

# **ICK Classification System for Partially Edentulous Arches**

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#### Keywords

Classification system; dental implants; removable partial denture.

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Previously presented at the Table Clinic Session at the American College of Prosthodontists 2006 Annual Session, Miami, FL.

Accepted May 24, 2007

doi: 10.1111/j.1532-849X.2008.00328.x

#### Abstract

Several methods of classification of partially edentulous arches have been proposed and are in use. The most familiar classifications are those originally proposed by Kennedy, Cummer, and Bailyn. None of these classification systems include implants, simply because most of them were proposed before implants became widely accepted. At this time, there is no classification system for partially edentulous arches incorporating implants placed or to be placed in the edentulous spaces for a removable partial denture (RPD). This article proposes a simple classification system for partially edentulous arches with implants based on the Kennedy classification system, with modification, to be used for RPDs. It incorporates the number and positions of implants placed or to be placed in the edentulous areas. A different name, Implant-Corrected Kennedy (ICK) Classification System, is given to the new classification system to be differentiated from other partially edentulous arch classification systems.

Partial edentulism is defined as the absence of some but not all the natural teeth in a dental arch.<sup>1</sup> Several methods of classification of partially edentulous arches have been proposed and are in use. It has been estimated that there are over 65,000 possible combinations of teeth and edentulous spaces in opposing arches.<sup>2</sup>

The most familiar classifications are those originally proposed by Kennedy,<sup>3</sup> Cummer,<sup>4</sup> and Bailyn.<sup>5</sup> Costa<sup>6</sup> in 1974 summarized most of the classification systems for partially edentulous arches and the rationale of the classification. These included: (i) the number and position of direct retainers,<sup>4</sup> (ii) the relation of edentulous spaces to abutment teeth,<sup>3</sup> (iii) the type of denture support, that is, tooth-supported, tissue-supported, or a combination, 5,7 (iv) the quality and degree of support a removable partial denture (RPD) receives from the abutment teeth and residual ridge,<sup>8</sup> (v) the number, length, and position of edentulous spaces and the number and position of remaining teeth,<sup>9</sup> (vi) the location and extent of edentulous spaces,<sup>10</sup> (vii) the boundaries of the spaces,<sup>11</sup> and (viii) combinations of these principles.<sup>3,12,13</sup> Classifications have also been proposed by Neurohr,<sup>14</sup> Austin and Lidge,<sup>15</sup> Avant,<sup>16</sup> and others.<sup>6,17</sup> Kennedy's method of classification is probably the most widely accepted classification of partially edentulous arches today.<sup>2,17</sup> None of these classification systems include implants, simply because most were proposed before implants became widely accepted. Recently, Misch and Judy<sup>18</sup> described a classification system depending on the Applegate-Kennedy system, with emphasis on the available bone in the edentulous area for implant placement. Their classification involves four divisions: Divisions A and B when bone is available for implant placement, division C when bone is not available for implant placement, and division D, restricted to cases with severe atrophy of the edentulous area involving basal bone.

Implants with or without attachments can be used to improve the support, stability, and retention of an RPD. The esthetic result of the RPD can be greatly improved by the use of implant attachments, thus eliminating unesthetic clasps. With the use of implants, the options for RPD use have increased, and the high demands of many patients for esthetic prostheses have been satisfied.<sup>19-21</sup>

At this time, there is no classification system for partially edentulous arches incorporating implants placed or to be placed in the edentulous spaces for an RPD.

The purpose of this article is to present a simple classification system for partially edentulous arches with implants based on the Kennedy classification system, with modification, to be used for RPDs.

### Kennedy classification system

The Kennedy method of classification was originally proposed by Dr. Edward Kennedy in 1925.<sup>3</sup> He divided all partially edentulous arches into four basic classes. Edentulous areas other than those determining the basic classes were designated as modification spaces.

- Class I: Bilateral edentulous areas located posterior to the remaining natural teeth,
- Class II: A unilateral edentulous area located posterior to the remaining natural teeth,
- Class III: A unilateral edentulous area with natural teeth remaining both anterior and posterior to it, and
- Class IV: A single, but bilateral (crossing the midline), edentulous area located anterior to the remaining natural teeth.

