



# Terminology focused on design and retention methods used for anterior resin-bonded fixed partial dentures in English literature: A scoping review

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## ABSTRACT

**Purpose:** Novel terms describing several designs of resin-bonded fixed partial dentures (RBFDPs) continue to appear. Indeed, a variety of terms are used in the English scientific literature. The use of a standard terminology is important for a fair and efficient understanding. This study aimed to investigate if the terminology used to describe designs and retention methods for anterior RBFDPs is standard.

**Methods:** An electronic search in the English literature was conducted in PubMed/Medline to identify all publications reporting RBFDPs in the anterior region until August 2022. This search was completed by hand searching. Terms indicating different designs of RBFDPs were listed and then classified. Percentages of their use were calculated to determine the commonly used terms. Analysis of the use of these terms was performed based on the standards determined by the latest edition of the Glossary of Prosthodontic Terms (GPT). The impacts of the MeSH Thesaurus and GPT on the nomenclature used for RBFDPs was assessed.

**Results:** A total of 125 articles were eligible for this review. In the retained articles, 86 terms were found. Among them, thirty-nine terms were classified into three groups. Only six terms were defined in the latest edition of GPT (GPT-9). Several classified terms that are commonly used were not identified in the GPT-9. Conversely to the GPT-9 which impact was insignificant, the MeSH Thesaurus had an important impact on the nomenclature used for RBFDPs.

**Conclusion:** The terminology used to describe designs and retention methods for anterior RBFDPs was non-standard. The GPT-9, constituting an important reference, defined a limited number of terms related to RBFDPs and had no significant impact on the standardization of the terminology used for RBFDPs. Efforts should therefore be continued to standardize the terminology. A specialized mini-glossary grouping and defining all the terms found in this study will be helpful in clarifying the terminology used for the anterior RBFDPs.

## 1. Introduction

Resin-bonded fixed partial dentures (RBFDPs), constituting a minimally invasive prosthetic solution, have been used for almost 50

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years [1,2]. Since their first description, RBFDPs have continued evolving thanks to the development of new technologies and materials in fixed prosthodontics. Along with this progress in science, novel terms describing different types of RBFDPs continue to appear. Consequently, a variety of terms have been used in scientific literature since the 1970s. Progress has been achieved in design, method of retention, composition and manufacture.

In 1977, Howe and Denehy demonstrated the possibility of using the Rochette design to replace an anterior missing tooth [3]. A few years later, the terms 'Rochette bridge' and 'Rochette-type adhesive bridge' appeared in scientific literature [4]. However, clinical results with regard to this design showed a high failure rate due to early debonding [5,6]. The retention mechanism using perforations in the Rochette design was incriminated in these failures [6,7]. Several attempts were made to replace perforations with other retention mechanisms. In 1982, Livaditis and Thompson, from the University of Maryland, described a technique for a retentive mechanism etching the inner side of cast retainers made from non-noble porcelain-fused to-metal alloys [7]. Since then, the term 'Maryland bridge' has been used in many papers [8–10]. However, the electrochemical etching procedure described by Livitadis was a sensitive technique [11].

It was for this reason that, in 1983, Moon and Knap, from the Medical College of Virginia, developed a roughened metal surface using salt crystals to create voids in self-curing acrylic resin patterns [11]. As a consequence, the term 'Virginia resin bonded bridge' appeared [11,12].

Another alternative was the cast mesh bridge. It constituted an alternative to Maryland Bridge and it made it possible to perform macromechanical retention using a net-like nylon mesh [13].

Since then, research has continued and many advances have been made at the levels of design and materials [2,6,14,15].

Originally, RBFDP is a prosthesis equipped with two lingual partial-coverage retainers that are fixed by a bonding technique.

Thanks to clinical observations and research, the principles of design and abutment preparation have evolved simultaneously with the progress in dental materials [1,2,6]. The one-retainer lingual design (Fig. 1) has nowadays been recommended as debonding will not go unnoticed [6]. This cantilever design tends to limit constraints on the prosthesis's retainer and, thus, increases their survival time [16].

The all-ceramic cantilever RBFDP (Fig. 1) has been currently considered as a definitive therapy, representing an optimal solution for adolescents or young adults facing potentially continuous growth [16]. In parallel with these developments, the list of terms used for RBFDPs is getting longer. The use of standardized terminology is important for a fair and efficient understanding [16,18]. In dentistry, as well as in other areas of healthcare, standardized nomenclature would permit authors to discuss their concepts and techniques and be sure that these would be understood by those who would read the articles, regardless of the geographic location or the specialty of the reader [19].

Efforts to standardize the terminology have been made. Indeed, the Glossary of Prosthodontic terms (GPT), published by the Academy of Denture Prosthetics, represents an important reference in prosthodontics. The first edition of the glossary was published in 1956 [20]. Revised editions had been published and the latest one was published in 2017 as the ninth edition (GPT-9) [19,18]. The use of a standardized terminology was valued in the series of GPTs [16,18].

The Medical Subject Headings thesaurus (MeSH Thesaurus) is a controlled and hierarchically-organized vocabulary produced by the National Library of Medicine (NLM) [21,22]. It was available to the public online since June 1997 [23]. The MeSH terms are standardized keywords used for research in the MeSH Database.

The present study had two objectives: firstly, to investigate if the terminology used in English literature to describe designs and retention methods for anterior RBFDPs is standard; and, secondly, to assess the impacts of the GPT and MeSH Thesaurus on the use of terms related to RBFDPs.

