

CROWNLAYS - SINGLE UNIT LITHIUM DISILICATE FIXED PROSTHESIS: CLINICAL EVALUATION FOR THE DURABILITY AND PATIENT SATISFACTION FOLLOWING PRECISE CEMENTATION PROTOCOL

Dr. Nikita R. Shoukhanda^{1*}, Dr. Saumya Sharma², Dr. Sanjeev Singh³, Dr. Gulab Chand Baid⁴, Dr. Vivek Lath⁵,
Dr. Priyabrata Jena⁶

¹ Post graduate student, Department of Prosthodontics, Crown and Bridge, Maitri College of Dentistry and Research Centre, Anjora, Durg, Chhattisgarh, India.

² Professor and HOD, Department of Prosthodontics, Crown and Bridge, Maitri College of Dentistry and Research Centre, Anjora, Durg, Chhattisgarh, India.

³ Professor and Vice Dean, Department of Prosthodontics, Crown and Bridge, Maitri College of Dentistry and Research Centre, Anjora, Durg, Chhattisgarh, India.

^{4,5} Professor, Department of Prosthodontics, Crown and Bridge, Maitri College of Dentistry and Research Centre, Anjora, Durg, Chhattisgarh, India.

⁶ Associate Professor, Department of Prosthodontics, Crown and Bridge, Maitri College of Dentistry and Research Centre, Anjora, Durg, Chhattisgarh, India.

Corresponding author: Dr. Nikita R. Shoukhanda, Post graduate student, Department of Prosthodontics, Crown and Bridge, Maitri College of Dentistry and Research Centre, Anjora, Durg, Chhattisgarh, India.

Email: nikitashoukhanda5@gmail.com

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Abstract

Aim & Objective: CROWNLAYS - Single Unit Lithium Disilicate Fixed Prosthesis: to analyse the performance and Clinical Evaluation for the Durability and Patient Satisfaction following precise Cementation Protocol.

Materials & Method: This is an observational study evaluating 20 lithium disilicate crownlays on 20 patients, prepared with minimally invasive criteria over a follow-up period between 1 to 6 months. Precise cementation protocol was followed using a rubber dam isolation (Variolink Esthetic Ivoclar Vivadent Manufacturing SRL, BZ, Italy). The survival rate was calculated by using modified united states public health services (USPHS) Ryge's criteria which is used for direct clinical evaluation of restoration and the crowns were examined for - Color match, Cavosurface marginal discoloration, Secondary caries, Gross fracture and Marginal integrity .

Statistical analysis : z test of proportion and chi square test.

Result: After completion of 6 months of follow up two case of gross fracture. 18 cases were found to be satisfactory without any failure.

Conclusion: Lithium disilicate posterior crownlays show an excellent complication-free survival rate, and the material allows for conservative restorations with minimum thickness.

Clinical Relevance: Monolithic lithium disilicate overlays feature a satisfying survival rate. The technique allows to perform restorations with a minimal removal of dental tissue, while limiting fractures over time. Its esthetical performance is excellent.

Introduction

The evolution of mechanical properties in restorative materials and adhesive cementation has led to the development of minimally invasive preparation criteria, which allow to preserve significant amounts of dental tissue with a consequent maximum reinforcement of dental elements. Importantly, the new materials have also contributed to overcoming the intrinsic problems related to the all-ceramic system, such as susceptibility to fracture and wear of antagonists. In recent years, the use of indirect adhesive restorations has also been extended to posterior teeth ^[1] achieving excellent results in terms of marginal closure, esthetic results, and reinforcement of the residual tooth structure, especially where cusps are covered ^[1,2]. Among these new materials, lithium disilicate is one of the most promising, thanks to its high mechanical strength, extraordinary versatility, bonding and excellent optical properties. Although glass ceramics are commonly indicated for esthetic restorations in the anterior area ^[3], the excellent biomechanical characteristics of lithium disilicate^[4] make the material also suitable for monolithic inlays or onlays in the posterior teeth. In particular, by using lithium disilicate, posterior loading requirements can be met with a more conservative restoration, with a thickness of just 1.0 mm, compared with the 1.5 to 2.0 mm commonly recommended for porcelain restoration. ^[5]As a result, the understanding of the importance of tissue preservation and the improvement of biomaterials have made it possible to develop treatment options that better and better meet the biological, biomechanical and esthetic objectives of this so-called "minimalist" dentistry. These minimally invasive restorations whose crownlays require a good mastery on the part of the practitioner, a rigorous and rather difficult preparation and bonding, thus their indications remain poorly known. ^[6]The aim and objective of the study is to study and evaluate the long term survival and patient satisfaction with lithium disilicate crown for posterior teeth and to analyse the performance and evaluate patient comfort and satisfaction with lithium disilicate crown.

