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Review Article

Literature Review: Partially Denture Arches Main Classifications

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Abstract

Several classifications for the partially denture arches have been proposed since the begining of the past century; however they are still used to date. This literature review revealed an antithesis among authors due to various parameters involved in the attempt to include all the requirements of a classification. With regards to variations between mechanical and topographic aspects, the position of retainers remains rather confusing. In order to improve the understanding of such matter, an analysis of all aspects relating to the main classifications was carried out. It is clear that no single classification is complete for prosthetic diagnosis and treatment planning. The teaching of such classifications ought to be encouraged in dental schools as they can be a great ally in assessing difficulties in the initial stages of the prosthetic treatment, which optimizes the planning of removable partial dentures (RPD). Considering the information obtained, it is clear that a minimum of three classifications should be used concomitantly: a mechanic-functional, a topographic and a third including characteristics of stress distribution along the teeth and the residual muco-alveolar structures. The methods involved in the systems of classification are key elements for case planning and discussion as well as for research and development.

Keywords: Partially denture arch; Kennedy's classification; Müller's classification; Wild's classification; Cummer's classification; Rumpel's classification; ACP edentulous classification system

Introduction

Nowadays the presence of standing teeth or dental prostheses is considered essential. One of the main reasons reported by patients regarding their need for teeth (or dentures) is esthetics, which brings a sense of well-being and self-satisfaction in their smile. Teeth help maintain the occlusion and its relationship with the masticatory muscles, the mandible, the maxilla and the temporomandibular joint. Therefore, it is important that they are present either naturally or in any type of dental prostheses that replace them adequately.

In the forth edition of the WHO's Oral Health Surveys - Basic Methods, codes and criteria for epidemiological indices of oral disease were established, however with regards to the index for prosthetic need, due to lack of standardized methods, no criteria was defined [1].

There are several classification models being proposed for identifying the different types of dental arches in relation to prosthetic space, topography, mechanics and function, some of which include teeth and/or saddle [2]. Nonetheless, there is no single classification that comprehends all the physiological, functional, anatomic, mechanic and topographic requirements, despite all being extremely important for making partial dentures [3].

The use of classifications aids programs of control and follow-up of patients, permitting the diagnosis of major

biomechanical problems involved in each type or arch, also allowing dental students and clinicians to use specific principles to study each category [4]. It is important to remember that classifications are limited to educational purposes, which offers practical guidance for the complexity of individual cases.

There are nearly a hundred types of classifications of several varieties [5]. The main ones are: Wild's, based on whether or not the appliance in function (RPD) generates leverage; Müller's, based on the RPD's functioning; Rumpel's, based on the RPD stress distribution during mastication; Cummer's, on the type of support and ideal location for an indirect retainer; ACP classification system, based on diagnosis and prognostic; Kennedy's, based on the topographic distribution of the remaining teeth - currently the most used. These are the classifications discussed in this study.

There are few conclusive studies in the literature regarding the different types of dental arches and their classifications. Therefore, it is extremely important to evaluate the main types of classification and their principles in order to obtain a set o parameters that will have both a preventative and functional impact on the oral health of an individual patient, thus minimizing complications of edentulous causes [5]. The aim of this study was to evaluate comparatively the main classifications of partially denture arches and their importance and clinical implications.

Bibliographic Reviews

Fifty years ago, exodontia was common practice in Dentistry, but along the years treatments have evolved, based on the science of prevention with emphasis on quality of life. Additionally, good appearance has become synonymous of health for most people and, with it the need for "the perfect smile" was created. However, esthetics has not been the only source of worry for people. The unbalance of the stomatognathic system caused by the loss of teeth can also generate changes in mastication and speech, creating difficulties and discomfort in the exercise of such activities. In addition, social skills can be negatively affected as a result of the embarrassment caused by a precarious oral condition [6].

There are some studies on the prevalence of the types of arches, but rare are those with full denture and completely edentulous patients as controls. In those studies the most frequent types or arch are Kennedy's I and II, respectively [7]. The small number of type III and IV are certainly due to the multitude of existing treatment modalities, from implants to fixed bridges and RPD. For patients with Kennedy's type III and IV the demand for treatment is high due to esthetic loss, therefore in areas of low socioeconomic status RPD remains the commonest treatment [8].

