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FACTORS ASSOCIATED WITH THE LOOSENING OF AN ANTERIOR UNITARY CROWN

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Abstract

The single-unit full-coverage crown is a fixed dental appliance that completely restores a severely decayed tooth. In practice, practitioners may encounter at least one occurrence of loosening of this crown. Previous studies indicate a prevalence of 0.55 to 5.5% at 5 years, and that it adversely affects patients' esthetics. The aim of this study was to describe the loosening of a single-unit total veneer crown in the anterior region. This is a prospective cross-sectional descriptive study conducted the month of January 2015 to the month of January 2020. All patients with a loosened anterior single-unit full-coverage crown who consulted the dentistry department of the Dispensaire Kintana and the Centre de Soins Spécialisés en Odonto-Stomatologie, CHU Mahavoky Atsimo were included in this study. Those who did not wish to be surveyed were excluded. The study comprised 32.6% men and 67.4% women. Forty-three (43) loosened crowns were identified, 46.5% of which occurred less than a year after placement, 37.2% between 1 and 3 years and 11.6% between 4 and 6 years. The associated factors were overbite (62.8%), inappropriate dental preparation (46.5%) and poor choice or handling of bonding materials (37.2%). A significant relationship was found between the occurrence of loosening and overbite and bonding materials, $p=0.018$. Loose crowns are mainly due to clinical errors. To ensure the success of the prosthesis, prosthetists must be vigilant in pointing out any errors to the practitioner before making the crown.

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Introduction:-

The unitary total overlap crown is a tooth-shaped "cap" that completely covers the decayed or damaged tooth. Producing a single-tooth prosthesis may appear easy and straightforward [1]. But mistakes can be made, leading to irreversible consequences and the loss of the supporting teeth. No practitioner can claim to be immune to failure in

fixed prosthetics, despite careful attention to the design stages. These failures manifest themselves in biological and technical complications. These include decay, loss of pulp vitality and periodontal disorders, fracture of the abutment tooth or materials, loss of retention or loosening, etc. [2].

Loosening or loss of retention of the prosthetic crown is a commonplace occurrence, but it can lead to socially embarrassing situations for patients. This complication is not uncommon, as anterior teeth are subject to shear forces in addition to compressive forces, which intensify the stresses encountered in the bonding material [3]. The loosening rate for single crowns varies from 0.55 to 5.5% at 5 years, depending on the study [4,5]. Loosening is more frequent in single-tooth prostheses than in implant-supported multi-tooth prostheses [6]. Loss of retention was the most frequently mentioned reason for consultation in the fixed prosthetics department of the Centre Hospitalier Universitaire-Centre National d'odontostomatologie in Bamako, with a rate of 64.29% [7].

In Madagascar, epidemiological data on prosthetic complications such as loosening of a prosthetic crown are scarce, although practitioners are not spared from this situation in their daily practice. This study was therefore carried out to describe the factors associated with the loosening of anterior total unit crowns.

Methodology:-

Type of study:

Cross-sectional prospective descriptive study

Study period:

The survey took place over a 5-year period from January 12, 2015 to February 15, 2019.

Study population:

Our study population consisted of patients who came for consultation to the dentistry department of the Dispensaire Kintana and the Centre de Soins Spécialisés en Odonto-Stomatologie (CSSOS), CHU Mahavoky Atsimo

Inclusion criteria :

All patients who presented with loosening of an anterior unitary crown were included in this study.

Exclusion criteria :

All patients who did not wish to take part in the study were excluded.

Data collection and analysis

Data were collected on the same day as the patients' office visits, using pre-established survey forms. The data were then recorded and analyzed on a computer using SPSS 20.0 software.

Ethical considerations

Patient participation in the survey was free and voluntary, following an explanation of the study objectives. Verbal informed consent was obtained from each patient. The principles of anonymity and confidentiality were respected.

Conflict of interest:

All authors declare no conflict of interest.

Résultats:-

Table I:- Distribution of patients according to socio-professional profile.