In 1954, Applegate<sup>12</sup> provided eight rules governing the application of the Kennedy system and proposed a new classification named the Applegate–Kennedy classification system for partially edentulous situations. These rules can be summarized in three general principles.<sup>18</sup> The first principle is that the classification should include only natural teeth involved in the definitive prostheses and follow rather than precede any extractions of teeth that might alter the original classification. The second principle is that the most posterior edentulous area always determines the classification. The third principle is that the edentulous areas other than those determining the classification are referred to as modifications and are designated by their number. The extent of modification is not considered, only the number of additional edentulous areas.

# Guidelines for the new classification system

The new classification system will follow the Kennedy method with the following guidelines:

- No edentulous space will be included in the classification if it will be restored with an implant-supported fixed prosthesis.
- (2) To avoid confusion, the maxillary arch is drawn as half circle facing up and the mandibular arch as half circle facing down. The drawing will appear as if looking directly at the patient; the right and left quadrants are reversed.
- (3) The classification will always begin with the phrase "Implant-Corrected Kennedy (class)," followed by the description of the classification. It can be abbreviated as follows:
  - (i) ICK I, for Kennedy class I situations,
  - (ii) ICK II, for Kennedy class II situations,
  - (iii) ICK III, for Kennedy class III situations, and
  - (iv) ICK IV, for Kennedy class IV situations.
- (4) The abbreviation "max" for maxillary and "man" for mandibular can precede the classification. The word modification can be abbreviated as "mod."
- (5) Roman numerals will be used for the classification, and Arabic numerals will be used for the number of modification spaces and implants.
- (6) The tooth number using the American Dental Association (ADA) system is used to give the number and exact position of the implant in the arch. (*Note*: other tooth numbering systems such as Fédération Dentaire Internationale [FDI]

can be used, as can the tooth name. The ADA system was used by the authors because of familiarity).

- (7) The classification of any situation will be according to the following order: main classification first, then the number of modification spaces, followed by the number of implants in parentheses according to their position in the arch preceded by the number sign (#).
- (8) The classification can be used either after implant placement to describe any situation of RPD with implants, or before implant placement to indicate the number and position of future implants with an RPD.
- (9) A different name, ICK Classification System, is given to this classification system to be differentiated from other partially edentulous arch classification systems.

# The proposed ICK classification system for partially edentulous arches

#### **Examples for Kennedy class I situations**

For Kennedy class I situations, Figures 1, 2, and 3 show the classification if no modification spaces exist. The full text can be used, or preferably the abbreviation (Fig 1).

If only one implant is placed in one of the two edentulous areas, it will be indicated between parentheses. This will mean that no implants were placed or to be placed in the other edentulous area (Fig 2).

The main classification, followed by the number of modification spaces, will be placed first, followed by the position (number) of the implants in the edentulous areas in parenthesis arranged according to the tooth numbering system used.

The arrangement of the implants will be from right to left in the maxillary arch and from left to right in the mandibular arch, following the arrangement of the tooth numbering system (Fig 3).

Figures 4, 5, and 6 show the classification with modification spaces. Figure 4 shows the situation if only one modification space exists, and Figure 5 if two modification spaces exist.

If only one of the modification spaces or one of the main edentulous spaces has implants, it will be the same as in Figure 5.

When more than two modification spaces exist, it will be as shown in Figure 6.



Figure 1 Maxillary implant-corrected Kennedy class I (#2, 15) or ICK I (#2, 15).



Figure 2 ICK | (#2).



Figure 3 ICK I (#18, 22, 31).



Figure 4 ICK I mod 1 (#19, 25, 30).



Figure 5 ICK I mod 2 (#18, 22, 26, 31).

### **Examples for Kennedy class II situations**

Figures 7 and 8 show the implant-corrected classification (ICK) for Kennedy class II situations without any modification spaces; Figures 9 and 10 show the same, but with modification spaces.

#### **Examples for Kennedy class III situations**

Figure 11 shows the implant-corrected classification for Kennedy class III without modification spaces; Figures 12 and 13 show the same, but with modification spaces.

#### **Examples for Kennedy class IV situations**

Figures 14 and 15 show the implant-corrected classification for Kennedy class IV situations.

## Discussion

One requirement of a classification of partially edentulous arches is that it provides immediate visualization of the



Figure 6 ICK I mod 3 (#18, 22, 28, 31).





edentulous situation and the proposed treatment planning and design.

