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INTEGRAL APPROACH FOR INDIVIDUAL SMILE REHABILITAION: ESTHETIC AND FUCTIONAL CONTRIBUTIONS

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Summary: The rehabilitation of an unesthetic smile in the anterior maxilla is always a clinical challenge, especially when an improper shape and size, old restorations, and unesthetic shading are present. In addition, an irregular gingival zenith contour in the anterior maxilla can affect the smile's harmony. Thus, detailed treatment planning is needed to define a functional and esthetic prosthetic rehabilitation. This study describes a clinical case in which a 38-year-old woman was rehabilitated using principles of Digital Smile Design planning and ceramic veneers guided by microinvasive preparation in the anterior zone of the maxilla. To normalize the gingival contour was done diathermocoagulation procedure with the immobilization of gingival level. Next steps included micropreparation, provinalization and fixation of completed veneers. Complex integral approach demonstrated in this clinical cases contributes to the achievement of successful functional and clinical results, that meet patient personal expectations.

Key words: functional and esthetic rehabilitation, veneers, DSD-principles.

Introduction. Restorative dentistry with the realization of guiding functional esthetical outcomes has become widely relevant, largely as a result of social tendencies and increased media profile. Corresponding adaptation of principles of smile designing for any restorative work can progressively refine the esthetics profile of the patients and their proper social arrangement. An understandable request for the supported perfect smile needs to be moderated with an appropriate awareness of the significant risks associated with invasive cosmetic procedures such as veneers and crowns. But even so, the esthetic treatment of anterior teeth with veneers is a conservative and lasting treatment option argumented by the results of series of clinical studies (Bottino M. A. et al., 2009). The treatment of esthetically critical zones depends on the attainment of a healthy, harmonious to the surrounding tissue, and an attractive smile line. When the tooth is severely discolored, the clinician must choose a veneer ceramic system very carefully, because translucent materials, such as hot-pressed ceramic, require excessive reduction of the dental structure to mask the discoloration (Gürel G., 2003). Even minimally invasive prosthetic restorations also require removal of sound enamel, so sometimes, it may be preferable to extend the veneer preparations beyond the contact points toward the palatal surface, to hide the margins of the restoration, which necessitates removal of additional tissue. Improvements in adhesive technologies provides conditions for wide use of indirect restorations that may be applied with removal of only a superficial layer of enamel. Progress in adhesive technologies has made possible a variety of more conservative restoration techniques (Conrad H. J., 2009). For example, when the colour of the existing substrate (the patient’s teeth) is acceptable, thin porcelain laminate veneers (0.3–0.7 mm) may be suitable [9-10]. The term “minimally invasive” is also used to describe full veneers

that wrap around the teeth, although such restorations actually cover the buccal and palatal surfaces of the prepared teeth. Restoration of missing dental tissues may be provided not only with ceramic veneers, but also with direct resin composites, such manipulations are quick and minimally invasive. This approach is inexpensive, the resulting restoration is easy to repair, and the esthetic results are acceptable. What is more, continual improvements in adhesive restorative materials and techniques have expanded the indication field of direct and indirect adhesive restorations, resulting in a greater overlap between both restoration types. Obviously, more and longer-term clinical trials were available for the indirect partial ceramic restorations, showing lower annual failure rates compared to their similarly sized direct composite restorations (Millar B. J., 2015). In addition, these restorations can function quite well in the medium and even long term. Patient and operator are the most important factors determining the longevity of adhesive restorations, followed by the materials and maintenance of the restorations. But even if taking into account all the implementation, such as progressive adhesive techniques, preparations method and improvements in ceramic materials manufacturing, there are still some complications that arise during individual clinical situations [9-11].