When there is total absence of teeth all fundamental functions are lost. The patient loses adequate protrusive and lateral movements, which are fundamental. The occlusal vertical dimension is distorted, bringing a deficit of facial esthetics. Dental prostheses in the upper arch are more common than in the lower, which suggests a higher facial esthetic concern by the patients, where the upper teeth show more in the smile than the lower teeth. Moreover, another possible reason for that is the greater difficulty in adapting lower appliances as well as the discomfort it may cause when being used [9].

Ideal Classification Requirements

An enormous possibility of combinations was calculated, 64,534 different distributions of saddle spaces and standing teeth for each arch [2]and 32,000 possible designs of an RPD. In that sense, attempts are made to group clinical situations in a reduced number of groups, making professional communication easier, since a classification has to allow for a topographic view of the partially denture arch, thus automatically generating a sketch of the biomechanical planning. However, framing all possible combinations and divide them into a lower number of classes would be a utopic idea, as no single classification basis can incorporate all the possible details. Hence the need to create a classification strategy with a more precise view of the case [2,10].

According to Kliemann & Oliveria [11], the requirements for an ideal classification are:

1- Allow for immediate visualization of the type of partially denture arch, the number and size of the remaining teeth, the size and number of saddles;
2- Allow for instant differentiation between tooth-borne, tissue-borne and tooth/tissue-borne appliances.
3- Permit qualitative evaluation of both bearing tissues.
4- Must be universally accepted in the communication between technicians in the area;
5- Obtain mechanical bases of planning;
6- Must be simple and of sensible design so as to prevent complications with its use.
Classifications have pre-established formulation bases, which are separated into three:
1- Biomechanical, where the classification is based on the work of the appliance on the teeth and on the mucosa.
2- Topographic, which is established by the saddles and teeth distribution in the arch.
3- Mechanical-functional, which establishes a relationship between the work of the appliance on the mucosa and on the teeth, together with its strength according to the size of the saddle [12].

Frith in 1935 described the work of the tissue-borne

prosthetic appliance as mostly supported by the mucosal tissues, tooth-borne as supported solely by teeth and tooth/tissue-borne, where the appliance acts both on mucosa and teeth (5Gil, C.1998).

Therefore, according to Kliemann & Oliveira [11] in order for a classification to be perfect, it must meet all the requirements proposed above.

Cummer's Classification

This classification is of extreme importance in RPD making, since it presents a biomechanical basis, taking into account the type of prosthetic support and the ideal location for the indirect retainer [11].

Cummer [10] seeked to relate the masticatory surfaces, both natural and artificial, according to the supporting teeth. Therefore, the higher the number of missing teeth, the higher the loading index on the supporting teeth.

According to the location of the indirect retainer's classes I and II require their use. Their location is determined by a perpendicular line to the fulcrum line equidistant to the two supporting teeth. In classes III andIV the appliance has no soft tissue support, thus being exclusively teeth-borne with a virtual rotational axis [10].

1- Class I, or diagonal: the positions of the direct retainers in the arch are diagonal [11].
2- Class II, or diametral, is also identified by the position of its two direct retainers, which are always placed diametrically [11].
3- Classe III or unilateral: is composed by two or more direct retainers which are placed on the same side of the arch, presenting a unilateral axis [11].
4- Class IV or Multilateral or Polylateral: it is established with three or four direct retainers in a triangular or quadrangular relationship with the arch [11].
According to the type of support, classes II and I present mixed support, thus making the appliances under this category supported by both teeth and soft tissue. Therefore we conclude that appliances for this type of arch may undergo, when in function, small rotational movements around the fulcrum line between the two main retainers. For classes III and IV (IV) in relation to the type of support, only tooth-borne appliances would be included, i.e., with no real rotational axis [11].

Wild's Classification

In 1933, Wild [17] - with mechanical basis - established his classification. It does not take into account topographic characteristics of the teeth in the arch. It does, however, take into consideration whether or not the work of the RPD generates leverage. It is divided into 3 classes only [5].