## 2. Materials and methods

An electronic search in the English literature was conducted in PubMed/Medline to identify the articles reporting anterior resin bonded fixed partial dentures until August 2022. The search equation was: denture, partial, fixed, resin-bonded [Title/Abstract] OR



Fig. 1. A one-wing All ceramic resin bonded fixed partial denture prior to cementation [17].

(dentures, partial, fixed, resin-bonded [Title/Abstract])) OR (resin-bonded prosthesis [Title/Abstract])) OR (resin-bonded prostheses [Title/Abstract])) OR (adhesive fixed partial denture [Title/Abstract])) OR (adhesive fixed partial dentures [Title/Abstract])) OR (adhesive bridge [Title/Abstract])) OR (adhesive bridges [Title/Abstract])) OR (adhesive fixed dental prosthesis [Title/Abstract])) OR (adhesive fixed dental prostheses [Title/Abstract])) OR (resin-bonded partial coverage fixed partial denture [Title/Abstract])) OR (resin-bonded partial coverage fixed partial dentures [Title/Abstract])) AND (anterior [Title/Abstract])) NOT (posterior [Title/Abstract])) NOT (splint [Title/Abstract])) NOT (periodontal splint [Title/Abstract])) NOT (full coverage crown [Title/Abstract])) NOT (full coverage restoration [Title/Abstract]). Then, a filter including English language was applied. All the titles and abstracts were screened in detail. Systematic reviews related to RBFPDs in the anterior region were specified and full texts of these articles were collected by the reviewers. The electronic search was complemented by hand-searching in the major journals of the field of prosthodontics. The latest edition of the Glossary of Prosthodontic Terms (GPT-9) was searched and uploaded from the official website of the Academy of Prosthodontics [24].

### 2.1. Inclusion and exclusion criteria

All the titles and abstracts were screened based on the inclusion and exclusion criteria by two independent reviewers (Tables 1 and 2). Decisions with regard to inclusion and exclusion criteria are outlined in Fig. 2 according to scientific content of the titles, abstracts, and keywords.

### 2.2. Term extraction and classification

Scientific terms describing different anterior RBFPDs (ARBFPDs) was extracted from the titles, abstracts, and keywords of the different articles selected and from the full content of the systematic reviews. Subsequently, basic terms were identified. During this step, it was ensured that a basic term describes only design, in a singular form, without mentioning the manufacturing method. An example is given in Fig. 3. Then, all basic terms were listed and duplicates were removed.

After that, basic terms recorded by electronic search were classified into groups according to design. Each group of terms was presented in a table. Slightly different expressions were placed in the same box and were separated by 'OR'.

### 2.3. Frequencies and percentages of appearance of classified terms

Each classified term was searched in the titles and abstracts of the selected final articles. Only one appearance was counted, even if a term was identified several times in the same article.

The frequency of occurrence of a classified term was then calculated by summing all the recorded occurrences. For systematic reviews, a term was counted if it was found in the titles and/or abstracts and/or the full text. For each classified term, the number of appearances was counted for the full study period and then during the period from 2018 to 2022.

The percentage of appearance for each classified term was calculated for the two aforementioned periods. It was calculated by taking its frequency of appearance divided by the total number of results and multiplied by 100 %. The total number of results represented the frequencies of appearance of all the terms in the same group.

### 2.4. Identification and labeling of terms in GPT-9

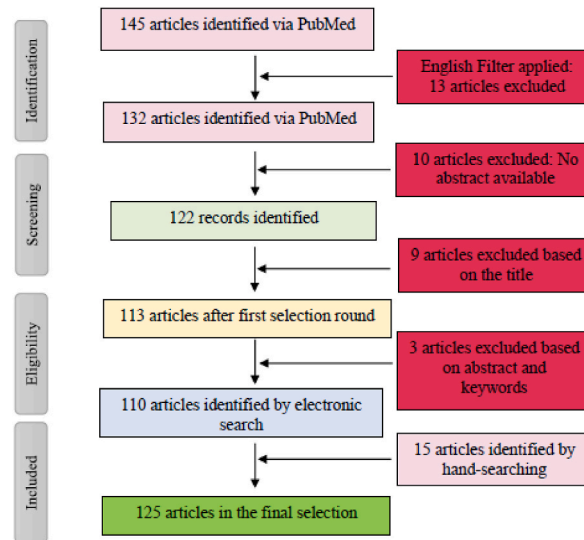
All the terms found in this study were searched in the ninth edition of the Glossary of Prosthodontic Terms (GPT-9). If a term was found, it was labeled according to GPT-9 as: Main Entry (ME), Obsolete (O), Slang (S), or Nonstandard (Ns). Otherwise, it was labeled as Not mentioned (Ne). Obsolete terms were recognized in GPTs when there is no evidence supporting their use. The label slang was used with words that are especially inappropriate or in contexts of extreme informality. In addition, nonstandard labels were used for words widely used informally, and which were different from the standards of the general prosthodontic community language [18,19].

