



REVIEW ARTICLE

LUTING AND BONDING AGENT USED IN FIXED PROSTHESIS: CRITERIA INHERENT TO DENTISTS

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ABSTRACT

Introduction: The aim of this study is to determine the criteria for the choice of a luting or bonding agents by dentists for the fixation of dental prostheses. **Materials and Methods:** A descriptive epidemiological survey was conducted among 320 private dentists in Casablanca. **Results:** 303 dentists participated in this study, a participation rate of 94.7% with a gender ratio of 0.91. Ionomer Glass Cement (CVI) is the most widely used cement for dentists with a percentage of 82.2%. Self-adhesive resins are the most used adhesives with a percentage of 63,2%. The factors identified as influencing the choice of luting cement are: the type of prosthesis for 71.3% of dentists, the preference according to experience for 68.3% and the properties of the material for 56.1% of them. Regarding bonding materials, the criteria identified as influencing the choice of adhesives are: the resistance to decohesion for 77.2% of dentists, the type of prosthesis for 70.6% and finally the preference according to the experience for 49, 3% of them. **Discussion:** CVI is the luting agent most used by the study population. For adhesives, self-adhesive is the most used material. This can be explained by the fact that the simplicity of their implementation protocol compared to other bonding agents. The type of prostheses and the resistance to decohesion are the major choice criteria for a luting or bonding agents. These two criteria depend on the clinical situation and the properties of these materials to make the most suitable choice. However, the preference of dentists from their experience is an important criteria of choice, which shows the significant place occupied by personal habits as a criteria of choice among the population of dentists studied. **Conclusion:** Restorative dentistry has undergone a significant evolution thanks to the development of new techniques and the appearance of new materials, with indications specific to each clinical situation. This complicates the task of the dentist to make a reasoned choice among the multitude of materials available.

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INTRODUCTION

The choice of the assembly method: luting or bonding, is the last step of the prosthetic chain. It must be well thought out and requires meticulous execution as it determines the long-term success of the prosthesis. The assembly material that will fill the space between the prosthetic part and the dental abutment aims to ensure the retention and durability over time of dento-prosthetic assembly. We will talk about physicochemical retention if the connection between the prosthetic element and the dental abutment uses the notion of adhesion is the case of assembly by bonding. On the other hand, when the retention is ensured by micro-keying with the formation of purely mechanical bonds, it will be called luting; finally, when the assembly mode uses these two processes, it will be called adhesive luting (Rosenstiel *et al.*, 1998). The selection of an assembly product by the dentist can prove to be

a difficult task considering the multitude of materials that exist on the market. Hence the value of clinicians' perfect mastery of the physicochemical, biological and many other attributes of assembly materials for a proper choice according to the clinical situation (Douglas Terry, 2005). The most commonly used assembly products, as well as the factors that allow selection of one material over another by clinicians, are poorly explored in the literature. Evidence of these factors will enable us to review the therapeutic orientations of dentists in terms of assembly, with the aim of improving the long-term success of prosthetic restorations and, consequently, better management patients.

MATERIALS AND METHODS

The most commonly used luting cements and bonding materials, as well as the factors that determine the selection of these materials by dentists, are poorly studied in the literature. For this purpose, a descriptive epidemiological survey was conducted among 320 Dentists in Casablanca, Morocco. The sample was compiled from a random survey from a list

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provided by the National Council of Council of the Order of Dentists (CNOCD) comprising a total of 1667 Dentists. Dentists who did not include fixed prosthesis in their daily practice were excluded from the survey as orthodontists or periodontists. The survey support was an individual questionnaire written on the basis of data found in the literature and supplemented by the results of a pre-survey of a focus group of 10 professors and former professors of fixed Prosthesis of the Faculty of Dental Medicine of Casablanca (FMDC) of Hassan II University.

This questionnaire allowed us to study several variables belonging to 3 main branches:

- Identification of the Dentist in function: sex, age, place and year of graduation, number of years of exercise and type of exercise (general practitioner or specialist).
- The fixed prosthesis luted in the daily dental practice: the types of cement used, the criteria of choice of the luting material.