In order for an appliance to fit in Wild's class I it must lever forwards or backwards. Class II must generate intercalated leverage. Class III is defined as mixed, since it has a free extremity that features leverage and an additional intercalated saddle [11].

Kennedy's Classification

Kennedy [13] proposed a new classification of the partially denture arch, which to date remains the most widely used [11].

This classification is purely topographic and does not take into account the number of standing teeth or the size of the saddle. However, it is based on the relationship between the saddles and the teeth. It is an anatomical and academic classification somewhat directed to solving functional issues and establishing an improved bioprosthetic visualization of the case to be treated. Kennedy based his classification on the posterior saddles as a determining aspect of the arch [14]. His method is divided into 4 classes:

1- Class I is defined based on the absence of bilateral posterior retainers, regardless of the number of missing teeth, just as long as no teeth are present posteriorly to the saddles;
2- Class II: is characterized by lack of posterior pillars unilaterally, according the characteristics of class I;
3- Class III is defined as presenting alternating saddles and posterior pillar teeth;
4- Class IV is described as a single anterior saddle.

Another important aspect is the fact that this system or arch classification was a result of the frequency of arch types reported in his private practice study. For example: class I arch was the commonest in his study [11].

It is true that this classification on its own does not describe accurately all possible teeth and saddles distributions, which makes it appropriate to associate an additional set of rules as per those by Applegate [16].

Applegate's Rules for Kennedy's Classification

Applegate found it difficult to use Kennedy's classification due to the lack of its biomechanical views as a result of it being purely topographic. In 1937, Applegate presented modifications for Kennedy's classification [5]. The intercalated positions of teeth would need to be considered, which created subdivisions and modifications. Applegate established 8 rules in his classification system:

1- Posterior saddles determine the class, even when additional saddles are present;
2- Additional saddle areas are called modifications or subclasses;
3- The extent of the modification is not taken into account,

but only the number of saddles. ;
4- Class IV does not present subdivisions. It is determined by an anterior saddle that crosses the midline. The absence of a single central incisor falls into class III, but both anterior incisors missing would fall into class IV. Any further saddles other than an anterior would change the classification altogether to a posterior one, even if it is less extensive;
5- The classification must be established after the initial treatment planning, as this may include extractions, which in turn may alter it;
6- In the case of a missing third molar, it should be ignored, as this tooth is not counted for prosthetic purposes;
7- If a third molar is present and included in the treatment planning for rehabilitation then it should be counted in the classification;
8- Also if the second molar is missing and it has no antagonist tooth, then it should be disregarded in the classification [14].

Rumpel's Classification

In 1927, Rumpel [4] presented a classification based solely on masticatory forces. This classification uses a previous method proposed by Riechelmann in 1920, which categorizes appliances according to the distribution of stress on mixed bearing structures, such as soft and hard tissues. Rumpel used a different terminology for his classification, such as non-physiologic, physiologic or semi-physiologic [15].

A non-physiologic class means that the appliance is tissue borne, as apposed to teeth-borne, since its main support comes mainly from the oral mucosa, although a minor element of tooth support may be present.

The physiologic classification comprises those appliances that are in turn fully teeth-borne.

A semi-physiologic category includes those appliances supported by both teeth and soft tissue, i.e., tooth/tissue-borne [4].

Müller's Classification

Müller proposed a simplified classification based on two main features: an appliance characterized by intercalated saddles would be called Müller's class I.

A cantilever appliance would be called Müller's class II, where the author aimed at cases of posterior saddles with no pillar teeth.

The intercalated appliance, nowadays known as Kennedy's Class III, can be equivalent; however, Kennedy's is typically more topographic [5].

Nevertheless, the term intercalated is not sufficiently clear, since the edentulous space, in this case, can be comprised by several missing teeth, a key factor during the planning stages, which can considerably alter the biomechanics of the appliance [5].

Acp's Classification

The American College of Prosthodontics (ACP) developed, in 2002, a system of classification, simple and organized for the evaluation of partial edentulism. This protocol was developed in order to improve communication between professionals and facilitate the clinical diagnosis of each case, with the application of standardized criteria, to ensure consistency of decision profissional in relation to the treatment plan [18].