**Table 1**  
Inclusion and exclusion criteria.

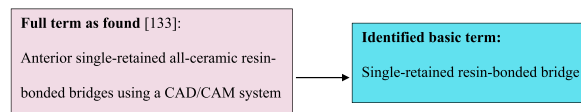
Inclusion criteria	
Type of publications	All scientific paper reporting on anterior resin bonded fixed partial denture (RBFPDs)
Concept	Different types of anterior RBFPDs
Context	The Full text is written in English language
Exclusion criteria	
Type of publications	Scientific paper reporting on: Removable partial denture, periodontal splints, resin bonded overcasting restorations, dental crowns, laminate veneers, Implant Supported Dental Prosthesis, when the type of the fixed partial denture remains unclear.
Concept	Different types of posterior RBFPDs
Context	a. Full text written in a language different from English language b. No available abstract (NAA)

**Table 2**  
Number of studies excluded with regard to each exclusion criteria.

Exclusion criteria	Number of publications
Type of publications	12
Concept	None
Context	a.13 articles (6 Chinese, 4 German, 1 Dutch and 2 Turkish) b.10 (NAA)



**Fig. 2.** Results of the article search.



**Fig. 3.** Diagram illustrating the method used to obtain basic terms focusing on design.

**2.5. Impact of the GPT-9 on the nomenclature used for RBFPDs**

The term considered as Main entry and the more cited in the GP-T9 was identified. The date of the first apparition of this term (DFAT) as Main entry in the different GPTs version was noted. Citations of this term were counted since the date of the first publication retained by this review until one year preceding the DFAT as Main entry in GPTs versions. Then the citations of this term were searched one year after the DFAT in GPTs versions as Main entry and for the same number of years as the previous time interval. The definition of this term in GPT-9 was recorded.

**2.6. Impact of the MeSH thesaurus on the nomenclature used for RBFPDs**

The MeSH descriptor for RBFPD in the PubMed database was identified as well as the entry terms. The MeSH term definition was recorded for RBFPD as well as the date of publishing.

Citations of the MeSH term was counted since the date of the first publication retained by this review until one year preceding the date when PubMed database became available online for free to the public (1997). Then the citations of this term were searched one year after this date and for the same number of years as the previous time interval.

**2.7. Compliance of GPT-9 and thesaurus definitions with current scientific data**

Both recorded definitions have been analyzed by two independent reviewers with the aim of comparing them to current scientific data.

The misuse of nomenclature was assessed by two independent reviewers.

### 3. Results

The initial electronic search generated 145 articles from PubMed/Medline. Application of filter 'English' gave 132 articles. Among them, ten articles published from 1983 to 1998 were excluded because of non-availability of abstracts. This lack of abstracts is due to individual Editors preferences and different author instructions, being outlined in the Journal's submission guidelines, at a certain period of time. After that, nine articles were excluded based on the titles and two articles were excluded based on the abstracts and keywords. In the final selection, 110 articles, covering the period extending from 1983 to 2022, were eligible for this study.

This study has included three systematic reviews (Tezulas et al., 2018, Wei et al., 2016 and Al-Bermani et al., 2021). Hand-searching generated 15 articles.

#### 3.1. Term extraction and classification

In this review, a total of 86 terms describing resin-bonded fixed dental prostheses were found, including 73 terms extracted from the various publications generated from the electronic search and 13 terms found by hand-searching as presented in Table 3 [4,10,11,13,25–42].

Among the terms found by the electronic search, 64 terms designating ARBFPDs were classified into 3 groups (Tables 5–7). The nine unclassified terms were used in one article for each (Table 4). Group 1 included terms with a general meaning (Table 5). However, group 2 involved terms designating the two-retainer design of RBFDP as outlined in Table 6 [43,44].

Group 3 gathered terms for the one-retainer design of RBFDP as presented in Table 7 [43,45–140].

#### 3.2. Identification and labeling of terms in GPT-9

Among the 86 terms identified in this study, six terms were found in GPT-9: four were labeled as Main entry (ME) which are Acid-etched fixed partial denture, Resin-bonded prosthesis, Resin-retained prosthesis and Rochette bridge. Two were labeled as Nonstandard (NS) which are Acid-etched bridge and Maryland Bridge (Table 3, Table 4 [1,2,38,43,45–47] and Table 5 [48,141]). The total number of general terms was 19, among them four terms were defined and labeled in GPT-9 (Table 5). Yet, the total number of terms describing the two-retainer and the one-retainer design were respectively 19 and 26. None of them was mentioned in GPT-9 (Tables 2 and 3).

#### 3.3. Frequency and percentage of appearance of classified terms

To simplify interpretation of results the percentages of appearance of the terms in the same boxes, considered as similar, were summed (Tables 5–7).

The frequency of use during the period extending to 2022 allowed to differentiate the commonly and rarely used terms. For instance, in group 1, a huge difference was noted in the frequency of use of 'Resin-bonded fixed partial denture', accounting for 28 %, compared to 'Resin-retained adhesive bridge', accounting for less than 1 %. (Table 5).

The terms 'Resin-bonded fixed dental prosthesis' (RBFDP) and 'Resin-bonded bridge' were ranked in second and third position with 20 % and 16 % respectively.

To facilitate the presentation of results of groups 2 and 3, the sum of percentages of appearance of the terms RBFDP and RBFDP considered as similar was adopted (Tables 6 and 7).

In group 2, the most used terms were: Two-retainer RBFDP/RBFDP, with 28 %, 'Three-unit RBFDP/RBFDP', and 'Two-retainer design RBFDP', with 20 % and 16 % respectively (Table 6).

The most common terms found in group 3 were: 'Cantilever or Cantilevered RBFDP or RBFDP', 'Single-retainer RBFDP/RBFDP', and 'Single-retainer cantilever RBFDP', with respectively 33 %, 25 %, and 10 % (Table 7).