Material and method

The objective of present study is to analyse the performance and evaluate patient comfort and satisfaction with lithium disilicate crown. It is the observational descriptive study evaluating 20 monolithic lithium disilicate crownlay restorations.

Inclusion criteria

Maxillary and mandibular RC treated molar teeth, No signs of periapical pathology seen, Adequate clinical crown height, Presence of opposing natural teeth .

Exclusion criteria

Poor oral hygiene, Active periodontitis, Insufficient crown length, Deep cervical caries, More destructed tooth structure. ^[7]

Tooth preparation

Make occlusal grooves of 1 to 1.5 mm through the mockup. Homothetic regularization of the occlusal surface, up to 2 mm. Potential build-up using a hybrid composite to cover the immediate dentin sealing, optimize the shape of the preparation and fill in undercuts. Preparation of the proximal "boxes" in Butt Joint, or rounded internal angle shoulder, with a minimum thickness of 1 mm to maximum 1.5 mm. Preparation of vertical and divergent (6-15°) and sharp internal walls. The fillet, if required, should be wide or in the form of a shoulder with a rounded internal angle and no associated chamfer. ^[8] (FIG.1)

Impression procedure

Polyvinyl siloxane material (Flexceed) is used for all crowns and by using one step / single mix putty wash technique impressions were made and poured in diestone (Neelkantho Dent Pvt Ltd). (FIG.2) Provisional crowns were given for occlusal and esthetic reasons and also to maintain gingival health and tooth position were luted using provisional cement. (template).

Cementation procedure (FIG.3)

Crownlays were adhesively cemented using Variolink Esthetic (Ivoclar Vivadent Manufacturing SRL, BZ, Italy). The inner layer of restorations was etched by hydrofluoric acid 9.6% (ENA etch, Micerium SPA, Avegno, Italy) for 30 s and then rinsed and dried. (FIG.3B) A silane coupling agent (Monobond, Ivoclar Vivadent Manufacturing SRL, BZ, Italy) was applied for a minute onto the inner surfaces and then airdried (FIG.3C). Subsequently, a layer of adhesive (Adhese Universal, Ivoclar Vivadent Manufacturing SRL, BZ, Italy) was placed avoiding polymerization in order to not increase the thickness in the tooth/restoration surface.

The operative field was isolated by use of a rubber dam; the dental cavity was then conditioned with 37% orthophosphoric acid (ENA total etch phosphoric acid 37%, Micerium SPA, Avegno, Italy), 30 s for enamel, and 15 s for dentin, being careful to protect contiguous teeth. (FIG.3E) Dental surfaces were then abundantly rinsed and air-dried. Cementation was performed with Variolink Esthetic (Ivoclar Vivadent Manufacturing SRL, BZ, Italy) placed on the inner surface of the crownlay. (FIG.3D) The overburden was removed with a brush before polymerization (1 min per surface), and margins were finished with a rubber pad. (FIG.3F) Occlusion was assessed and polishing was carried out. (FIG.3G)

Clinical evaluation method

The Cvar- Ryge quality criteria were used to standardize the clinical evaluation of the crowns. Restoration were clinically examined by two dentist after careful calibration. The patient were examined every 3 to 6 months during routine hygiene appointments. Every examination was performed using an intraoral mirror, a sharp explorer, and a periodontal probe and radiographs will be recorded every year. (FIG. 4)

Each crown was carefully evaluated with a sharp dental explorer for apparent alteration in its outward structure integrity. The crowns were examined for - Color match, Cavosurface marginal discoloration, Secondary caries, Gross fracture and Marginal integrity in accordance with Cvar- Ryge criteria. Evaluation parameters (Alfa, Bravo, Charlie and Delta) were used to classify long term quality of crown. If crown has catastrophic failure, it was replaced. (Table 1)^[9]

