual variables. Subsequently, a classification system was developed based on the most objective variables. The survey was sent to a cross-sectional sample of 10% of the ACP fellows and members and to representatives of prosthodontic organizations. A five-step scoring grid was included that asked if the classification would be one of the following: very helpful, helpful, not helpful and had minor flaws, or had major flaws. Of the 250 drafts sent out, 56 were returned. When the results were tallied, 73.4% of responses expressed the view that the classification would be very helpful or helpful. Nine percent said the system would not be helpful. Minor flaws were identified by 15.6% of the respondents, and 1.7% stated that the system had major flaws; however, no consistent flaws were identified in the comments. The additional information gained from this survey and initial draft comments was incorporated into a definitive document.

System Applications

This system, when combined with the appropriate Parameter of Care,[3] will establish a basis for diagnosis and treatment procedures. In addition, patients will be provided with treatment justifications for third-party payers to ensure that the patient is able to receive appropriate prosthodontic care, should referral to a specialist be necessary.

The classification system will be of value to dental faculty responsible for screening new edentulous patients. Dental educators will need to determine which classes of complete edentulism can be treated within their predoctoral clinical program.[4] Patients diagnosed at more advanced levels should be referred to graduate prosthodontics programs or to a practicing prosthodontist.

Data gathered and organized using this system will enable the dental educator, general dentist, or prosthodontist to review clinical outcomes on evidence-based diagnostic criteria. By identifying the advanced patient before treatment and making the appropriate referral, when indicated, the incidence of retreatment should decrease.

The classification system will be subject to monitoring and revision as new diagnostic and treatment information becomes available in the literature. The experiences gained in its application in practice will enable the provider to determine which treatment

Table 1. Checklist for Classification of Complete Edentulism

			Class I	Class II	Class III	Class IV
Bone Height-Mandibular						
	21 mm or greater					
	16-20 mm					
	11-15 mm					
	10 mm or less					
Residual Ridge Morphology-Maxilla						
	Type A -	resists vertical & horizonal, hamular notch, no tori				
	Type B -	no buccal vest., poor hamular notch, no tori				
	Type C -	no ant vest, min support, mobile ant. ridge				
	Type D -	no ant/post vest, tori, redundant tissue				
Muscle Attachments-Mandibular						
	Type A -	adequate attached mucosa				
	Type B -	no b attach mucosa (22-27), +mentalis m				
	Type C -	no ant b&l vest (22-27), +genio & mentalis m				
	Type D -	att mucosa only in post				
	Type E -	no att mucosa,cheek/lip moves tongue				
Maxillomandibular Relationships						
	Class I					
	Class II					
	Class III					
Conditions requiring Preprosthetic Surgery						
	Minor soft tissue procedures					
	Minor hard tissue procedures					
	Implants - simple					
	Implants with bone graft - complex					
	Correction of dentofacial deformities					
	Hard tissue augmentation					
	Major soft tissue revisions					
Limited Interarch Space						
	18-20 mm					
	Surgical correction needed					
Tongue Anatomy						
	Large (occludes interdental space)					
	Hyperactive - with retracted position					
Modifiers						
	Oral manifestations of systemic disease					
		mild				
		moderate				
		severe				
	Psychosocial					
		moderate				
		major				
	TMD symptoms					
	Hx of paresthesia or dysesthesia					
	Maxillofacial defects					
	Ataxia					
	Refractory Patient					

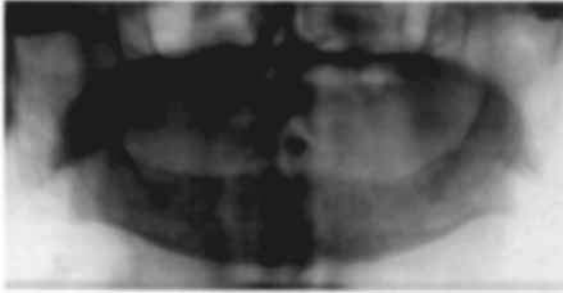**Figure 1.** Radiograph with residual bone height of 21 mm or greater measured at the least vertical height of the mandible (Type I).