During the period from 2018 to 2022, the most frequent terms used to designate the one-retainer design was 'Single-retainer resin-bonded fixed dental prosthesis', with 22 %.

While, for the two-retainer design, three terms have been used at the same percentage (33 %), these are: 'RBFDP two retainer', 'RBFDP three unit' and 'RBFDP two wing'.

Furthermore, from 2018 to 2022, six new terms appeared for the single retainer design, which are 'Resin-bonded prosthesis', RBFDP made with a conventional two-retainer design', 'Two lingual retainer design RBFDP' (Tables 5 and 6).

The use of certain sub-terms constituting various terms was examined. A sub-term is defined as a term that enters into the

**Table 3**

Hand-searching terms.

1. Acid-etched fixed partial denture (ME)	7. Etched cast-resin bonded bridge	11. single abutment single pontic cantilever resin-bonded bridge
2. Acid-etched fixed prosthesis	8. Maryland Bridge denture	12. Single-unit single-retainer cantilever resin-bonded bridge
3. Acid-etched prosthesis	9. Resin-bonded cast mesh bridge	13. Virginia bridge
4. Acid-etched restoration	10. Rochette-type adhesive bridge	
5. Adhesive bridgework		
6. Acid-Etched Resin-Bonded Fixed Partial Denture		

ME: Main Entry in GPT-9.

**Table 4**

Not Classified Terms found by electronic search.

1. Bondsteel fixed partial denture	5. Rochette Bridge (ME)
2. Carolina bridge	6. Pin-retained, resin-bonded fixed partial denture
3. Laminate veneer retained all-ceramic Resin Bonded Fixed Dental Prosthesis	7. Surface retained adhesive/adhesively Fixed Dental Prosthesis
4. Multi-retainer resin-bonded fixed dental prosthesis	8. Surface retained Resin Bonded Fixed Dental Prosthesis
	9. Umgeni bridge

ME: Main Entry in GPT-9.

**Table 5**

Arrangement of terms in group 1 in a descending order of frequency between 1983 and 2022.

	<sup>1</sup> Frequency/ <sup>2</sup> Percentage of appearance 1983–2022		<sup>1</sup> Frequency/ <sup>2</sup> Percentage of appearance 2018–2022		Terms label according to GPT-9
	1	2	1	2	
	1. Resin-bonded fixed partial denture	34	27,4 %	2	
2. Resin-bonded fixed dental prosthesis	25	20,1 %	12	40 %	Ne
3. Resin-bonded bridge	20	16,1 %	4	13,3 %	Ne
4. Adhesive bridge	13	10,4 %	4	13,3 %	Ne
5. Resin-bonded prosthesis Or Resin-retained prosthesis <sup>a</sup>	8	6,4 %	1 <sup>a</sup>	3,3 %	ME
6. Maryland Bridge Or Etched metal, Maryland-type bridge	5	4 %	1	3,3 %	Ns
7. Resin-retained bridge Or Resin-retained adhesive bridge	4	3,2 %	1	3,3 %	Ne
8. Resin-bonded bridgework	3	2,4 %	1	3,3 %	Ne
9. Resin-bonded restoration	2	1,6 %	0	0 %	Ne
10. Adhesive-retained fixed partial denture OR Adhesive fixed partial denture OR Adhesive fixed dental prosthesis	6	4,8 %	2	6,6 %	Ne
11. Resin-bonded fixed bridge	1	0,8 %	1	3,3 %	Ne
12. Resin-bonded partial coverage fixed partial denture	1	0,8 %	1	3,3 %	Ne
13. Acid-etched bridge	1	0,8 %	0	0 %	Ns
14. Maryland fixed dental prosthesis	1	0,8 %	0	0 %	Ne

ME: Main Entry, O: Obsolete, S: Slang, Ns: Nonstandard, Ne: Not mentioned in GPT-9.

<sup>a</sup> This number was recorded for the corresponding term.**Table 6**

Arrangement of terms in group 2 in a descending order of frequency between 1983 and 2022.

	<sup>1</sup> Frequency/ <sup>2</sup> Percentage of appearance 1983–2022		<sup>1</sup> Frequency/ <sup>2</sup> Percentage of appearance 2018–2022	
	1	2	1	2
	1. Resin-Bonded Fixed Partial Denture with two retainers OR Two-retainer resin-bonded fixed partial denture Or Two-retainer resin-bonded fixed dental prosthesis	7	28 %	1
2. Three-unit resin-bonded fixed dental prosthesis OR Three-unit resin-bonded fixed partial denture OR Three-unit adhesive fixed partial denture	5	20 %	1	33 %
3. Resin-bonded fixed dental prosthesis made with a conventional two-retainer design. OR Resin Bonded Fixed Partial Denture with a conventional two-retainer design OR Resin-bonded fixed dental prosthesis with a two-retainer design OR Two-retainer design resin-bonded fixed dental prosthesis	4	16 %	0	0 %
4. Two lingual retainer design resin-bonded fixed dental prosthesis OR Two retainer lingual design resin-bonded fixed partial denture OR Two lingual retainer resin-bonded fixed partial denture	3	12 %	0	0 %
5. Two-wings Resin-Bonded Fixed Dental Prosthesis	1	4 %	1	33 %
6. Bridge with two bonded wings	1	4 %	0	0 %
7. Resin-bonded bridge with a fixed-fixed design	1	4 %	0	0 %
8. Three-unit surface retained resin-bonded fixed dental prosthesis	1	4 %	0	0 %
9. Three-unit two-retainer fixed-fixed resin-bonded fixed dental prosthesis	1	4 %	0	0 %
10. Two-retainer fixed-fixed resin-bonded fixed dental prosthesis	1	4 %	0	0 %

formulation of another longer term.