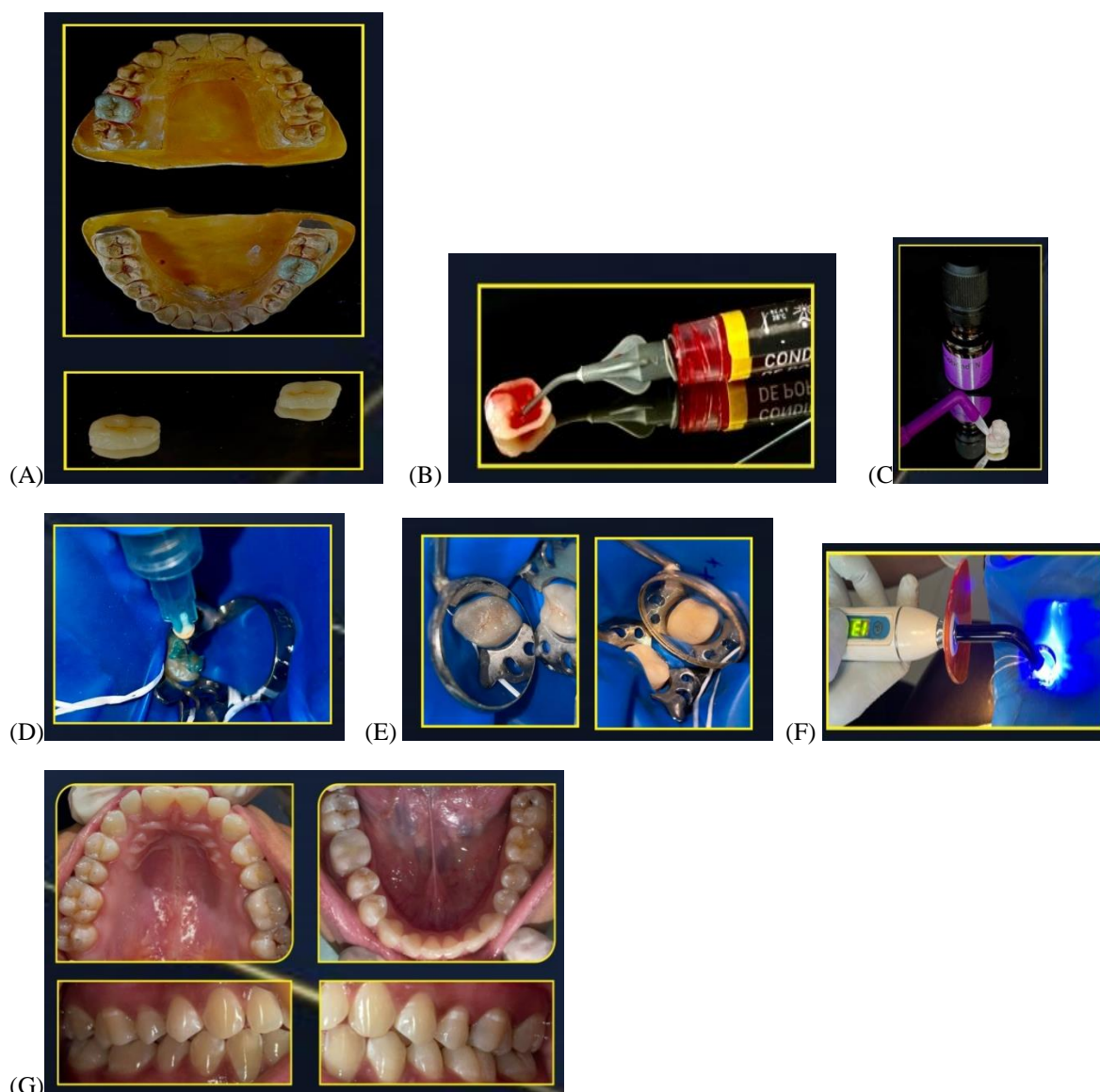
Fig.1 tooth preparation done with 26 & 46 (occlusal and lateral view)



Fig.2 impression made with polyvinyl siloxane material



Fig. 3 (A) lithium disilicate prosthesis of 26 & 46, (B) prosthesis etch with 9.6% HF (20 sec), (C) silanized with MONOBOND – S, (D) tooth surface etched with 37% PA (45 sec), (E) isolation done with rubber dam cementation of crown, (F) light polymerization (20 sec) each side., (G) post operative view.