This classification includes four criteria that are considered relevant to the evaluation of partially edentulous patients:

-Location and extention of edentulous area;
-Condition of the abutment teeth;
-Characteristics of the residual ridge;
-Occlusion.

At the end of the application of this classification system, patients are categorized in a range of among Class I and Class IV. Class I is the minimally compromised clinical or ideal case. On the other hand, the classification has a grading undergoes a Class IV that represents a situation with severe impairment and prognosis, therapy which requires extensive oral rehabilitation.

Discussion

This study was based on the different classifications of saddles in dental arches, which are fundamentally important. They can have roots on principles such as biomechanics, which takes into account the masticatory forces; and topography, which deals exclusively with the distribution of teeth and saddles in the dental arch; or even the relationship between the two [11]. It was via these principles that authors tried to create a universal standard of differentiation of the different types of partially denture arches. The ideal way of planning a RPD is to use 3 classifications: a topographic, a mechano-functional - according to the work of the appliance itself, and finally a classification that includes the distribution of stress on the teeth and the surrounding tissues.

The table 1 illustrates a comparison between the classifications according to the ideal requirements. To date, no published classification has managed to achieve all the necessary requirements proposed by Kliemann in 1999 [11].

Table 1. Comparison between classifications according to the requirements for an ideal classification.

	Immediate visualization	Immediate differentiation	Universally accepted	Mechanical basis	Simple and logical
Cummer				X	
Wild		X		X	
Kennedy			X		X
Rumpel		X		X	
Müller		X		X	
ACP		X	X	X	

According to Gil [5], since the beginning of the 20th century there had been a clear need for a universal classification for partially denture arches. This lack of standardization led to attempts to create several classifications, with further subdivisions, which did not help solve the problem. In the past, the ever appearing classifications aimed to provide guidance for treatment planning. With the progress of prosthetic dentistry, the subsequent classifications were incomplete and inadequate in at least one aspect, since a greater knowledge of morphology, physiology and physiopathology was evolving.

According to Gil [5], in Cummer's classification, nothing is mentioned on the work capacity of the appliance, which introduces a fundamental conceptual error in his Class III or unilateral, which disregards the use of indirect retainers. It is known that this type of appliance under vectors of lateral instability would require stabilization by means of extending towards the opposite side of the arch.

Cummer et al [2] in 1921, failed to consider the condition of the standing pillar teeth as he tried to explain that the greater the number of saddles the greater the stress on the remaining standing teeth. This mathematical view ignores the diagnosis of the condition of the supporting tooth.

Kennedy's classification, the most widely used, presents a clearer method, significantly simpler and more advanced than the others. It is easy to memorize and to apply to treatment planning. However, Kennedy does not account for the biomechanical conditions and the qualitative value of the pillar teeth, being the latter the most important downside of his essentially topographic method. It also fails to determine the number of saddles and teeth in each arch.

In 1937, Applegate introduced subdivisions to Kennedy's classification, which complements it and improves its understanding in the study of appliances and in the treatment planning. The author defines each class better and adds subdivisions that clarify the state of the arches [16].

The system of classification by Rumpel has the merit for serving as a basis to several other classifications, however Rumpel did nothing more than use different terms such as non-physiologic, physiologic and semi-physiologic, in order to indicate the same aspects proposed by other authors: tissue-borne, tooth-borne and tooth/tissue-borne[16].

Müller class II is also essentially topographic. It is known that appliances with no posterior pillar teeth are not the only ones that present leverage. Class I appliances, intercalated type, can also induce anterior leverage. This happens when the pillars are united via an arch instead of a straight line. Even the class II appliance has a functional meaning, which translates exactly into that which we try to avoid in RPD: lever action [16].

All classifications are somewhat interlinked, however some dealt with the same feature, only changing the terminology, such as Rumpel [4] 1927 and Miller [9] 1970. Miller's (9) class I is equivalent to Rumpel's [4] physiologic, taking into account that they are based on topography and biomechanics respectively.