Firstly, in group 1, the sub-term 'Bridge' was used in 47 citations while 'FDP' and 'FPD' were found in 67 citations in the total period of study, representing 38 % and 54 %, respectively.

**Table 7**

Arrangement of terms in group 3 in a descending order of frequency between 1983 and 2022.

	<sup>1</sup> Frequency/ <sup>2</sup> Percentage of appearance 1983–2022		<sup>1</sup> Frequency/ <sup>2</sup> Percentage of appearance 2018–2022	
	1	2	1	2
1. Cantilever Resin-Bonded Fixed Dental Prosthesis Or Cantilever resin-bonded fixed partial denture Or Cantilevered Resin-Bonded Fixed Dental Prosthesis Or Cantilevered resin-bonded fixed partial denture Or Cantilevered adhesively fixed dental prosthesis	20	33 %	4	22,2 %
2. Single-retainer resin-bonded fixed partial denture Or Single-retainer resin-bonded fixed dental prosthesis Or Resin-bonded fixed dental prosthesis with one-retainer Or Resin-bonded fixed dental prosthesis with single-retainer Or Resin-bonded fixed dental prosthesis with a single retainer design	15	25 %	4	22,2 %
3. Cantilever single-retainer resin-bonded fixed dental prosthesis Or Single-retainer cantilever resin-bonded fixed dental prosthesis Or Resin-Bonded Single-Retainer Cantilever Fixed Dental Prosthesis Or Cantilever single-retainer/One-retainer resin-bonded fixed partial denture	6	10 %	1	5,5 %
4. Cantilever resin-bonded bridge Or single-retained resin-bonded bridge	5	8,3 %	2	11,1 %
5. Resin-Bonded Fixed Partial Denture with a cantilevered single-retainer design Or Resin-bonded fixed dental prosthesis with a cantilevered/cantilever single-retainer design	4	6,6 %	0	0 %
6. Two-unit cantilevered/cantilever, resin-bonded fixed dental prosthesis	2	3,3 %	1	5,5 %
7. Cantilever design resin-bonded fixed dental prosthesis	1	1,6 %	1	5,5 %
8. One-cantilever Resin-Bonded Fixed Dental Prosthesis	1	1,6 %	1	5,5 %
9. Cantilever Resin-retained Bridge	1	1,6 %	1	5,5 %
10. Cantilever resin-retained prosthesis	1	1,6 %	1	5,5 %
11. One-wing Resin-Bonded Fixed Dental Prosthesis	1	1,6 %	1	5,5 %
12. Resin-bonded one-wing bridge	1	1,6 %	1	5,5 %
13. Cantilevered resin-bonded bridgework	1	1,6 %	0	0 %
14. Cantilever resin-bonded prosthesis	1	1,6 %	0	0 %

'Resin-bonded' was mentioned 96 times while 'Adhesive' and 'Adhesive-retained' were used 21 times. Secondly, in group 2, the sub-terms 'two-retainer', 'two-retainer design', and 'two-retainer lingual design' were used in 16 citations whereas 'two bonded wings' and 'two-wings' were used only in two publications during all the study period which represents respectively 64 % and 8 %.

Finally, in group 3, 'Cantilever/cantilevered', 'Single-retainer' or 'Single-retainer cantilever' were found respectively in 32,15, and 10 citations, accounting for respectively 54 %, 25 %, and 13 %. The sub-term 'one wing' was used in two publication which represents only 3,4 %.

### 3.4. Impact of the GPT-9 on the nomenclature used for RBFDPs

The term that is considered as Main entry and the more cited in the GPT-9 was 'Resin bonded prosthesis' (RBP). All definitions of other terms naming different RBFDPs refer to the definition of RBP. The first definition of this term as Main entry in the different GPTs version was documented in the GPT-7 published in 1999. In this review, it was recorded 3 citations for 'RBP' during 15 years, since 1983 until 1998, which represents 50 % of the total number of citations.

The same result was recorded for this term during 15 years since 2000 until 2015.

### 3.5. Impact of the MeSH thesaurus on the nomenclature used for RBFDPs

The MeSH descriptor for RBFDP in the PubMed database was 'Resin Bonded Fixed Partial Denture' (RBFDP). The entry Terms were: Maryland Bridge, Resin-Bonded Bridge and Resin-Bonded Acid-Etched Fixed Partial Denture. The latter term was not among the terms recorded by this review.

In this review, it was counted 7 citations for 'RBFDP' during 13 years, since 1983 until 1996, which represents 20,5 % of the total number of citations. Whereas, it was counted 18 citations for this term during 13 years, since 1998 until 2011, which represents 52,9 % of the total number of citations.

### 3.6. Compliance of both definitions with current scientific data

The analyze of definitions has shown that the definition of the MeSH term 'RBFDP', since 1992 in the NLM thesaurus<sup>23</sup>, is completely outdated and that the definition of the term 'RBP', since 2017 in GPT-9, lacks important updates.

In this review, it was noted that five terms were used improperly to indicate the ARBFDPs which are Inlay-retained adhesive Fixed Dental Prosthesis (Aktas et al., 2013 [47]), Anterior three unit prosthesis (Penteado et al., 2019 [110]), Zirconia cantilever restorations, Cantilever bridge (Rosentritt et al., 2009 [116]), and All ceramic Maryland Bridge (Tezulas et al. 2018 [1]).