Statistical analysis

Survival rate of these crowns were statistically evaluated using the z test of proportion and chi square test. The data was entered into SPSS Version 23.0 (trial version) for statistical analysis.

Result

After completion of 6 months of follow up two case of gross fracture. 18 cases were found to be satisfactory without any failure.

Table 2 shows distribution of color match according to different time period with alpha color match in between duration of 1 month, 3 months & 6 months in which no changes were observed. Table 3 shows distribution of cavosurface margin discoloration according to different time period with alpha visual inspection in between duration of 1 month, 3 months & 6 months in which no significant changes were observed. Table 4 shows distribution of secondary caries according to different time period with alpha visual inspection in between duration of 1 month, 3 months & 6 months in which no significant changes were observed. Table 5 shows distribution of marginal integrity according to different time period with alpha visual inspection in between duration of 1 month, 3 months & 6 months in which no significant changes were observed. Table 6 shows distribution of gross fracture according to different time period with alpha and bravo in between duration of 3 month in which significant changes were observed.

Table 1: Modified United States Public Health Service (USPHS) Ryge Criteria for Direct Clinical Evaluation of Restoration.

CATEGORY	CHARACTERISTIC	METHOD
	COLOR MATCH	
Alpha (A)	The restoration appears to match the shade and translucency of adjacent tooth tissues	Visual inspection
Bravo (B)	The restoration does not match the shade and translucency of adjacent tooth tissues, but the mismatch is within the normal range of tooth shades	Visual inspection
Charlie (C)	The restoration does not match the shade and translucency of the adjacent tooth structure, and the mismatch is outside the normal range of tooth shades and translucency	Visual inspection
	CAVOSURFACE MARGINAL DISCOLORATION	
Alpha (A)	There is no visual evidence of marginal discoloration different from the color of the restorative material and from the color of the adjacent tooth structure.	Visual inspection
Bravo (B)	There is visual evidence of marginal discoloration at the junction of the tooth structure and the restoration, but the discoloration has not penetrated along the restoration in a pulpal direction	Visual inspection
Charlie (C)	There is visual evidence of marginal discoloration at the junction of the tooth structure and the restoration that has penetrated along the restoration in a pulpal direction	Visual inspection
	SECONDARY CARIES	
Alpha (A)	The restoration is a continuation of existing anatomic form adjacent to the restoration.	Visual inspection

Bravo (B)	There is visual evidence of dark keep discoloration adjacent to the restoration (but not directly associated with cavosurface margins)	Visual inspection
	MARGINAL INTEGRITY	
Alpha (A)	The explorer does not catch when drawn across the surface of the restoration toward the tooth, or, if the explorer does not catch, there is no visible crevice along the periphery of the restoration	Visual inspection & explorer
Bravo (B)	The explorer catches and there is visible evidence of a crevice, which the explorer penetrates, indicating that the edge of the restoration does not adapt closely to the tooth structure. The dentin and/or the base is not exposed, and the restoration is not mobile	Visual inspection & explorer
Charlie (C)	The explorer penetrates crevice defect extended to the dento-enamel junction.	Explorer
	GROSS FRACTURE	
Alpha (A)	Restoration is intact and fully retained	
Bravo (B)	Restoration is partially retained with some portion of the restoration still intact	
Charlie (C)	Restoration is completely missing	

Table 2 : Distribution of Color match according to different time period

		Group			Total	Z value	P value
		1 MONTH	3 MONTH	6 MONTH			
Color match	Alpha	20	20	20	60		
		33.3%	33.3%	33.3%	100.0%	0.000	1.000
Total		20	20	20	60		
		33.3%	33.3%	33.3%	100.0%		

Table 3: Distribution of Cavosurface margin discoloration according to different time period

		Group			Total	Z value	P value
		1 MONTH	3 MONTH	6 MONTH			
Cavosurface margin discoloration	Alpha	20	20	20	60		
		33.3%	33.3%	33.3%	100.0%	0.000	1.000
Total		20	20	20	60		
		33.3%	33.3%	33.3%	100.0%		

