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RESEARCH ARTICLE

KNOWLEDGE, ATTITUDE AND PRACTICE AMONG GENERAL DENTAL PRACTITIONERS AND POSTGRADUATE STUDENTS ON INTRAORAL REPAIR OF FRACTURED ZIRCONIA BASED RESTORATIONS IN NAMAKKAL DISTRICT- A QUESTIONNAIRE SURVEY

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Abstract

Restoring lost tooth structure with a material that mimics natural teeth, both in contour and color, is gaining attention among the dentist as well as the patients. One such esthetic material is zirconia. Monolithic Zirconia based restorations are restricted for posterior regions, where mechanical properties are of prime concern and Bilayered Zirconia restorations, are used to achieve better esthetics in the anterior regions. Fracture or chipping of the veneered Zirconia based restorations has been reported clinically and rather than replacing the entire fractured restoration, intraoral repair procedures can be carried out to correct the fractured restoration, which are proven scientifically. Many intraoral repair systems are available in the market. Dentist should have in depth knowledge and awareness on how and when to use the intra oral repair system for each case, which will prevent the need for fabricating a new restoration. Thus the aim of this study is to assess the Knowledge, Attitude and Practice among general dental practitioners and postgraduate students on intraoral repair of fractured zirconia based restorations in Namakkal district.

Introduction:-

The search for an ideal material in replacing the natural dentition is a never ending process. Though Metal ceramic restoration is considered as a gold standard as reliable materials [1], it does not fulfill the esthetic requirements. Thus restoring lost tooth structure that mimics natural teeth both in contour and color is gaining attention among the dentist as well as the patients.

Ceramics in dentistry was introduced by De Chemant in the 17th century and followed by Alex Duchateau, who made denture teeth with ceramics [2]. Zirconia was first introduced to the medical field in the year 1969[3], since then it is widely used because of it's high strength, biocompatibility and esthetics. Zirconia based restorations can be of two types: bilayered (veneered) and monolithic (full-contour) [4]. Since zirconia does not have silica in its composition it exhibits limited translucency. Therefore, a zirconia framework could be veneered in an attempt to make the restoration optically more favorable.

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So monolithic Zirconia based restorations are restricted for posterior regions, where mechanical properties are of prime concern compared to esthetics. Bilayered or veneered Zirconia based restorations, will have a coping made of zirconia and it will be layered by glass ceramics to achieve better esthetics [4] and is indicated for anterior regions.

Despite it's high clinical success rate, fracture or chipping of the veneered Zirconia based restorations occurs between 0-54% after one to three years of clinical observation [5]. Fracture may result from trauma, fatigue, occlusal prematurity, parafunctional habits, poor abutment preparation, inappropriate coping design, and incompatibility of coefficient of thermal expansion between ceramic and the metal structure [6].

According to Heintze and Rousson , the chipping of veneered zirconia-based restorations can be classified by severity as follows[7].
Grade 1: small surface chipping;
Grade 2: moderate surface chipping;
Grade 3: severe veneering porcelain chipping, exposing the zirconia framework.

Repair procedures are carried out only for grade 1 and grade 2 chipping. When the fracture surface extends into a functional area, this could be considered Grade 3 chipping. In this case, the best treatment plan would be to replace the damaged prosthesis as function of the prosthesis is always the first priority.

Rather than replacing the entire restoration, intraoral repair procedures can be carried out to correct the fractured restoration, belonging to grade I and 2 categories. Repairing is no longer considered as a patch work, rather, it is considered as a scientifically proven approach. This procedure considerably saves patient's treatment time and cost [4]. When existing restoration is to be replaced by a new one the loss of tooth structure is inevitable. By repairing the restoration the hard tissue substance can be preserved.

Many intraoral repair systems are available in the market. Dentist should have in depth knowledge and awareness on how and when to use the intra oral repair system for each case, which will prevent the need for fabricating a new restoration. Thus the aim of this study is to assess the Knowledge, Attitude and Practice among general dental practitioners and postgraduate students on intraoral repair of fractured zirconia based restorations in Namakkal district.

Materials And Methods:-

A self constructed questionnaire was fabricated with close ended questions related to intraoral repair of zirconia restorations. The questionnaire was checked for its content validity by circulating among the experts in the field of Prosthodontics. Based on the validity response obtained from the experts, irrelevant questions were eliminated and necessary corrections were made to the existing questionnaire.