Figure 3. Radiograph with residual bone height of 11 to 15 mm measured at the least vertical height of the mandible (Type III).

procedures would be most appropriate for a patient with a specific diagnosis.

With the premise that complete edentulism has differing degrees of severity, the committee sought to identify and group the most significant diagnostic criteria. The following criteria should help in applying the guidelines in a consistent manner.

A Systematic Review of Diagnostic Criteria for the Edentulous Patient

The diagnostic criteria are organized by their objective nature and not in their rank of significance. Because of variations in adaptive responses, certain criteria are more significant than others.[5] However, objective criteria will allow for the most accurate application of the classification system and measurement of its efficacy. Objectivity also will provide reliable outcome data and mechanisms for review by third-party payers and peer-review panels. The diagnostic criteria used in the classification system are listed in the worksheet (Table 1).
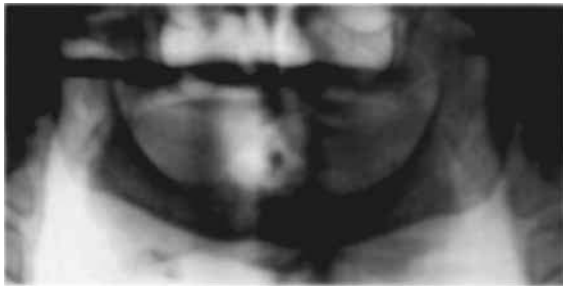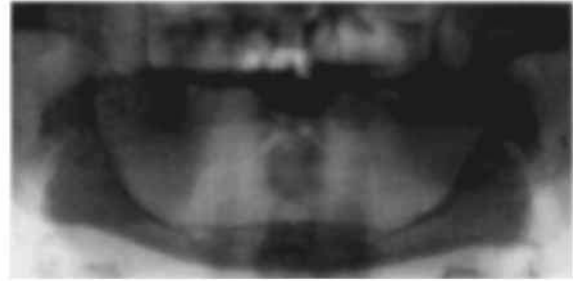
Bone Height: Mandible Only

The identification and measurement of residual bone height is the most easily quantified objective criterion for the mandibular edentulous ridge.[6-9] In addition, it represents a measurement of the chronic debilitation associated with complete edentulism in the mandible. Despite the lack of a known etiology, it has been established that the loss of denture-supporting structures does occur.[6,8] Atwood's description in 1971 of alveolar bone loss is still applicable today: "Chronic progressive, irreversible and disabling process probably of multifactoral origin. At the present time, the importance of various cofactors is unknown." The continued decrease in bone volume affects: 1) denture-bearing area; 2) tissues remaining for reconstruction; 3) facial muscle support/attachment; 4) total facial height[9]; and 5) ridge morphology.

The results of a radiographic survey of residual bone height measurement are affected by the variation in the radiographic techniques and magnification of panoramic machines of different manufacturers. To minimize variability in radiographic techniques, the measurement should be made on the radiograph at that portion of the mandible of the *least*
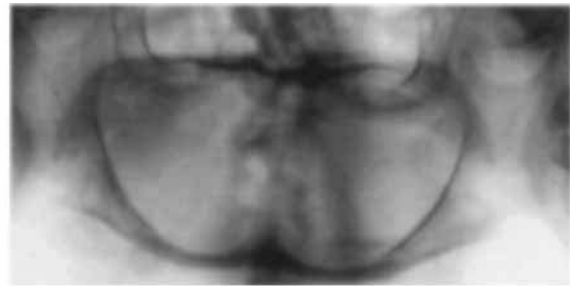

Figure 2. Radiograph with residual bone height of 16 to 20 mm measured at the least vertical height of the mandible (Type II).

Figure 4. Radiograph with residual bone height of 10 mm or less measured at the least vertical height of the mandible (Type IV).