And finally, the fixed prosthesis bonded in daily dental practice: the position of the bonded prosthesis in the therapeutic arsenal, the types of bonded prosthesis made, the types of bonding resins used and the criteria for choosing the bonding material. The statistical analysis of the data was done using the software Epi info 7.

RESULTS

Of the 320 dentists in the original sample, 303 of them answered our questionnaire, The participation rate is 94.7% with a gender ratio of 0.91. An omni-practical exercise was recorded in 74.9% of clinicians (Table 1), and the fixed prosthetic acts represent 57.1% of the daily acts of our sample (Table 2). 84.9% of the dentists in our study practice more than a method of assembling dental prostheses: All the dentists fix their prosthesis permanently, 40.3% of them used adhesive bonding, 30.4% adhesive luting, and 74.3% claimed to use provisional luting (Table 3). Ionomer Glass Cement (CVI) is the most widely used cement for dentists with a percentage of 82.2%, followed by CVIMAR with a utilization rate of 63% (Table 4). Criteria for selecting a cement for our sample are shown in Table 5.

In order of importance, we find: the type of prosthesis, according to preference and experience, the properties of the material, its shape or presentation, its cost, a product recommended by a colleague or a supplier and finally the quality / ratio price of the material. Concerning the bonded prosthesis, 44.8% of dentists did not include it in their daily practice (Table 6). Ceramic veneers are the most successful bonded prosthetic act for 76.5% of dentists in our sample (Table 7). Our study showed that the non-use of the bonded prosthesis by the dentists in our sample is mainly related to the risk of failure considered to be higher compared to the luted prosthesis for 70.3% of them (Table 8). Self-adhesive resins are the most used adhesives with a percentage of 63, 2% (Table 9). The criteria identified as influencing the choice of adhesives are shown in Table 10: the resistance to decohesion for 77.2% of dentists, the type of prosthesis for 70.6%, the preference according to the experience for 49, 3% of them, and finally the cost of the material and the form of his presentation.

Table 1. Distribution of Dentists by type of practice

Type of pratique	Effective	Percentage
Omni practitioner	227	74,9%
Spécialist	76	25,1%
Total	303	100%

Table 2. The part of the fixed prosthesis in daily practice

Part	Effective	Percentage
0-25%	66	21,8%
25-50%	173	57,1%
50-75%	39	12,90%
75-100%	5	1,7%
No response	20	6,5%
Total	303	100%

Table 3. Percentage of use of each type of assembly method by Dentists

Assembly method	Effective	Percentage
Final luting	303	100%
Bonding	122	40,3%
Adhesive luting	92	30,4%
Temporary luting	225	74,3%
No response	19	6,2%

Table 4. The proportion of Dentists using each type of luting agents

Type of luting agents	Effective	Percentage
Glass ionomer cement	249	82,2%
CVIMAR	191	63%
Zinc phosphate cement	53	17,5%
Polycarboxylate cement	3	1%

Table 5. Ranking in order of importance of the criteria of choice of the luting agents by the Dentists

Criteria of choice	Effective	Percentage
Type of prothèses	216	71,3%
according to preference and experience	207	68,3%
The properties of the material	170	56,1%
Form of presentation	73	24,1%
Material cost	37	12,2%
Recommended by a colleague	3	1%

Table 6. Proportion of Dentists who practice the bonded prosthesis

Response	Effective	Percentage
Yes	136	44,9%
No	148	44,8%
No response	19	6,3%
Total	303	100%

Table 7. Different Types of bonded prosthesis in order of importance

Type de prothèse	Effective	Percentage
Ceramic veneer	104	76,5%
Bonding metallic bridge	60	44,1%
Ceramic or composite Inlay onlay	52	38,2%
Bonding ceramic bridge	37	27,2%
Bonding crowns	7	5,1%

Table 8. Reasons for not using bonding

Reasons	Effective	Percentage
Risk of failure	104	70,3%
No training during the University course	34	23%
Financial reasons	24	16,2%
No request in practice	21	14,1%