#### 4. Discussion

A descriptive terminology for RBFDPs involves the method of retention, composition, design characteristics, and manufacturing method. Thus, a complete description for a RBFDP includes four adjectives. In this review, design and method of retention were considered to be linked, and for convenience the terminology was investigated regardless of composition and method of manufacture. The design and methods of retention have been researched to achieve long-lasting retention for the RBFDPs.

Different retention methods were experimented on the dental and the prosthetic substrates, and complementary means was added to enhance the retention and stability (grooves, pins etc.).

The principles of design and abutment preparation have evolved [6,21]. Originally, resin-bonded restorations were completely retained through adhesion [3,128]. However, minimal preparation of the abutment teeth is now required to optimize mechanical resistance and retention [6,15].

This allows the delivery of a more predictable medium-to long-term restoration [6,15].

The adhesive retention requires surface treatment to improve adhesion such as acid-etching and tribochemical silica-coating [142].

Anterior RBFDP frameworks are designed with either one (cantilever), two (fixed-fixed), or multiple retainers. The two-retainer fixed-fixed design has been the most popular [2].

In this review, it was noted that terms exempt from design characteristics were always used to designate the two-retainer fixed-fixed design.

Nevertheless, the general terms, which do not specify the number of retainers, could be interpreted as Two-retainer or Multi-retainer prosthesis.

The terms of group 2 and 3, mentioning the number of retainers, are therefore more exact in describing RBFDPs in the anterior region.

##### 4.1. The origin of the terms

Thanks to this review, it was possible to distinguish between nomenclature based on proper noun and descriptive nomenclature.

Terms based on proper noun have been referred to authors who first invented the device (Rochette bridge, Rochette-type adhesive bridges), or to author's university (Maryland bridge, Maryland type-bridge, Maryland fixed dental prosthesis, Virginia bridge, Carolina bridge).

Exceptionally, a recorded term which is Umgeni Bridge has been referred to a River (Umgeni River [46]).

The second type, descriptive nomenclature, is composed from descriptive words of retention methods and design of RBFDPs.

Terms based on descriptive words for retention have been referred to surface treatment ('Acid-etched fixed prosthesis', Acid-etched FPD, Acid-etched bridge, Resin-bonded cast mesh bridge) or to preparation design ('Pin-retained, resin-bonded fixed partial denture', 'Surface retained resin bonded Fixed Dental Prosthesis').

Terms based on descriptive words for design have involved the characteristics of the retainers, units, pontic and abutment. Other terms have combined several descriptive words. It was recorded various terms in this review according to the number of retainers: Multi-retainer RBFDP, Two-retainer RBFDP, One-retainer RBFDP. Retainers of ARBFDPs were always situated in the lingual surface which is described by terms such 'Lingual retainer design RBFDP'. Recently, it was described buccal retainers of an all ceramic RBFDP to improve aesthetics with the term 'Laminate veneer retained all-ceramic RBFDP' that is uncommon [1]. A cantilevered pontic was indicated by terms such as Cantilever RBFDP which is the most commonly used and considered as synonym for the term RBFDP with a single retainer design.

Several terms indicated the total number of units instead of retainers. As an example, the term 'Three-unit RBFDP', meaning that the device is equipped with two retainers and a pontic, is synonym for 'Two-retainer RBFDP'. Both terms implies that the pontic is intermediate. While, the term 'Two-unit RBFDP' was used as synonym for the terms 'Cantilever RBFDP and 'One-retainer RBFDP'.

Terms that combine several descriptive words for design were very rarely used, for examples:

'Single abutment single pontic cantilever resin-bonded bridge' and Three-unit two-retainer fixed-fixed RBFDP'.

##### 4.2. Discussion on the used nomenclature

Language is developing with progress in the art and science of Prosthodontics which is imposing a dynamic in terminology. A first facet of this dynamic is the perpetual generation of new terms reflecting new designs and methods of retention. A second facet of this dynamic, detected across the different versions of the GPT, appears through the addition of new terms, the removal and the label change of others. Thus, terms that are originally considered as main entry may be changed to slang, non-standard, or obsolete in later versions. This dynamic was noted in the GPT-7 published in 1999, the GPT-8 published in 2004 and the GPT-9 published in 2017 [19, 143,144] for the terms concerning the anterior RBFDPs as described in the following paragraph. The terms 'Acid-etched bridge', 'Maryland bridge', 'Bonded bridge' and 'Virginia Bridge' were defined in the GPT-7 as Main entries that are synonyms for 'Resin-bonded Prosthesis'. Later, in the GPT-9 the terms 'Acid-etched bridge' and 'Maryland bridge' were labeled as Nonstandard, while 'Bonded bridge' was labeled as Slang and 'Virginia Bridge' was deleted.

Over the last 10 years reviewed by this study, the term Maryland bridge was employed in the title of a historical article (Gutmann et al., 2019 [80]) and in the abstract of a second as a treatment option that is not aesthetic (Moslehifard et al., 2014 [104]).

The term Maryland bridge was defined originally as a Metal-ceramic RBFDP with an electrolytic etching of the metal surface [18]. In this review, it was utilized by an author as a synonym of a Metal-ceramic RBFDP without an electrolytic etching of the metal surface



[106].