One of them is the preservation or reproduction of optimal mucogingival aesthetics can be difficult to achieve from both a functional and aesthetic perspective (Peto D., 2015). These difficulties are exacerbated where a patient presents with a so-called high smile line exposing differing lengths of teeth in the aesthetic zone. Sometimes because of lack of communication between dentist and patients there is a difference in their clinical and aesthetical outcomes expectations. However, many of these pieces of information may not be taken into consideration if their real meaning is not transferred in an adequate way to the design of the restorations. That's why the use of digital smile design system must guide the succeeding phases of the rehabilitation, scientifically integrating all of the patient's needs, desires, functional, structural, and biological issues into the esthetic treatment design. It works as a frame of reference for the treatment that will be performed (Coachman C., 2013). The use of the DSD can make the diagnosis more effective and the treatment planning more complete, and the effort required to implement it is rewarded as the treatment sequence becomes more logical and straightforward, time and materials are saved, and the costs of treatment are reduced [15-16].

This case report describes the treatment of female patients with complaints for her exterior smile profile due to the problems with anterior teeth. The complex and integral use of DSD-principals, wax-up and relevant ceramic materials guided by micro-invasive preparation made it possible to restore her dental status to the proper esthetical conditions that meets her personal expectations.

Case report. 38-old female patients visit the University Dental Clinic of Uzhgorod National University with the complaints of her anterior frontal teeth look. She was dissatisfied with the form of teeth, differences of coloration and position, and the formation of interdental spaces that were visualized during the smile. Previously teeth were restoratively and endodontically treated, but outcomes were discontented (Fig.1)

Figure 1. View of patients teeth with retractor

After discussion patient was proposed with the option of ceramic veneers to restore optimal clinical smile profile guided by micro-invasive preparation technique. Also, patient was informed about the perspective of DSD-principles use to understand and consolidate with her expectations. On the next visit DSD-modeled form and view of full rehabilitated smile were presented to patient. After she agreed with the successful aesthetic outcomes the active phase of treatment was started.

Firstly, correction of gums level was done due to the parameters of biological with and indicators found during DSD-analysis. Gingivocorrection was done by the diathermocoagulation after retraction step, the level of gingiva reduction was different at different position, but didn't exceed 1 mm (Fig. 2-3). To preserve adequate gums level the soft tissue was immobilized with flow composite for 2 weeks (Fig. 4).

Figure 2. Retraction of gums

Figure 3. Correction of gums level with diathermocoagulation due to biological width parameters and indication of DSD-analysis

Figure 4. Immobilization of corrected gums position with composite

After two weeks preparation phase was initiated. After achieving adequate hard tissues reduction provisional crowns made by the laboratorial algorithm were placed (Fig.5-6).Final restoration with gingiva mask was made of feldspathic ceramic and fixed using Relyx Ultimate cement with adaptive adhesion protocol after 12 days (Fig. 7-10). After immediate fixation was noticed countered red profile at the gum level, but within the 3 weeks soft tissue arise to the normal condition contributing to the adequate emergency profile with definitive restoration.

Figure 5. View after preparation

Figure 6. View after the provizinalization. Provisional crowns were made by laboratory protocol.

Figure 7. View of final restoration with gingival mask.

Figure 8. View of final restoration with gingival mask.

Figure 9. View right after cementation of final restoration

Figure 10. View with the healed soft tissue contour and adequate esthetic profile after 3 weeks

Discussion. This clinical report describes a situation in which application of feldspath ceramic veneers was chosen as the therapy of choice to provide optimal cosmetic and functional result. As stated Kumar M. V. and Gulivindala D. (2015), in cosmetic dentistry, success lies largely in understanding complaints and expectations of patients, therefore, before choosing an aesthetic treatment, it is important that they be able to visualize the desired outcome, be involved in decision making while storing medical records safeguards any unintended consequences. Practitioners understand that investment in modern, top level equipment, allows therapeutic approaches that equally respond functional and aesthetic needs of patients along with an increased confidence and higher professional satisfaction (Ackerman M. B., Ackerman J. L., 2002; Kim K. et al., 2015). That's why during the presented clinical case was use DSD-principles, that provides following advantages during the treatment:

- aesthetic diagnosis: after careful examination of patient characteristics in terms of facial and dental analysis, digital analysis of photographs introduced into software and drawing reference lines allow observation and highlighting of issues that could not be observed clinically;
- communication: although rendering the aspects of cosmetic dentistry is achieved by the dental technician on a wax model–wax-up – according to the instructions on the teeth form, color, arrangement supplied by the dental practitioner, sometimes the final restoration is more likely to not fully meet patient's expectations;
- DSD-makes possible transmission of more elaborate data in four dimensions: aesthetics, functional, structural and biologic (Beuer F. et al., 2015);
- feedback: treatment steps stored in slides with photos, videos, notes, charts and drawings allow accurate analysis and evaluation of all stages of restoration as well as revisions, revaluations or comparisons among different treatments (Coachman C., Calamita M., 2013).

DSD helped not only agree with patients expectations, but also to form some indication for gums level correction due to the influence of biological width considerations, which consists of a sulcus depth of 0.69 mm, an epithelial attachment of 0.97 mm, and a connective tissue attachment of 1.07 mm, stated to be totally stated of 2.04 mm. There is general agreement that placing restorative margins within the biologic width frequently leads to gingival inflammation, clinical attachment loss, and bone loss (Peto D., 2015). This is thought to be due to the destructive inflammatory response to microbial plaque located at deeply placed restorative margins. Clinically, these changes are manifested as deepened periodontal pockets or gingival recession. These changes have been substantiated by studies that have assessed the histological and clinical responses of periodontal tissues to restorative margins placed within the biologic width. Recently, Gunay et al. (2000) demonstrated that restorative margin placement within the biologic width was detrimental to periodontal health/ It was shown that margins positioned subgingivally were associated with the most gingival inflammation leading to violation of biologic width, whereas supragingivally located crown margins were associated with the least gingival inflammation. Supragingival placement of restoration margins allows for ease of impression making, cleansing, and detection of secondary caries and is associated with maintainable probing depths. Subgingival restorations can have damaging effects on the neighboring hard and soft tissues, especially when they encroach on the junctional epithelium and supracrestal connective tissue (Schmidt J. C. et al., 2013). Due to stated above to provide optimal gingiva level was

done correction with use of diathermocoagulation. Corrected volume was different above every tooth by the formed profile was maximally adequate and expected. Correction was done within 1 mm near every tooth. To save such position of gums was done immobilization with the use of flowable composite (Lee E. A., 2004) [19-20]. After gums healed status was determined, the next phase of treatment started which consists of preparation and use of provisional crowns.

When creating a feldspathic porcelain veneer, it is necessary to realize that the space required for shade change ranges from 0.2 mm to 0.3 mm per shade (Layton D. M., 2011) [1]. It is also important to consider the condition of the substrate to which the veneers will be bonded. To successfully bond feldspathic veneers, the requirements that must be met include 50% or more enamel on the tooth, 50% of the bonded substrate must be in the enamel, and 70% or more of the margin must be in the enamel, as was stated by Alex G. (2008) and Yavuz T. et al. (2013) [3-4]. It is always preferable to preserve the cingulum and lingual marginal ridges, as these anatomic landmarks provide the tooth with more than 80% of its strength. Also, due to Layton D. M. et al., when deciding whether to use feldspathic veneers, it is also necessary to undertake a flexural risk assessment. Flexural risk tends to be higher when bonding to higher levels of dentin because dentin tends to be more flexible than enamel. If bonding to enamel, the flexural risk is low to moderate (Yu H. Y. et al., 2006) [2]. A simple but strong determinant of tooth flexure is to observe mesial–distal craze/fracture lines on the lingual. Tensile and shear stress risk assessments are also necessary when deciding on feldspathic porcelain veneers Therefore, to preserve the health of the gingival tissues and prevent overcontouring, a slight 0,5-0,7 mm reduction of tooth surface was done depends on anatomical conditions of each tooth [13, 14].

After creating appropriate prepared teeth profile provisional crowns were placed over them. Provisilization has become a critical tool in testing the understanding between the dental professional and patient. A provisional restoration allows time for adaptation, to see if the proposed smile changes work for you and if they are compatible with gingival (gum) health and biting function (Shopper D. P., Shopper H. P., 2012). If the provisional restoration works, the final restoration is guaranteed to work. The essential difference between the provisional and the final restoration is the materials from which they are made [21-23]. The final ceramics are more durable and longer lasting than the plastics generally used for the provisional restorations.