Table 9. Types of bonding resins used by dentists

Type of bonding agents	Effective	Percentage
Self-adhesiveresins	86	63,2%
Composite	73	53,7%
4-METAResin	60	44,1%

Table 10. Criteria for choosing bonding materials

Criteria	Effective	Percentage
Resistance To the decohesion	105	77,2%
Type of prosthesis	96	70,6%
According to preference and experience	67	49,3%
Cost of material	21	15,4%
Form of presentation	11	8 %

DISCUSSION

The size of our sample is statistically sufficient for the parameters that were studied to be representative and extensible to all private Dentists practicing in Casablanca. However, the generalization of the results must be done in a cautious way and its extension can not interest the public sector where such a study can give different results. Practitioners now have a very wide range of assembly materials. This abundance of choice is theoretically an improvement of the therapeutic potential and the fields of indication of each remain distinct. Indeed, luting and bonding materials are entities each having very specific properties; while hybrid materials have a chemical nature and intermediate characteristics between those of cements and adhesive resins (Abo-Hamar *et al.*, 2005). According to the literature, there is no ideal cement meeting all the therapeutic expectations (Rosenstiel *et al.*, 1998). Each type of cement has unique characteristics of its own (Douglas, 2005), with the results of our study where 64.4% of the Dentists in our sample use more than one cement for the assembly of their cemented prostheses. The results obtained showed that the most used luting cement is glass ionomer cement with a percentage of 82.2% of users followed by CVIMAR with 63%. According to Brunton PA, glass ionomer cement was the most used cement in the UK with a 67% share (Brunton *et al.*, 2008) well ahead of CVIMAR, which represented a utilization rate of no more than 18% (Brunton *et al.*, 2008), contrary to the results of our investigation, where the latter finds a great success with the Dentists of Casablanca. Despite the fact that zinc phosphate cement is the oldest cement with the most clinical hindsight (Cheron and Degrange, 2007), it represented only a utilization rate of no more than 28% in the same Brunton PA study (Brunton *et al.*, 2012) and 17.5% in our survey.

On the other hand, in a thesis work, carried out at the University of Toulouse, it has been shown that zinc phosphate cements were traditionally the most used despite their known weaknesses: high initial solubility, relatively low cohesion and therefore relatively friable resulting in cemented joints lacking resistance to decohesion and therefore lack of tightness and lack of chemical adhesion to the dental substrate (Chotard, 2013). These data are thus superimposable on the results of our study, in which the use of this type of cement represented a minimal percentage not exceeding 1% which shows that it is used very little by practitioners, thus going towards an exceeding its use. In the case of polycarboxylate cement, no practitioner used this type of cement because of the awareness of practitioners that emerging luting cements have much higher qualities (Brunton *et al.*, 2008). Their only strong point

compared to the previous ones, is a much better pulp biocompatibility, but their much higher solubility of adhesion, their weak mechanical resistance, as well as their weak power of adhesion (Capelle) make that they should not find any more their indication today for the final cementation. However, they remain used for temporary cementation of long duration. However, with regard to adhesive luting, a discrepancy was noted between the percentage of dentists: 30.4% use adhesive bonding (Table 3) while those who claimed to use CVIMAR are 63% (Table 4).