The questionnaire was checked for it's reliability by carrying out a pilot testing among 10 participants to evaluate the questions in terms of organization, order, logical sequence, content, grammar, and clarity of meaning. The final questionnaire was devised based on the validity and reliability response. Apart from demographic data, the following questions were included to assess the knowledge, awareness and practice on intraoral repair techniques of fractured zirconia based restorations, among the study population.

Inclusion Criteria:
1. General dental Practitioners(with under graduate degree and postgraduate degree) and
2. Postgraduate Students In Namakkal District

The Estimated population is around 400. When Confidence interval is kept as 95%, then, n=197; with 5% margin of error calculated using RAOSOFT software. The questionnaire was circulated among the study population through online portal and distribution of hard copies. The number of study population who responded to the questionnaire amounted to 213 out of which 116 were general dental practitioners and 97 were post graduate students

Results:-

The data were statistically analyzed using chi-square test. P value less than or equal to 0.05 was considered statistically significant.GDP represents general dental practitioners.

Table1:- Analysis Of Variance On Knowledge Assessment Using Chi-Square Test:

SNO	Questions	Options	GDP	POST GRADUATES	SIG
1	Fracture of veneered restoration with zirconia framework exposure can be prepared by	a) Macromechanical method	25.0%	27.8%	
		b) Chemical method	12.9%	13.4%	
		c) Combination of both	62.1%	58.8%	.876
2	Is bevelling created at the fractured porcelain margin?	a) Yes b) No	75.0% 25.0%	66.0% 34.0%	.149
3	While bevelling the fractured margins, Diamond burs should be used at	a) High speed b) Low speed	31.0% 69.0%	27.8% 72.2%	.610
4	Tribochemical coating is preferred for	a) silicate ceramics b) oxide ceramic c) metal substructure	44.0% 37.9% 18.1%	34.0% 41.2% 24.7	.276

62% of general dental practitioners and 58% of post graduate students had knowledge that a combination of Macromechanical method and Chemical method should be used to prepare the fracture of veneered restoration with zirconia framework exposure. 75% of general dental practitioners and 66% of post graduate students had knowledge that creating bevel at the fractured porcelain margin will improve the final outcome of the restoration. Only 31% of general dental practitioners and 27% of post graduate students had knowledge that while bevelling the fractured margins, Diamond burs should be used at high speed. Only 37.9% of general dental practitioners and 41.2% post graduate students had knowledge that tribochemical coating is preferred for oxide ceramics. There was no statistically significant difference in terms of knowledge on intraoral repair of zirconia based restorations, among the general dental practitioners and post graduate students.

Table 2:- Analysis Of Variance On Awareness Assessment Using Chi-Square Test.

SNO	Questions	Options	GDP	POST GRADUATES	SIG
1	Have you encountered a fractured zirconia crown(s)/FPD(s) in your clinical practice?	a) Yes	50.0%	37.1%	.059
		b) No	50.0%	62.9%	
2	What is your opinion towards repair procedure?	a) It is a mere patchwork b) Scientifically proven approach	43.1% 56.9%	35.1% 64.9%	.231
3	According to you what is the main advantage of repairing the restoration instead of replacement	a) Less chair time b) Lower cost c) Easier application d) All the above	7.8% 24.1% 6.0% 62.1%	10.3% 21.6% 12.4% 55.7%	. 352
4	. According to you, what could be the potential problem in carrying out	a) Need to explain to the patient regarding the cause of restoration	22.4%	36.1%	.019

	intraoral repair procedure?	failure b) Anticipating the longevity of the repaired restoration c) Procuring intra oral repair kit d) Handling difficulties in the operative field	36.2% 16.4% 25.0%	30.9% 5.2% 27.8%	

50.0%of of general dental practitioners and 62.9% of post graduate students have not encountered a fractured zirconia crown(s)/FPD(s) in their clinical practice. 56.9% of general dental practitioners and 64.9% of post graduate students believed that repair procedure was a scientifically proven approach. 62.1% of general dental practitioners 55.7% of post graduate students believed that combination of less chair time, Lower cost and Easier application were the main advantage of repairing the restoration instead of replacement. 22.4% of general dental practitioners pointed out that there could be problem due to the Need to explain to the patient regarding the cause of restoration failure while carrying out the intraoral repair procedure. 36.2% of general dental practitioners pointed out that there could be problem in Anticipating the longevity of the repaired restoration. 16.4% of general dental practitioners pointed out that there could be a problem related to Procuring an intra oral repair kit. 25.0% of general dental practitioners pointed out that there could be handling difficulties in the operative field. 36.1% of post graduate students pointed out that there might be some difficulty in explaining the patient regarding the cause of restoration failure, while carrying out the intraoral repair procedure. 30.9% of post graduate students pointed out that there could be difficulty in anticipating the longevity of the repaired restoration. 5.2% of post graduate students pointed out that there could be difficulty in Procuring intra oral repair kit. 27.8% of post graduate students pointed out that there could be handling difficulties in the operative field. There was statistically significant difference between general dental practitioners and post graduate students regarding the potential problem in carrying out intraoral repair procedure. Other options under awareness assessment were not statistically significant