After 3 weeks, when emergency gums contour was adapted definitive restoration were placed with the use of Relyx Ultimate cement. Sometimes, patients not sure what to choose: composite direct veneers of their indirect ceramic analogues. In one clinical study, there was no significant difference in patient satisfaction with composite or ceramic veneers immediately after placement, but after 2 years of clinical service, patients were significantly more satisfied with the ceramic restorations (Peumans M. et al., 2000; McLaren E. A., Figueira J., 2015). In another study, survival rates for veneer restorations were 94% for ceramic restorations, 90% for indirect composite restorations and 74% for direct composite restorations [5]. However, the material used for the restorations had no significant influence on absolute and relative failures. In yet another clinical study, direct resin composite veneers had a failure rate of 14% over 3 years of service, with a low incidence of marginal staining. Various clinical studies of Layton D. M. and Walton T. R. (2011) have shown that the survival rate for bonded ceramic veneer restorations is more

than 90% over 10 years of clinical service. In those studies, the failures reported were either cohesive ceramic fractures (the majority) or failures of the adhesive between the cement and the tooth surface. Adhesive-related failures could be attributed to the extent of tooth preparation. Particularly with deep preparations in dentin, less adhesion can be expected relative to enamel. In fact, the bond strength of composite cement to enamel is in the range of 40 MPa, sometimes exceeding the cohesive strength of enamel itself. Failure of the adhesive between cement and enamel was rarely observed. In addition to fractures, other types of failure, such as microleakage and debonding, have been reported [6].

In this context, as an alternative to direct resin composite restorations, small pieces of thin ceramic veneers could be etched and adhered to enamel to restore the small defects, and this approach was applied in the current case. However, one of the most important aspects for long-term survival with these fragile restorations is the bonding procedure. Hence, the clinical success of the bonded porcelain restorations is largely determined by the quality of adhesion. For the ultimate esthetic outcome, a minimum thickness of resin cement at the interface is required, since resin composites are more prone to wear and discoloration than ceramic restorations. For implementation of bonding protocol in presented case was use RelyX Ultimate, which is an adhesive resin cement used in combination with Scotchbond Universal Adhesive. It is dual curing and supplied in an automix syringe. The cement can be used either in a “total etch” or “self-etch” procedure. RelyX Ultimate, in combination with Scotchbond Universal Adhesive, is indicated for the final cementation of all ceramic, resin nano ceramics, composite, and metal restorations, including inlays, onlays, crowns, bridges, Maryland bridges, veneers, and posts. Scotchbond Universal Adhesive is applied to the tooth and also to the internal aspect of the restoration. No additional silane or primer is needed for the restorative material. The cement contains a component that acts as a dual-cure activator for the adhesive. Working time is 2:30. Light-curing time is 20 seconds per surface, and self-curing time is six minutes. RelyX Ultimate was evaluated by 36 consultants in 962 uses. It received a 96% clinical rating. Use of such progressive and respectfull material made its own contribution for achieving successful definitive outcomes, and also helped to eliminate mistakes, that can occur with the use of other bonding systems.

View with the healed soft tissue contour and adequate esthetic profile after 3 weeks fully meets patients expectations, and, thus, functional stability of constructions is argumented by consideration of adequate occlusion conditions and interproximal contacts situation.

Conclusion

Currently, the properties of ceramics indicate that they are materials capable of mimicking human enamel and their mechanical properties are expanding their clinical applications. Therefore, based on this literature review, it is possible to conclude that the clinical success of ceramic veneers depends on both the suitable indications of the patient and the correct application of the materials and techniques available for that, in accordance with the necessity and goals of the aesthetic treatment. By understanding the concepts of aesthetics combined with top - level materials and technologies, practitioners will introduce predictability, the most desired item in dentistry, to fully meet the expectations of patients.

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