These results could be explained by the fact that a large number of dentists would use CVIMAR without realizing that they are using an adhesive luting because they would not understand the definition. Overall, our results show that the criteria most taken into account by dentists in order of importance in the choice of a luting cement are: the type of prosthesis, their preference according to the experiment, with the properties of the material representing such an important criteria, the form of presentation, the cost, advised by a colleague or a supplier, and finally depending on the quality / price ratio. The dentists in our sample therefore choose their cements in a reasoned way and the indications of these are taken into account since the type of prosthesis is the most important criteria of choice and that the properties of the material are not neglected. In the past, most prosthetic restorations were made using a metal frame. Dentists used a zinc phosphate cement to fix these restorations on the abutment teeth (Behr *et al.*, 2009). Then with the appearance of aesthetic restorations made with composite resin or porcelain, conventional cements had to leave their place to bonding resins that have won over many practitioners (Huang *et al.*, 2002) or 40.3% of Dentists in our sample although their appearance is relatively new. Indeed, the joint prosthesis has undergone changes in its clinical applications. It now seems clear that the conventional joint prosthesis based on essentially mechanistic concepts that cause tissue loss that is often excessive, if not extreme, is no longer acceptable either biologically or biomechanically. Conventional fixed prosthesis techniques are now limited in their indications in order to respond to the principle of "therapeutic gradient" which is a concept of modern care responding to the growing aesthetic demand of our patients, as well as to the principle of Tissue saving thanks to the bonding which should be an essential practice in our therapeutic arsenal allowing an efficient and durable assembly of the prosthetic devices to the dental tissues. Thanks to the sophistication of adhesive techniques and the development of ceramic materials, it would seem possible nowadays to reproduce a "biomimetic" correspondence between aesthetic substitution materials and the anatomic substrate of a natural tooth (Tirlet *et al.*, 2014). This interceptive treatment philosophy is part of the therapeutic concept of bio-emulation (El Bernoussi *et al.*, 2010). And according to our study, most of the adhesive prostheses would be ceramic veneers with an achievement rate of 34.3% compared to other types of bonded procedure; This reflects a concordance of the concepts of Dentists in our sample with the current principles of modern non-invasive dentistry since these devices are on the one hand a durable solution with a high success rate (failure rate of less than 5% on 5 years) (Land and Hopp, 2010). And on the other hand, they represent the most aesthetic use of ceramic materials, with a minimal tissue cost and a patient satisfaction rate of 97.1% (Granel-Ruiz *et al.*, 2010). However, a significant difference was noted in our survey between the percentage of dentists performing a

bonding procedure that is 40.3% and those who used the bonded prosthesis is 44.9%, this could be explained either by a error in the filling of the questionnaire by the dentists or inattention on their part. The 44.8% of clinicians who did not practice the bonded prosthesis in their dental office suggested that it was because of the risk of failure that they considered high compared to the conventional prosthesis in 70.3% of cases. This raises a fundamental question about the causes of failure of the bonded prosthesis; they depend not only on the chosen materials, but also on the respect of the complexity of the technique of implementation and therefore operator-dependent as well as on a therapeutic indication adapted to the clinical situation such as the contra-indication of the bonding in a patient with poor oral hygiene (El Bernoussi *et al.*, 2010). Although bonding techniques are at least as effective and reliable as other more traditional ones today, they require a good knowledge of the biomaterials to be used and the respect of rigorous clinical protocols (Vanheusden, 2014). Self-adhesive glues represent the most successful bonding material among the Dentist population of this study with a utilization rate of 63.2%. These results could be explained by the fact that self-adhesive resins are the only bonded family that does not require prior treatment of dental tissues (Behr *et al.*, 2004). That being the case, the main criteria taken into consideration by the dentists of our study in order of importance in the choice of a bonding material are: the resistance to decohesion with 77.2%, the type of prosthesis at 70, 6%, the preference of each practitioner according to his experience is also an important factor for 49.3% of the dentists in the sample. The cost of the material is not negligible for 15.4% of practitioners and the form of presentation of the material at 8%. These results demonstrate once again that the choice of the material is made in a thoughtful way respecting the indications of each type of product.

Conclusion

The final assembly stage of the prosthetic restoration by luting or bonding, is the last link in the prosthetic chain, on which depends largely on the durability of the prosthesis (Capelle). It is therefore essential for each practitioner to control the indications according to the type of prosthesis. It is essential to sensitize practitioners and to make them aware that the choice of the assembly material depends largely on the clinical situation, because with practice these clinicians will tend to rely on their own clinical experience and resort to a material according to their personal habits. Given the small number of studies on the determination of the criteria inherent to practitioners in the choice of a method of assembly or a material of assembly, and considering that our study was carried out with Moroccan privatedentists of Casablanca with characteristics of their own, it would be interesting to carry out other similar studies with the public sector as well as in other regions of Morocco in order to better explore these data, which will make it possible to review the state of knowledge of assembly, with the ultimate goal of improving our therapeutics and ensuring its long-term success.

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