Table 3:- Analysis Of Variance On Practice Assessment Using Chi-Square Test.

SNO	Questions	Options	GDP	POST GRADUATES	SIG
1	Do you regularly use rubber dam while carrying out intraoral repair procedure?	a)Yes a) No	30.2% 69.8%	41.2% 58.8%	.092
2	Do you generally do a mock up in order to choose a correct shade of composite?	a)Yes b) No	68.1% 31.9%	71.1% 28.9%	.632
3	Is partial replacement of the restoration with a laminate veneer, an alternative solution?	a) Yes b) No	64.7% 35.3%	63.9% 36.1%	.911
4	When do you consider replacing the restoration?	a) Fracture involving functional areas b) Fracture affecting the esthetics	64.7% 35.3%	60.8% 39.2%	.564
5	Sequence of steps that you will carry out when there is zirconia framework exposure	a) Acid etching-air abrasion-silane coupling agent-adhesive resin-composite b) Air abrasion-acid etching- silane coupling agent-adhesive resin-	36.2% 50.9%	37.1% 44.3%	.458

		composite c) Air abrasion-acid etching- adhesive resin- silane coupling agent- composite	12.9%	18.6%	

69.8% of general dental practitioners and 58.8% of post graduate students did not regularly use rubber dam while carrying out intraoral repair procedure. 68.1% of general dental practitioners and 71.1% of post graduate students did a mock up in order to choose a correct shade of composite. 64.7% of general dental practitioners and 63.9% of post graduate students considered a laminate veneer as a partial replacement of the restoration, as an alternative solution. 64.7% of general dental practitioners and 60.8% of post graduate students considered replacing the restoration when the fracture involved functional areas. 50.9% of general dental practitioners and 44.3% of post graduate students followed the correct Sequence of steps while repairing zirconia framework exposure which is as follows: Air abrasion-acid etching- silane coupling agent-adhesive resin-composite. There was no statistically significant difference between general dental practitioners and post graduate students regarding the practice assessment in carrying out intraoral repair procedure

Discussion:-

Many dentist and post graduate students were reluctant to fill the questionnaire survey as they were flooded with KAP SURVEY during the ongoing COVID pandemic. The questionnaire was circulated among the study population through online portal and distribution of hard copies. The responses were coded and statistical analysis was done.

In order to achieve a durable bond strength between the existing porcelain and the repair

Composite resin, the fractured site is prepared by a combination of mechanical and chemical methods [8]. Mechanical methods include chair side air-abrasion with aluminum oxide particles and diamond rotary instruments and acid etching with hydrofluoric acid and chemical methods include chemical adhesion by applying silane and adhesive resins. After physically isolating the surface, air abrasion using an intraoral sandblaster can increase the macro-mechanical retention. Acid etching using 6–10% HF for 90–180 s on the porcelain can create micromechanically etched patterns that allow the silane coupling agents and the adhesive resin to penetrate the surface. It has been well established that a combination of micromechanical roughening and silane application to the porcelain creates durable bonding [4]. Recently, laser irradiation is proposed to enhance the adhesion of composite resins and zirconia. 62% of general dental practitioners and 58% of post graduate students stated that a combination of Macromechanical and chemical methods are required to prepare the Fracture of veneered restoration with zirconia framework exposure.

It is preferable to create a bevel at the fractured porcelain margin as bevelling will Increase bonding strength and it will also help to blend composite resin with the existing porcelain. Since the adhesion between composite resin and glazed porcelain is not optimal, the surface of the glazed porcelain to be bonded should be slightly prepared using fine diamond burs [4]. 75% of general dental practitioners and 66% of post graduate students stated that creating bevel at the fractured porcelain margin will improve the result.