Figure 5. Type A maxillary residual ridge.

vertical height. The values assigned to each of the four types listed below are averages that historically have been used in relation to preprosthetic surgical procedures. A measurement is made and the patient is classified as follows:

- Type I (most favorable): residual bone height of 21 mm or greater measured at the least vertical height of the mandible (Fig 1);
- Type II: residual bone height of 16 to 20 mm measured at the least vertical height of the mandible (Fig 2);
- Type III: residual alveolar bone height of 11 to 15 mm measured at the least vertical height of the mandible (Fig 3);
- Type IV: residual vertical bone height of 10 mm or less measured at the least vertical height of the mandible (Fig 4).

Residual Ridge Morphology: Maxilla Only

Residual ridge *morphology* is the most objective criterion for the *maxilla*, because measurement of the

Figure 6. Type B maxillary residual ridge.

Figure 7. Type C maxillary residual ridge.

maxillary residual bone *height* by radiography is not reliable.[11] The classification system continues on a logical progression, describing the effects of residual ridge morphology and the influence of musculature on a maxillary denture.[12]

Type A (most favorable) (Fig 5)

- Anterior labial and posterior buccal vestibular depth that resists vertical and horizontal movement of the denture base.
- Palatal morphology resists vertical and horizontal movement of the denture base.
- Sufficient tuberosity definition to resist vertical and horizontal movement of the denture base.
- Hamular notch is well defined to establish the posterior extension of the denture base.
- Absence of tori or exostoses.

Type B (Fig 6)

- Loss of posterior buccal vestibule.
- Palatal vault morphology resists vertical and horizontal movement of the denture base.
- Tuberosity and hamular notch are poorly defined, compromising delineation of the posterior extension of the denture base.

Figure 8. Type D maxillary residual ridge.

● Maxillary palatal tori and/or lateral exostoses are rounded and do not affect the posterior extension of the denture base.

Type C (Fig 7)

● Loss of anterior labial vestibule.
● Palatal vault morphology offers minimal resistance to vertical and horizontal movement of the denture base.
● Maxillary palatal tori and/or lateral exostoses with bony undercuts that do not affect the posterior extension of the denture base.
● Hyperplastic, mobile anterior ridge offers minimum support and stability of the denture base.[13,14]
● Reduction of the post malar space by the coronoid process during mandibular opening and/or excursive movements.

Type D (Fig 8)

● Loss of anterior labial and posterior buccal vestibules.
● Palatal vault morphology does not resist vertical or horizontal movement of the denture base.
● Maxillary palatal tori and/or lateral exostoses[15] (rounded or undercut) that interfere with the posterior border of the denture.
● Hyperplastic, redundant anterior ridge.
● Prominent anterior nasal spine.

Muscle Attachments: Mandible Only

The effects of muscle attachment and location are most important to the function of a mandibular denture.[9,16-18] These characteristics are difficult to quantify. The classification system follows a logical

Figure 10. Type B mandibular muscle attachments. Loss of anterior labial vestibule.

progression to describe the effects of muscular influence on a mandibular denture. The clinician examines the patient and selects the category that is most descriptive of the mandibular muscle attachments.

Type A (most favorable) (Fig 9)

● Attached mucosal base without undue muscular impingement during normal function in all regions.

Type B (Fig 10)

● Attached mucosal base in all regions except labial vestibule.
● Mentalis muscle attachment near crest of alveolar ridge.

Type C (Fig 11)

● Attached mucosal base in all regions except anterior buccal and lingual vestibules—canine to canine.

Figure 9. Type A mandibular muscle attachments. All vestibules are adequate.

Figure 11. Type C mandibular muscle attachments. Loss of anterior labial and lingual vestibules.
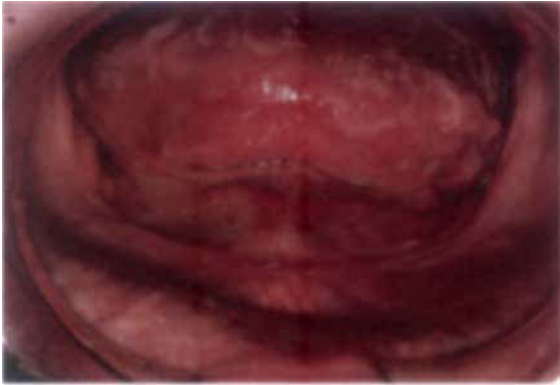
Figure 12. Type D mandibular muscle attachments. Only the posterior lingual vestibule remains.