The five authors in their classifications present conceptual failures. None of them include the number of teeth in each arch and their condition or the size of the saddles.

Wild, Rumpel and Miller [4,9,17] presented more succinct classifications by reducing the number of classes. All three are similar. They differ in the base used to establish their categories: biomechanics, biomechanics and topography, respectively. It is possible to suggest that only the terminology was changed. For instance, Wild's class III or mixed is Rumpel's semi-physiologic and Müller's intercalated or class I, which represent a tooth/tissue borne prosthesis. Still under the same umbrella, Kennedy's class III can be included.

The system ACP [18] classification intends to offer as a benefit of improvement between intra operators consistency; improved professional communication; facilitate reimbursements to insurers; objective method for screening patients in dental schools; consistency among different diagnosis.

Conclusion

After a long study of the different types of classification, their requirements and the need for an ideal classification, it was concluded that there is no single system that meets all the necessary requirements, since there is such an enormous amount of combinations between saddles

and standing teeth that it would be impossible to include all of them under a single set of categories using all the proposed requirements. Therefore, clinicians should use the classification that is most adaptable to each situation or to them.

References

1. Colussi CF, Freitas SFT, Calvo MCM. Perfil epidemiológico da cárie e do uso e necessidade de prótese na população idosa de Biguaçu, Santa Catarina. Rev Bras Epidemiol. 2004, 1(7): 88-97.

2. Cummer WE. Possible combinations of teeth present and missing in partial restorations. Dent Summary 1921, 41(2): 156-166.

3. McGarry TJ, Nimmo A, Skiba JF, Ahlstrom RH, Smith CR et al. Classification system for partial edentulism. J Prosthodont. 2004, 13(2): 73-82.

4. Rumpel C. Klinik der zahnärztlichenProthese. Vjschr Zahnheik. 1928, 1(177): 538.

5. Gil C. Avaliação comparativa dos sistemas de classificação dos arcos parcialmente edentados: uma revisão crítica de oitenta anos. Rev Odontol Univ São Paulo. 1998, 12(1): 65-74.

6. Turano JC, Turano LM. Fundamentos de prótese total. 5. ed. São Paulo: Editora Santos; 2000.

7. Anderson JN, Sheff BDS, Lammie GA. A clinical survey of partial dentures. Br Dent J. 1952, 92: 59-67.

8. Bonachela WC, Telles DM. Planejamento em reabilitação oral com prótese parcial removivel. 1a ed. São Paulo: Editora Santos; 1998.

9. Miller EL. Systems for classifying partially edentulous arches. J Prosthet Dent. 1970, 24(1): 25-40.

10. Cummer WE. Possible combinations of teeth present and missing in partial restorations. Oral Health. 1920, 10: 421-430.

11. Kliemann C, Oliveira W. Manual de Prótese Parcial Removível. 1a ed. São Paulo: Editora Santos. 1999.

12. Curtis DA, Curtis TA, Wagnild GW, Finzen FC. Incidence of various classes of removable partial dentures.J Prosthet Dent. 1992, 67(5): 664-667.

13. Kennedy E. Partial denture construction. Dent Items Interest. 1925, 47(1): 23-35.

14. De Fiori SR, Lourenção AR. Prótese parcial removível fundamentos bioprotéticos. 1a ed. São Paulo: EditoraPancast; 1989.

15. Salomon H, Bonyhard B. Zursystematik der abnehmbarenpartiellenprothese. Z Stomat. 1937, 35(15): 975-985.

16. Zavanelli RA, Guilherme AS, Tavares LR. Prevalência de arcadas parcialmente desdentadas de pacientes atendidos na faculdade de odontologia - UFG de 1994 a 2004a. Robrac. 2007, 16(42): 23-27.

17. Wild W. Statik und biostatikbei der konstruktionpartiellerprothesis. Dtsch Z Wschr. 1933, 33(48): 1131-1143.

18. McGarry TJ, Nimmo A, Skiba JF, Ahlstrom RH, Smith CR et al. Classification system for partial edentulism. J Prosthodont. 2002, 11(3): 181-193.