While bevelling the fractured margins the Diamond burs should be used at High speed in order to avoid vibration of low speed hand piece, which could produce cracks and fissures at the ceramic margin [4]. Only 31% of general dental practitioners and 27% of post graduate students stated that while bevelling the fractured margins, diamond burs should be used at high speed

The hydrofluoric acid is the only acid capable of dissolving bonds in silicate substances. Given that zirconia is an oxide ceramic, chemically inert and has no silica content, surface treatment methods including acid etching and silanization do not affect the adhesion between the zirconia framework and composite resin [4,8]. Zirconia can be bonded to silanes if tribo-chemical coating is performed in advance, and it has been used for intraoral surface treatments through the development of a chairside system (e.g. CoJet, 3M ESPE, USA) . The system consists of 30 μm aluminum oxide particles doped with silica. This treatment simultaneously roughens and incorporates silica into the zirconia surface. The silica-enriched surface will then react with the silane [9]. Only 37.9% of general dental practitioners and 41.2% post graduate students had knowledge that Tribochemical coating is preferred for oxide ceramics

50.0%of of general dental practitioners and 62.9% of post graduate students have not encountered a fractured zirconia crown(s)/FPD(s) in their clinical practice. 56.9% of general dental practitioners and 64.9% of post graduate students believed that repair procedure was a scientifically proven approach. 62.1% of general dental practitioners and 55.7% of post graduate students believed that combination of less chair side time; lower cost and easier application were the main advantage of repairing the restoration instead of replacement. 22.4% of general dental practitioners pointed out that there could be problem in explaining the patient regarding the cause of restoration failure while carrying out the intraoral repair procedure. 36.2% of general dental practitioners pointed out that there could be problem due to the Anticipating the longevity of the repaired restoration. 16.4% of general dental practitioners pointed out that there could be difficulty in procuring intra oral repair kit. 25.0% of general dental practitioners pointed out that there could be problem due to the Handling difficulties in the operative field. 36.1% of post graduate students pointed out that there could be that there might be some difficulty in explaining the patient regarding the cause of restoration failure, while carrying out the intraoral repair procedure. 30.9% of post graduate students pointed out that there could be problem in anticipating the longevity of the repaired restoration. 5.2% of post graduate students pointed out that there could be a problem related to Procuring an intra oral repair kit. 27.8% of post graduate students pointed out that there could be problem due to the Handling difficulties in the operative field.

For intraoral use, a rubber dam is indispensable, as contamination of the silanized surface with water or other solutions inactivates the silane [4]. 69.8% of general dental practitioners and 58.8% of post graduate students did not regularly use rubber dam while carrying out intraoral repair procedures. When rubber dam and proper isolation procedures are not used, there is more chance of failure of any restorative procedure

In addition to intraoral repair, preparing the defective restoration for a laminate veneer and bonding the veneer onto the existing restoration [4] is another option for repairing Grade 2 chippings. In areas demanding a highly aesthetic result or in cases involving large defects or multi-unit restorations, the partial replacement of the veneering porcelain with a laminate veneer offers an attractive solution. 64.7% of general dental practitioners and 63.9% of post graduate students considered a laminate veneer as a partial replacement of the restoration, as an alternative solution.

64.7% of general dental practitioners and 60.8% of post graduate students considered replacing the restoration when the Fracture involved functional areas. When the fracture surface extends into a functional area, this could be considered Grade 3 chipping. In this case, the best treatment plan would be to replace the damaged prosthesis as function of the prosthesis is always the first priority [4]. Interestingly, it is to be noted that intraoral repair was more likely to be performed if the same dentist had placed the original restoration, irrespective of the type of fracture.

Conclusion:-

Chipping is considered one of the most frequent complications of veneered zirconia-based restorations. The chipping can be corrected via either a replacement of the entire restoration or intraoral repair measures. Repairing an existing restoration prolongs not only the life of the restoration but also the life of the affected tooth, since in comparison with a newly made restoration; a repair reduces the loss of dental hard substance. Under certain conditions, repairing restorations is also considerably more cost effective and less invasive than replacement restorations. Therefore, both dentists and patients are willing to accept intraoral repair. There was no statistically significant difference on most of the aspects of knowledge, awareness and practice among general dental practitioners and post graduate students on intra oral repair procedure in managing fractured zirconia based restoration. To conclude general dental practitioners and post graduate students should gain sufficient knowledge about the intra oral repair procedure so that the need for making new restoration can be eliminated and making it cost efficient for the patient.

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