Changes was not an absolute rule in all cases. The terms ‘Resin bonded Prosthesis’, ‘Resin retained prosthesis’ and ‘Rochette bridge’ have been defined as main entries in GPT-7 since 1999 and keep the same labeling to the present day through GPT-9.

The terms Virginia bridge (GPTs 7 and 8) and Rochette bridge (GPTs 7,8 and 9) are considered irrelevant for the clinical practice and unrequired except for describing the history of the RBFDPs.

#### 4.2.1. Inappropriate use of certain terms

In this review, it was noted a confusing term which is ‘All Ceramic Maryland Bridges’.

This term was used as a searching text words in a systematic review by Tezulas et al., in 2018.

This term is inappropriate because it associates the words all ceramic with Maryland bridge which is contradictory with the original definition of the Maryland bridge.

Cantilever bridge and Zirconia cantilever restorations are also inappropriate terms and must not be utilized to name a RBFDP as detected in a Randomized Controlled Trial by Rosentritt, M et al., in 2009.

The use of the term ‘Inlay-retained adhesive Fixed Dental Prosthesis’ was confusing as recorded in an in vitro study by Aktas et al., in 2013. The study aimed to evaluate the effect of different preparation designs on the fracture strength of fiber-reinforced adhesive FDPs in the anterior region [47]. This term should be reserved to the posterior RBFDP.

The term Loop connector Fixed partial denture was recorded in a clinical report by Dandekeri SS and Dandekeri S in 2014. This term was used as variant of RBFDP for replacement of single anterior tooth while maintaining the diastema. It described a particular design of RBFDP which consists on a loop that connects two lingual plates accommodated on the palatal surfaces of the abutment teeth [67].

The term ‘Loop connector FPD’ is confusing because it could be interpreted as a design where in loop connectors are attached to full coverage retainers.

Terms describing the surface treatment of non-precious alloys by the acid-etch technique are no longer relevant. Indeed, the most recent article in which the term sub-term ‘Etched metal’ was used was from 1991 in a comparative study (Mito et al., 1991 [40]). This is due to the development of adhesive resin that bond to the metallic oxides of non-acid etched alloy or to the Triborosilicate coated alloy [19].

Moreover, thanks to the progress in dental ceramics, the use of glass-ceramics and zirconia has become a good alternative to metallic alloy for RBFDPs.

Likewise, terms base on preparation design are rarely used (Pin-retained RBFDP).

The terms including the words ‘Surface-retained’ were noted in 3 citations [41,92,137]. They indicated the absence of preparation and described the Fibre-reinforced composite fixed dental prosthesis with two retainer design.

Conversely, the current nomenclature insists on the adhesive bonding by different expressions such as Resin Bonded Prosthesis, Resin retained Prosthesis, Adhesive-retained fixed partial denture, Resin-retained bridge etc.

Terms describing the design with number of units such as, Three-unit RBFDPs could be confusing. Indeed, this descriptive word has been used for a long time for the full coverage Fixed Partial Dentures (FPDs) such as Three-unit FPDs, Four-unit FPDs etc. The authors think that this formulation, while correct, is confusing.

Term combining several descriptive words are very long and their use is not convenient such as: Three-unit two-retainer fixed-fixed RBFDP and Single-unit single-retainer cantilever resin-bonded bridge. It should be noted that this formulation does not include materials or manufacture methods that makes it longer.

The terminology for novel terms which are commonly used in the current literature was complex. These terms are composed of different sub-terms: Cantilever/cantilevered, wing or retainer, two-unit or three-unit, single-retainer or two-retainers. Sometimes two or more sub-terms were used separately, such as Cantilever single-retainer RBFDP or forming a compound adjective such as Wing-retained RBFDP, surface-retained RBFDP.

The term ‘Wing-retained RBFDP’ was not found verbatim, but in similar forms such as: ‘Two-wings RBFDP’, ‘One-wing RBFDP’ etc.

#### 4.3. Impact of the GPT-9 on the nomenclature used for RBFDPs

The term ‘Resin bonded prosthesis’ was recorded as Main entry and as the more cited among terms naming the RBFDPs through the GPTs 7,8 and 9. Its first apparition was in GPT-7 published in 1999. Percentages of citation in articles were calculated during two equal periods of time that are far from the recorded date of the first apparition of the term ‘Resin bonded prosthesis’ by one year.

That allowed to assess the impact of the GPTs on the use of this term by comparing the percentages in both periods. As shown in the results, the term ‘Resin bonded prosthesis’ was cited from 1983 to 1998 and from 2000 to 2015 with the same percentage of 50 %. Consequently, there was no significant impact of the GPTs 7,8 and 9 on the use of this reference term.

#### 4.4. Impact of the MeSH thesaurus on the nomenclature used for RBFDPs

The MeSH term for RBFDP in the PubMed database was “Resin Bonded Fixed Partial Denture”. Citation percentages in articles registered for the MeSH term were calculated over two equal time periods that are one year away from the date that PubMed database became freely available online to the public (1997). This made it possible to assess the impact of the MeSH Thesaurus on the use of this term by comparing the percentages in the two periods. The results showed a significant difference in both time intervals in the use of this MeSH term (20.5 % before 1997 and  $\approx$  53 % after 1997). Therefore, the MeSH Thesaurus had a significant impact on the

nomenclature used for RBFDPs.

#### 4.5. Problems in the process of the nomenclature standardization

Standardized nomenclature is needed mainly in presentations at professional meetings, in the written form of the literature (scientific article, administrative services, health insurance providers, forensic expertise.), in teaching and in continuing education. It is required also in communication with the patient, with the laboratory, with colleagues and with the media.