Figure 13. Type E mandibular muscle attachments. No discernible vestibular anatomy remains.

- Genioglossus and mentalis muscle attachments near crest of alveolar ridge.[15]

Type D (Fig 12)

- Attached mucosal base only in the posterior lingual region.
- Mucosal base in all other regions is detached.

Type E (Fig 13)

- No attached mucosa in any region.

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:

- Class I (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 (eg, 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).
- Class III: Maxillomandibular relation requires tooth position outside the normal ridge relation to attain esthetics, phonetics, and articulation (ie crossbite—anterior or posterior tooth position is not supported by the residual ridge).

Integration of Diagnostic Findings

The previous four subclassifications are important determinants in the overall diagnostic classification of complete edentulism. In addition, variables that can be expected to contribute to increased treatment difficulty are distributed across all classifications according to their significance.

Classification System for Complete Edentulism

Class I (Fig 14 A-H)

This classification level characterizes the stage of edentulism that is most apt to be successfully treated with complete dentures using conventional prosthodontic techniques.[6] All four of the diagnostic criteria are favorable.

- Residual bone height of 21 mm or greater measured at the least vertical height of the mandible on a panoramic radiograph.
- Residual ridge morphology resists horizontal and vertical movement of the denture base; Type A maxilla.
- Location of muscle attachments that are conducive to denture base stability and retention; Type A or B mandible.
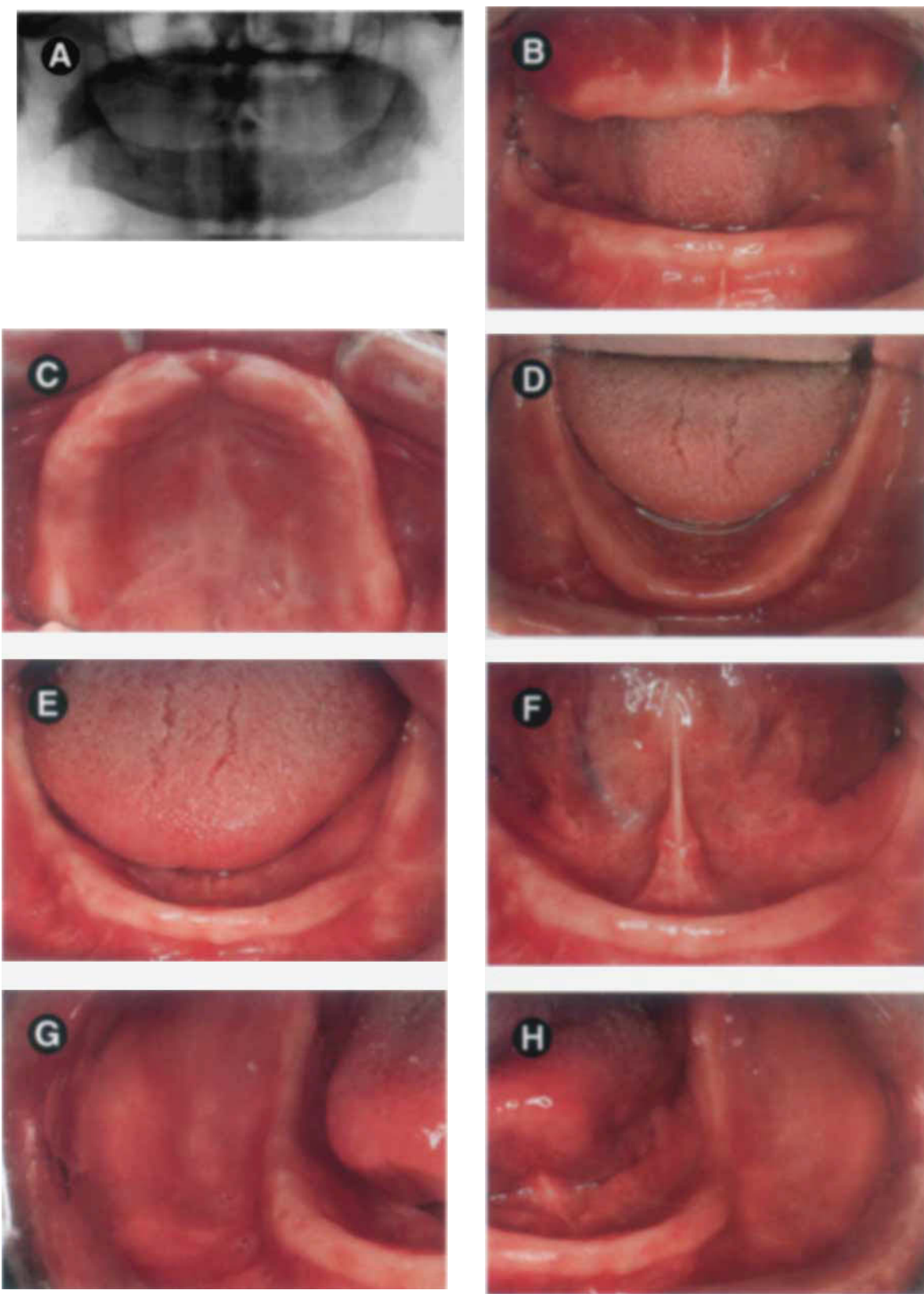- Class I maxillomandibular relationship.