The proposed classification can be used before or after implant placement. The original Kennedy classification can be used to describe the situation without implants, and then the implant-corrected classification can be used to describe the situation with implants. It means that the classification can be used either retrospectively to describe an existing situation, or prospectively for future planning. For example, in a Kennedy class I situation with two implants already placed in the area of teeth #2 and 15, this system can be used to describe the existing situation as shown in Figure 1, retrospectively. If the same situation has no implants placed, but implants were planned to be placed in the area of teeth #1 and 15, this system can be used prospectively to describe the future situation and help in treatment planning.

Any edentulous space to be restored with an implantsupported fixed prosthesis will not be included in the classification as mentioned earlier in the guidelines. A description of the types of the removable and/or fixed prosthesis can be mentioned following the classification. The implant size, length, and system can also be included.



Figure 9 ICK II mod 1 (#21, 26, 30).

Misch and Judy<sup>18</sup> classification can be used for the edentulous area regarding the available bone for implant placement, as follows: divisions A and B for edentulous areas with bone available for implant placement, division C when bone is insufficient for implant placement, and division D when the edentulous area is severely atrophied involving basal bone. The authors did not use this in the classification to avoid complexity. It can be mentioned after the classification, if desired.

For dental schools using Kennedy's classification system for the classification of partially edentulous arches, this new classification system can be included to make the original classification broader to incorporate implants with RPDs. This can be done by explaining the original Kennedy classification first, then after the students become familiar with the original classification, the new implant-corrected classification can be introduced. Emphasis should be made about using the new classification system only when implants are incorporated with an RPD, not to be confused with the original classification without implants.

The guidelines of the new classification system can be summarized or compacted for teaching purposes. The examples provided with drawings showing the use of this new classification



Figure 8 ICK II (#2, 7).



Figure 10 ICK II mod 2 (#24, 29)



Figure 11 ICK III (#6).

in different Kennedy classification classes should be helpful in explaining the use of this new classification for educational purposes.

The recently developed Prosthodontic Classification System, or Prosthodontic Diagnostic Index (PDI) for complete edentulism,<sup>22</sup> partial edentulism,<sup>1</sup> and completely dentate patients,<sup>23</sup> has gained more interest among educational centers and clinicians. Implants are involved in the classification for complete edentulism. If the condition requires a simple implant procedure, it will be classified as class III. If the condition requires complex implant procedures with bone graft, it will be class IV.

For partial edentulism, the residual ridge will be classified according to the complete edentulism classification. For example, if the residual ridge is classified as class III according to the complete edentulism classification, the condition will be class III, if no other factors make it class IV, and so on.

The authors suggest that this new classification be used with the PDI for partial edentulism according to the following: if the implant-corrected classification (ICK) of the condition involves the placement of two or fewer implants, the condition will be considered as simple and placed as class III (implants-simple)



Figure 13 ICK III mod 3 (#23, 26).

in the PDI. If the condition involves placement of more than two implants, with or without bone graft, it will be considered as complex and placed as class IV (implants-complex) in the PDI.

The presented classification is simple, but needs practice for familiarization. A software program (Dental Flash, Attachments International, San Mateo, CA) can be used to assist in drawing and designing any classification, and printing the design cleanly. This is very helpful for students and residents.

A widely used classification (Kennedy) is followed with modification for implant location and number. The classification is simple and easy to visualize, it can be done by observing the diagnostic casts or radiograph (e.g., Panorex), and assists in proposed treatment planning and design. The system provides ease in communication with the laboratory and assists professional communication regarding the different situations of partially edentulous arches with implants for RPDs.

The classification will be difficult for individuals who are unfamiliar with the Kennedy classification. Information is provided about the location and the number of the implants, but not the quality of the bone. Refinement and revision may be required.



Figure 12 ICK III mod 1 (#6, 11).

Figure 14 ICK IV (#6, 11).



Figure 15 ICK IV (#19, 22).

#### Summary

A classification system for partially edentulous arches with implants has been proposed. The Kennedy classification was used with modification. It incorporates the number and positions of implants placed or to be placed. A different name, ICK Classification System, is given to the new classification system to be differentiated from other partially edentulous arch classification systems.

#### Acknowledgments

The authors thank Drs. Amir Saad and Mounir Iskandar, residents in the Graduate Prosthodontics Program, Indiana University, for their help in using the software that produced the figures.

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