KLINIČKI RAD
CLINICAL ARTICLE

OPTIMALNA OSNOVA I DIZAJN KRUNICE KAO OSNOVA ZA USPEŠNU PROTETSKU RESTAURACIJU

OPTIMUM FRAMEWORK AND CROWN DESIGN AS THE BASIS FOR SUCCESSFUL RESTORATIONS

[1]Saša Stanković, [2]Mirjana Bošković; [3]Danimir Jevremović

[1]KLINIKA ZA STOMATOLOGIJU, MEDICINSKI FAKULTET, ODELJENJE ZA STOMATOLOŠKU PROTETIKU, NIŠ, SRBIJA
[2]PRIVATNA STOMATOLOŠKA ORDINACIJA „DR MIRJANA BOŠKOVIĆ“, NIŠ, SRBIJA
[3]STOMATOLOŠKI FAKULTET PANČEVO, SRBIJA

[1]FACULTY OF MEDICINE, UNIVERSITY OF NIS, SERBIA
[2]PRIVATE DENTAL PRACTICE 'MIRJANA BOSKOVIC', NIS, SERBIA
[3]FACULTY OF DENTISTRY, DEPARTMENT OF PROSTODONTHICS, PANCEVO, SERBIA

Apstrakt

Uvod: *izrada estetske restauracije u stomatološkoj protetici predstavlja veliki izazov zahtevajući i odgovarajuće veštine. Odabir korektnog materijala u pojedinim indikacijama je prvi težak zadatak. Takođe, kombinacija materijala i njihova biokompatibilnost predstavlja sledeći izazov. Iako je prisutno izuzetno povećanje broja fiksnih bezmetalnih restauracija, metal-keramičke nadoknade još uvek zauzimaju važno mesto.*
Materijal i metode, cilj *ovog rada je da prikaže praktičnu primenu stomatoloških legura firme Ivoclar Vivadent (Liechtenstein) i to Colado CC koja je na bazi kobalta i hroma, Calisto CP⁺ koja sadrži kobalt i paladijum i 4all koja predstavlja leguru na bazi nikla i hroma.*
Zaključak: *postizanje prirodne nijanse i oblika zuba, imitacija različitih iregularnosti (rotacija, malpozicija), kao i struktura površine su odlučujući faktor za ostvarivanje estetskih indirektnih restauracija. Estetski aspekt protetske restauracije je odlučujući za zadovoljstvo pacijenta. Međutim, ukoliko metalna osnova nije korektno dizajnirana i ispolirana, dugotrajni uspeh restauracije ne može biti osiguran.*

Ključne reči: *estetska restauracija, legura, krunica, most*

Abstract

The fabrication of an esthetic restoration is a particular craft. The selection of the correct material for the respective indication is the first difficult task. The combination of materials and their compatibility is the second challenge. Even if an increasing number of fixed metal-free restorations are fabricated today, metal-ceramic restorations still constitute the largest share. Particularly in distal areas, where the restorations and bridges are exposed to high compressive, bending, shear and tensile forces, metal-ceramic restorations have proved their worth.
This article shows three alloys from Ivoclar Vivadent(Liechtenstein): Colado CC is a cobalt-chromium ceramic alloy, Callisto CP⁺ is a cobalt-based alloy containing palladium and 4all is a nickel-chromium ceramic alloy.
In addition to a natural shade and shape, the imitation of irregularities (rotation, wear) and the surface structure are decisive for the lifelike appearance of a restoration. However, if the framework has not been correctly designed and the alloy cast and finished carefully, the long-term success of the restorations cannot be ensured. Hence, the correct framework design is the basis for a durable, esthetic restoration.

Key words: *esthetic restoration, alloy, crown, bridge*

Uvod

Izrada estetske restauracije u stomatološkoj protetici predstavlja veliki izazov zahtevajući i odgovarajuće veštine. Odabir korektnog materijala u pojedinim indikacijama je prvi težak zadatak. Takođe, kombinacija materijala i njihova biokompatibilnost predstavlja sledeći izazov. Iako je prisutno izuzetno povećanje broja fiksnih bezmetalnih restauracija, metal-keramičke nadoknade još uvek zauzimaju važno mesto. Naročito u distalnim partijama, gde su indirektne restauracije izložene visokim pritiscima, savijanju, silama smicanja i vučenja, predstavljaju način rešavanja parcijalne bezubosti.