Figure 14. Class I patient. (*A*) Panoramic radiograph. (*B*) Facial view at the approximate occlusal vertical dimension. (*C*) Occlusal view: maxillary arch. (*D*) Occlusal view: mandibular arch. (*E*) Facial view: tongue in resting position. (*F*) Facial view: tongue elevated. (*G*) Lateral view of mandible: patient right. (*H*) Lateral view of mandible: patient left.

Figure 15. Class II patient. (*A*) Panoramic radiograph. (*B*) Facial view at the approximate occlusal vertical dimension. (*C*) Occlusal view: maxillary arch. (*D*) Occlusal view: mandibular arch. (*E*) Facial view: tongue in resting position. (*F*) Facial view: tongue elevated. (*G*) Lateral view of mandible: patient right. (*H*) Lateral view of mandible: patient left.
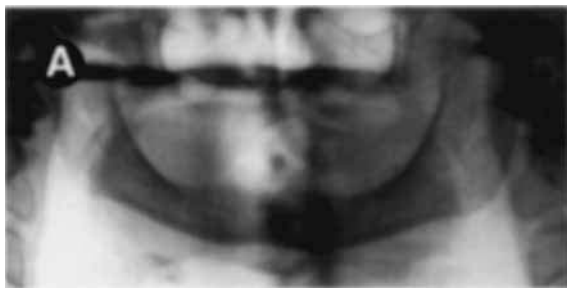
Figure 16. Class III patient. (*A*) Panoramic radiograph. (*B*) Facial view at the approximate occlusal vertical dimension. (*C*) Occlusal view: maxillary