While the dentist is not asked, in clinical practice, to use technical terms, he could employ generic words of Fixed Prosthodontics. Rarely, patients want to know the exact name of the prosthesis, in this case the dentist must respect the standardized nomenclature.

In what follows, the identified obstacles to the standardization of the terminology related to RBFDPs are presented.

##### 4.5.1. Disparities between the GPT-9 and the MeSH thesaurus

Disparities were recorded between the GPTs and the MeSH Thesaurus regarding the nomenclature for the RBFDPs. First, it was noted that the intersection between the Mesh words and the terms defined in the GPT-9 gives a single result which is Maryland Bridge labeled as Nonstandard in GPT-9. This fact constitutes a problem in the process of the nomenclature standardization. Second, the term 'Resin bonded Prosthesis', a main entry in GPTs, was not considered in the NLM thesaurus the more influent. Third, the terms Resin bonded bridge and Maryland bridge are entry terms in the MeSH Thesaurus whereas the sub-term 'Bridge' was labeled as slang in GPT-9.

The word Bridge was used in several terms, even for novel terms designating one-retainer design of RBFDPs. The use of the sub-term 'bridge' for naming new terms is likely due to the fact that authors tried to write brief and concise titles to make them more attractive to readers [145].

##### 4.5.2. Outdated definitions

The definition of the RBFDP since 1992 in the NLM thesaurus is completely outdated.

Indeed, this definition emphasize the electrolytically etching of cast-metal retainer which is currently abandoned. This definition refers to the Maryland bridge as a possible synonym with this expression "This type of bridgework is sometimes referred to as a Maryland bridge."

The definition of the resin bonded prosthesis (RBB) since 2017 in GPT-9 refers to the Rochette bridge and the Maryland bridge as historical devices. It also highlight some changes. First, the progress in adhesive bonding that discharge from the electrolytic etching of the metal surface. The second recentness is that fabrication of RBB from non-metallic materials become possible thanks to the fiber-reinforced composite resin. Nevertheless, this definition lacks important updates which are the new single-retainer design and that glass-ceramics and zirconia becomes a real alternative for metal alloys.

#### 4.6. Non integration of the new terms in the GPT-9 and outdated MeSH thesaurus

This review has shown that a limited number of terms designating RBFDPs was defined in GPT-9. The single-retainer design is required in the current clinical practice and consequently becomes more used in the literature. However, no term referring to this new conception has been defined in GPT-9. Conversely, a rarely used old terms such as 'Acid etched fixed partial denture' and 'Rochette bridge' were defined as main entries through the GPT-9.

It was also noted that the MeSH Thesaurus related to RBFDP was not updated since 1992.

#### 4.7. A proposal for a standardized nomenclature for anterior RBFDPs

Building on the results and observations from this study, the authors present in what follows a proposal for a standardized nomenclature for anterior RBFDPs.

The proposed nomenclature is based on descriptive words for design involving the characteristics of the retainers. A Fixed Partial Denture (FPD) usually consists of at least two full coverage retainers. A full-coverage FPD bonded with resin cement could be named Resin-bonded FPD. This poses a problem, because it is not known exactly what type of prosthesis it is. Thus, precision on the characteristics of the retainers allow to resolve this problem.

Besides, the authors consider that the sub-term Wing is more appropriate than Retainer and its use should be encouraged. The sub-term Wing describes a partial retainer that differs from the full coverage retainer by the extent of prepared surface. The preparation is minimally invasive, of small extent and confined to enamel. For this reason, authors recommend the use of more exact terms that are 'One wing RBFDP' or 'Two wings RBFDP'.

The term resin-bonded prosthesis (RBP) shorter than the term resin bonded fixed partial denture could be a valuable alternative to it.

The incorporation of the word "lingual" is not required since commonly used RBP always have a lingual retainer design and laminate veneer all-ceramic RBPs are still exceptional.

Thus, a proposed nomenclature focused on design and methods of retention for anterior RBFDP is: One-wing resin-bonded prosthesis and Two-wings resin-bonded prosthesis.

This study has two main limitations: Only PubMed/Medline database was searched.

- The terminology was analyzed according to standards set by a unique reference which is the Glossary of Prosthodontic Terms.

## 5. Conclusion

Through this review, 86 terms describing the design and retention methods of anterior RBFDPs were recorded. Classification tables were achieved for 64 terms identified in this review.

Within the limitations of this study, it was demonstrated that terminology focused on design and retention methods used for anterior resin-bonded fixed partial dentures in English literature was non-standard. Furthermore, the ninth edition of the Glossary of Prosthodontic terms, constituting an important reference in Prosthodontics, defined a limited number of terms for RBFDPs and had no significant impact on the standardization of the terminology.

Classification tables will be of great help to both learners and researchers, but efforts should be continued to standardize terminology. A specialized mini-glossary, grouping and defining all the terms recorded in this study, will be helpful in clarifying the terminology used for the anterior RBFDPs. However, this study should be completed by another investigation on the terminology focused on materials and manufacturing methods used for anterior RBFDPs.

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## Data availability statement

Data will be made available on request.

## CRediT authorship contribution statement

**M. Chebil:** Writing - review & editing, Writing - original draft, Visualization, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Y. Gassara:** Writing - original draft, Visualization, Methodology, Conceptualization. **S. Nasri:** Writing - original draft, Visualization. **B. Harzallah:** Validation, Supervision.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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