Table 4 : Distribution of Secondary caries according to different time period

		Group			Total	Z value	P value
		1 MONTH	3 MONTH	6 MONTH			
Secondary caries	Alpha	20	20	20	60		
		33.3%	33.3%	33.3%	100.0%	0.000	1.000
Total		20	20	20	60		
		33.3%	33.3%	33.3%	100.0%		

Table 5: Distribution of Marginal integrity according to different time period

		Group			Total	Z value	P value
		1 MONTH	3 MONTH	6 MONTH			
Marginal integrity	Alpha	20	20	20	60		
		33.3%	33.3%	33.3%	100.0%	0.000	1.000
Total		20	20	20	60		
		33.3%	33.3%	33.3%	100.0%		

Table 6: Distribution of gross fracture according to different time period

		Group			Total	Chi sq	P value
		1 MONTH	3 MONTH	6 MONTH			
Gross fracture	Alpha	20	19	19	58		
		34.5%	32.8%	32.8%	100.0%	1.034	0.596
	Bravo	0	1	1	2		
		0.0%	50.0%	50.0%	100.0%		
Total		20	20	20	60		
		33.3%	33.3%	33.3%	100.0%		

Discussion

Ceramic bonded partial restorations are now a reliable means of restoring decayed teeth in the posterior region, provided that the indication is well defined^[10-11]. Despite their many advantages, they may have some disadvantages^[6]:

Ceramic restorations have the advantage of being aesthetically pleasing, offering a variety of colors with staining and layering possibilities. This aesthetic is stable over time and the surface is perfectly polished. This surface finish, the intrinsic properties of the ceramics and the precision of the marginal adaptation make ceramic restorations highly biocompatible. The bonded posterior partial restoration makes it possible to restore or even

improve the biomechanical resistance of the tooth/restoration assembly. Although they are so-called "fragile" materials, the ceramics used for bonded partial restorations have constantly improved mechanical properties, especially with lithium disilicate. These materials are stable over time and make it possible to restore functional occlusion with physiological surfaces. Their modulus of elasticity is close to that of enamel and this is related to the principle of biomimetics already mentioned ^[10]. Luciano et.al. in their study concluded that Lithium disilicate IPS e.max Press confirmed to be a reliable material for monolithic restorations yielding a highly satisfying survival at 32 months. Its biomechanical characteristics allowed them to work on minimal thicknesses values of 0.7 mm without affecting the strength ^[12]. There is a wide range of material choices and several shaping modes are possible. Although more difficult than composite resin restorations, it is possible to repair ceramic restorations with conventional composite resin provided that the protocol for bonding to vitreous ceramic is followed.

As this is a fragile material, cavity preparations must be done in a rigorous manner to minimize stress and the fitting of the parts must be delicate to avoid fracturing the ceramic. Ceramic restorations can be more mutilating than composite resin restorations and are more suitable for onlays than inlays. Because of the risk of fracture, bonded posterior partial restorations are contraindicated in cases of untreated bruxism, although lithium disilicate-reinforced ceramics appear to provide good short-term results. Due to the hardness of the ceramic, there is a risk of wear of the antagonistic enamel and of composite resin restorations. ^[6]Simeone et al concluded that even though bruxism is considered as a high risk factor for failure, they suggested that bruxers can be treated with ceramic veneered lithium disilicate restoration. ^[7]

However, leucite and lithium disilicate reinforced glass-ceramics have a hardness close to that of enamel. This could broaden the range of indications for ceramic inlays/onlays. Their manufacturing costs are high.

Conclusion

The longevity of bonded partial restorations depends on a number of factors specific to the patient, the practitioner and the properties of the biomaterials. Thus, compliance with the principles of preparation by the practitioner, as well as many other factors such as the choice of materials, the method of assembly, occlusion, patient hygiene, Lithium disilicate posterior crownlays show an excellent complication-free survival rate, and the material allows for conservative restorations with minimum thickness. The responsible clinician must be sensitive to all sensitivities and establish a compromise treatment plan to achieve an esthetic and durable partial restoration, according to the specifics of the clinical case, the patient's wishes and the current state of science, and therefore must adhere to certain principles during the design. Hence, the study concludes if strict cementation protocol with rubber dam isolation is followed it increases longevity of the restoration.

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