arch. (*D*) Occlusal view: mandibular arch. (*E*) Facial view: tongue in resting position. (*F*) Facial view: tongue elevated. (*G*) Lateral view of mandible: patient right. (*H*) Lateral view of mandible: patient left.
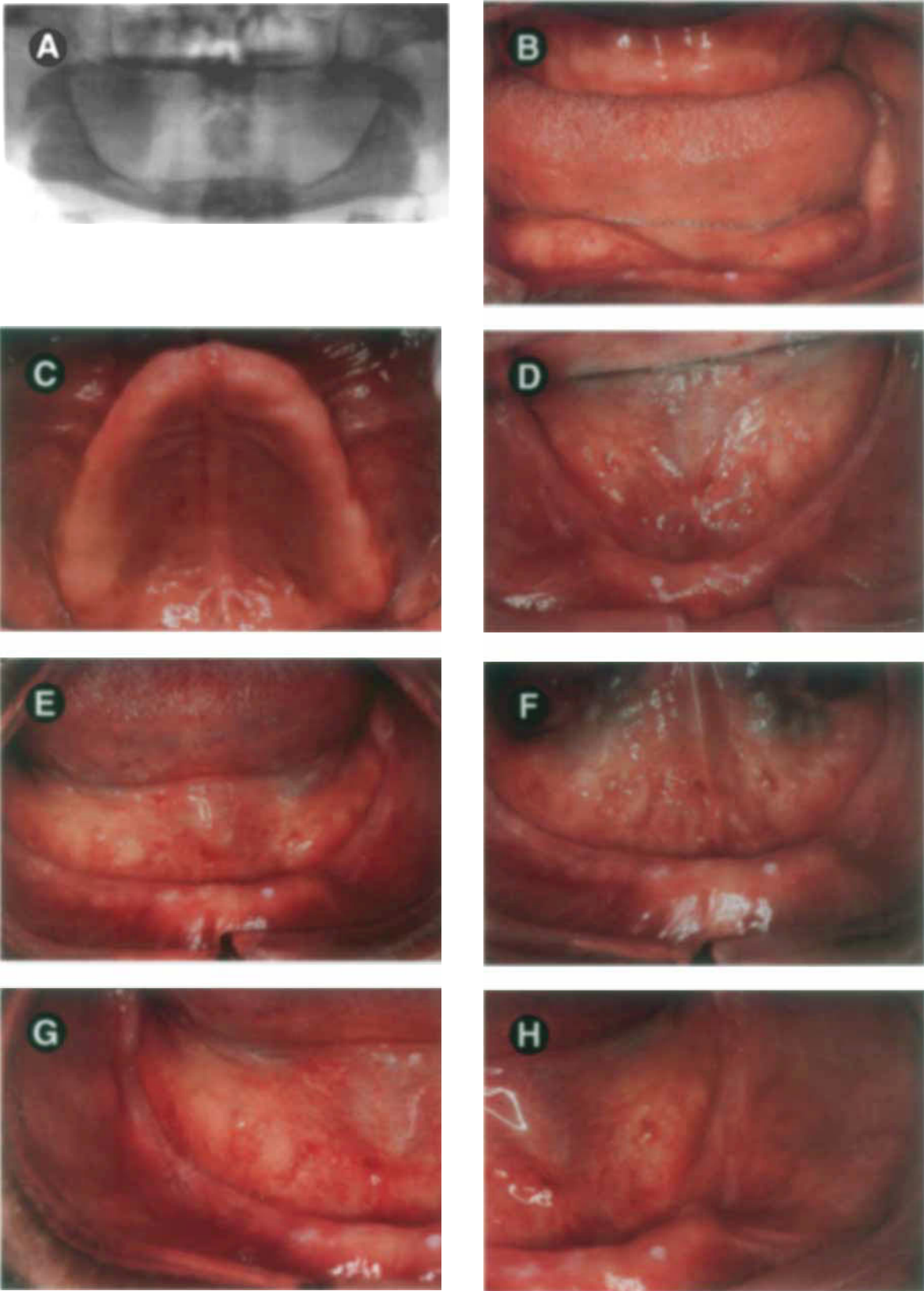
Figure 17. Class IV patient. (*A*) Panoramic radiograph. (*B*) Facial view at the approximate occlusal vertical dimension. (*C*) Occlusal view: maxillary arch. (*D*) Occlusal view: mandibular arch. (*E*) Facial view: tongue in resting position. (*F*) Facial view: tongue elevated. (*G*) Lateral view of mandible: patient right. (*H*) Lateral view of mandible: patient left.
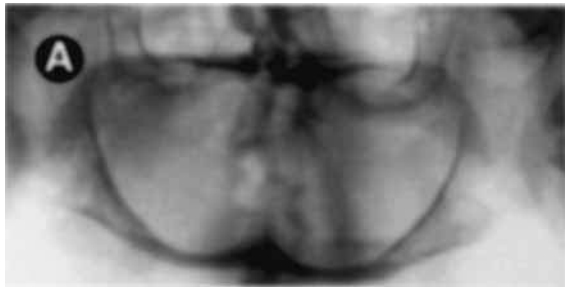
Class II (Fig 15 A-H)

This classification level distinguishes itself by the continued physical degradation of the denture-supporting anatomy, and, in addition, is characterized by the early onset of systemic disease interactions, patient management, and/or lifestyle considerations.