Socio-professional profile	Effective	Proportion (%)
Gender		
Male	14	32,6
Feminine	29	67,4
Total	43	100
age range		
18-28 years old	14	32,6
29-38 years old	18	41,9
39-48 years old	07	16,3

Over 49 years old	04	9,3
Total	43	100
Profession		
Civil servants	15	34,9
Retailers	15	43,9
Household	4	9,3
Students	9	20,9
Total	43	100

Sex ratio = 0.48 and average age = 32 years

Tableau II:- distribution of patients by abutment tooth characteristics and crown type according to manufacturing materials

Characteristic abutment tooth	Effective	Proportion (%)
Endodontically treated tooth	43	100
Living tooth	00	00
Total	43	100
Crown type by material		
Resin crown	13	30,2
Metal-ceramic crown	25	58,1
Ceramic-ceramic crown	5	11,6
Total	43	100

Table III:- Distribution of patients by age of loosening.

Age of loosening	Effective	Proportion (%)
Less than one year	20	46,5
1 - 3 years	16	37,2
4 to 6 years	05	11,6
7 to 10 years	02	4,7
More than 10 years	00	00
Total	43	100

Table IV:- Distribution of patients according to factors associated with crown loosening.

Loosening factors	Effective	Proportion
Overbite		
Yes	27	62,8
No	16	37,2
Inadequate tooth preparation		
Yes	20	46,5
No	23	53,5
Factors related to sealing materials		
Yes	16	37,2
No	27	62,8
If yes		
Cement fracture or lack of cohesion	11	68,75
Lack of cement in crown intrados / preparation	5	31,25

Table V:- Sample distribution according to loosening factors and age of onset.

Loosening factors	Age of occurrence of loosening				p
	Less than a year n(%)	1-3 years n(%)	4-6 years n(%)	7-10 years n(%)	
Overbite					

Yes	17(63)	7 (25,9)	3(11,1)	0(0)	0,018
No	3(18,8)	9(56,2)	2(12,5)	2(12,5)	
Inadequate tooth preparation					
Yes	12(60)	5(25)	3(15)	0(0)	
No	8(34,8)	11(47,8)	2(8,7)	2(8,7)	
Factors related to sealing material					0,018
Yes	3(18,8)	9(56,2)	2(12,5)	2(12,5)	
No	17(63)	7(25,9)	3(11,1)	0(0)	

Discussion:-

This is a descriptive cross-sectional study of patients with loosening of a fully-covered single-tooth crown in the anterior teeth. Forty-three (43) cases of loosening were observed over a 5-year period. This loss of retention was the most common reason for consultation with 64.29% of cases in Mali [7] and was considered the most frequent failure among technical complications according to Benhamou W [2].

Socio-professional profile (Table I)

Our sample was predominantly female, 67.4% of cases with a sex ration of 0.48. This result differs from those of Thioune et al [8], 51.55% were men, with a sex ratio of 1.06.

The 29 to 38 age group was the most represented (41.9%), with an average age of 32. Our population is much younger compared with the study by Thioune N et al, where the mean age was 42.9 ± 13 years [8]. This could mean that young Malagasy are increasingly concerned about their oral health.

The majority of our population were shopkeepers (43.9%) and civil servants (34.9%). This confirms that fixed prosthesis is reserved for those with better economic situations, as previous studies have reported [9, 10]. Diallo K *et al* reported the same result in their study [7].

Characteristics of abutment teeth

In this study, all the abutment teeth were treated endodontically (Table II). It is highly probable that, at the beginning, the majority of his teeth were decayed with significant coronal decay justifying this practice. The studies by Thioune N et al in 2016 and Kabore WAD et al, in 2017 corroborate this finding. [8,11] In Burkina Faso, the tooth to be crowned must be systematically devitalized by more than half of practitioners [12]. However, the devitalized tooth presents a biomechanical weakness due to the loss of substance associated with the access cavity and biological changes [13].