- Residual bone height of 16 to 20 mm measured at the least vertical height of the mandible on a panoramic radiograph.
- Residual ridge morphology that resists horizontal and vertical movement of the denture base; Type A or B maxilla.
- Location of muscle attachments with limited influence on denture base stability and retention; Type A or B mandible.
- Class I maxillomandibular relationship.
- Minor modifiers, psychosocial considerations, mild systemic disease with oral manifestations[6]

Class III (Fig 16 A-H)

This classification level is characterized by the need for surgical revision of supporting structures to allow for adequate prosthodontic function. Additional factors now play a significant role in treatment outcomes.

- Residual alveolar bone height of 11 to 15 mm measured at the least vertical height of the mandible on a panoramic radiograph.
- Residual ridge morphology has minimum influence to resist horizontal or vertical movement of the denture base; Type C maxilla.
- Location of muscle attachments with moderate influence on denture base stability and retention; Type C mandible.
- Class I, II, or III maxillomandibular relationship.
- Conditions requiring preprosthetic surgery[13]:
  1) minor soft tissue procedures;
  2) minor hard tissue procedures including alveoloplasty[18];
  3) simple implant placement, no augmentation required;
  4) multiple extractions leading to complete edentulism for immediate denture placement.
- Limited interarch space (18-20 mm).
- Moderate psychosocial considerations[19,20] and/or moderate oral manifestations of systemic diseases or conditions such as xerostomia.[21]

- TMD symptoms present.[14]
- Large tongue (occludes interdental space)[22] with or without hyperactivity.
- Hyperactive gag reflex.[23,24]

Class IV (Fig 17)

This classification level depicts the most debilitated edentulous condition. Surgical reconstruction is almost always indicated but cannot always be accomplished because of the patient's health, preferences, dental history, and financial considerations. When surgical revision is not an option, prosthodontic techniques of a specialized nature must be used to achieve an adequate treatment outcome.

- Residual vertical bone height of 10 mm or less measured at the least vertical height of the mandible on a panoramic radiograph.
- Residual ridge offers no resistance to horizontal or vertical movement; Type D maxilla.
- Muscle attachment location that can be expected to have significant influence on denture base stability and retention; Type D or E mandible.
- Class I, II, or III maxillomandibular relationships.
- Major conditions requiring preprosthetic surgery:
  1) complex implant placement,[25] augmentation required;
  2) surgical correction of dentofacial deformities;
  3) hard tissue augmentation required;
  4) major soft tissue revision required, ie, vestibular extensions with or without soft tissue grafting.
- History of paresthesia or dysesthesia.
- Insufficient interarch space with surgical correction required.
- Acquired or congenital maxillofacial defects.
- Severe oral manifestation of systemic disease or conditions such as sequelae from oncological treatment.
- Maxillo-mandibular ataxia (incoordination).
- Hyperactivity of tongue that can be associated with a retracted tongue position and/or its associated morphology.
- Hyperactive gag reflex managed with medication.
- Refractory patient (a patient who presents with chronic complaints following appropriate therapy). These patients may continue to have difficulty achieving their treatment expectations despite the thoroughness or frequency of the treatments provided.
- Psychosocial conditions warranting professional intervention

Guidelines for Use of the Complete Edentulism Classification System

In those instances when a patient's diagnostic criteria are mixed between two or more classes, *any single criterion* of a *more complex class* places the patient into the more complex class. The analysis of diagnostic factors is facilitated with the use of a worksheet (Table 1).

Use of this system is indicated for pretreatment evaluation and classification of patients. Reevaluation of classification status should be considered following preprosthetic surgery. Retrospective analysis on a posttreatment basis may alter a patient's classification.

Closing Statement

The classification system for complete edentulism is based on the most objective criteria available to facilitate uniform utilization of the system. With such standardization, communication will be improved among dental professionals and third parties. This classification system will help to identify those patients most likely to require treatment by a specialist or by a practitioner with additional training and experience in advanced techniques. This system should also be valuable to research protocols as different treatment procedures are evaluated.

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