Type of crown according to materials used

More than half of all crowns were made of metal-ceramic (58.1%) (Table II). Thioune N et al, also reported 59.09% of cases with metal-ceramic crowns [8]. This result confirms that patients are combining their functional needs with increased aesthetic demands [14].

Age of onset of crown loosening

Crown loosening was found at less than one year of function in 46.5% of patients, at 1-3 years in 37.2% and at 4-6 years in 11.6%. Only 4.7% of patients showed loosening after 7 to 10 years of function (Table III). Our study does not concur with those of Tanguy M et al. The probability of a crown being present in the mouth for at least five years was 92.7% [15]. The average duration of wear of the prostheses examined was 5 years, according to Thioune N et al [8].

This difference may be justified by the fact that our study focused solely on loosening. Technical problems related to repeated loosening of the prosthetic crown were the second most common reason for removal [15].

Factors associated with the loosening of fully veneered single crowns

Overbite

Overbite was the major cause of loosening of the full-coverage unit crown in this study, accounting for 62.8% of cases (Table IV). Examination of the crown and verification in occlusion in the mouth revealed exposed metal or holes on the palatal surface of the crown and premature contact of the crown, confirming the presence of overbite.

Several studies have confirmed this result [12, 16]. Crowns with an overbite are often loosened within a year of placement, and a significant relationship was found, with $p=0.018$ (Table V). Thus, a static and dynamic occlusal analysis should be performed by odontostomatologists before cementing the crown to avoid occlusion-related failures.

Non-compliance with tooth preparation

Inadequate preparation of the stump was also noted, accounting for 46.5%. Insufficient preparation on the palatal surface and short preparation height were highlighted. A height greater than the width of the preparation is generally recommended for anterior teeth [17]. According to Fall M et al, loosening of a restoration is a sign that the principles of abutment tooth preparation have not been observed [12]. The success of restorations depends on biomechanical and biomimetic imperatives. Among the steps required to meet these objectives, preparation is essential, as it must combine protection of residual structures with sufficient space for prosthetic materials [18].

Incorrect choice and handling of bonding materials

1. The loosening of the prosthetic crown was related to the assembly materials in 37.2% of patients (Table IV). Three situations were noted during examination of the loosened crown:
2. Lack of luting cement on the preparation and intrados of the crown (68.75%). This may be due to an error in mixing the cement (liquid/powder), which was too fluid. The success of fixed prosthetics depends on mastery of the techniques and steps involved [19].
3. Presence of unadulterated luting cement in the crown intrados, with few traces on the preparation or vis versa (31.25%). This means that the materials used do not have their own adhesion to the tooth or to the prosthetic crowns. According to Chesneau J et al, a lack of adhesion between the luting material and the dental or prosthetic surface, or a lack of cohesion within the luting material itself, are risk factors for crown loosening [3]. Some materials, such as zinc phosphate cements, do not have the potential to adhere to dental and prosthetic surfaces and are incompatible with coronal-radicular reconstruction. [20]. Glass ionomers, on the other hand, are incriminated by their high solubility in the presence of humidity [21]. Loosening of the prosthetic crown and incorrect choice or handling of bonding materials are significantly related, $p=0.018$ (table V). It is therefore important that practitioners follow the recommendations of the manufacturers of the chosen products.

Conclusion:-

The loosening of a fully veneered single-tooth crown is a prosthetic complication often observed in anterior teeth. It can be the source of abutment tooth extraction, which can be fatal for patients.

In the present study, the incidence of loosening was 43 cases over 5 years, and the loosening was the result of poor choice or handling of the bonding material, non-compliance with the dental preparation concept and prosthetic overbite. The loosening occurred early, especially in cases of prosthetic overbite. The impression may also be associated with loosening, but we were unable to evaluate this in this study.

Therefore, this complication is mainly caused by clinical rather than laboratory errors. However, it is crucial that the practitioner and the prosthetist communicate closely in order to correct any errors present.

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