Introduction

The fabrication of an esthetic restoration is a particular craft. The selection of the correct material for the respective indication is the first difficult task. The combination of materials and their compatibility is the second challenge. Even if an increasing number of fixed metal-free restorations are fabricated today, metal-ceramic restorations still constitute the largest share. Particularly in distal areas, where the restorations and bridges are exposed to high compressive, bending, shear and tensile forces, metal-ceramic restorations have proved their worth.

Cilj ovog rada je da prikaže praktičnu primenu stomatoloških legura firme Ivoclar Vivadent (Liechtenstein) i to Colado CC[1] koja je na bazi kobalta i hroma, Calisto CP+ [2]koja sadrži kobalt i paladijum i 4all[3] koja predstavlja leguru na bazi nikla i hroma. U tabeli 1 je dat sastav svake od legura.

Colado CC is a cobalt-chromium ceramic alloy, Callisto CP+ is a cobalt-based alloy containing palladium and 4all is a nickel-chromium ceramic alloy.

Tabela 1.

Sastav**:**
Colado CC:
Co 60.0, Cr 25.5, Mo 5.5, W 5.0, Ga 3.0, Nb - 1.0, Fe - 1.0, B - 1.0
Interval topljenja: 1170 – 1380 **°C**
Temperatura livenja: 1380 – 1410 **°C**
Oksidacija: 950 **°C**, 1 min., u vakuumu

Callisto CP+:
Pd 25.0, Co 40.0, Cr 21.4, Mo 12.7, W - 1.0, B - 1.0, Ta - 1.0
Interval topljenja: 1185 – 1275 **°C**
Temperatura livenja: 1345 – 1385 **°C**
Oksidacija: 900 **°C**, 1 min., bez vakuuma

4all:
Ni 61.4, Cr 25.7, Mo 11.0, Si 1.5, Mn - 1.0, Al - 1.0, C - 1.0
Interval topljenja: 1260 – 1350 **°C**
Temperatura livenja: 1405 – 1465 **°C**
Oksidacija: 950 **°C**, 1 min., bez vakuuma

Table 1.

Composition:
Colado CC:
Co 60.0, Cr 25.5, Mo 5.5, W 5.0, Ga 3.0, Nb - 1.0, Fe - 1.0, B - 1.0
Melting interval: 1170 – 1380 **°C**
Casting temperature: 1380 – 1410 **°C**
Oxidation: 950 **°C**, 1 min., with vacuum

Callisto CP+:
Pd 25.0, Co 40.0, Cr 21.4, Mo 12.7, W - 1.0, B - 1.0, Ta - 1.0
Melting interval: 1185 – 1275 **°C**
Casting temperature: 1345 – 1385 **°C**
Oxidation: 900 **°C**, 1 min., without vacuum

4all:
Ni 61.4, Cr 25.7, Mo 11.0, Si 1.5, Mn - 1.0, Al - 1.0, C - 1.0
Melting interval: 1260 – 1350 **°C**
Casting temperature: 1405 – 1465 **°C**
Oxidation: 950 **°C**, 1 min., without vacuum

Izrada metalokeramičkog mosta i pune livene krunice

1. Preparacija

Uspeh metalo-keramičke restauracije počinje još u fazi izrade gipsanog modela. Nakon redukcije gingivalnog polja, koje treba posmatrati pod mikroskopom, pristupa se iz-

Fabrication of a PFM bridge and a full cast crown

1. Preparation

The success of metal-ceramic restorations starts as early as with the stone model. After the reduction of the gingival area, which I usually carry out under the microscope, an anatomic

radi nadoknade u vosku na modelu koji ima separirane segmente (sl.1). Pokretni model dozvoljava minimalne pokrete tako da se konačna adaptacija cervikalnog regiona radi na nesegmentiranom gipsanom modelu. Na ovaj način je moguće postići pravilno marginalno zatvaranje nakon livenja.

2. Izrada osnove u vosku

Za izradu stabilne osnove neophodno je pažljivo modelovanje u vosku. Međutim, postavlja se pitanje šta čini korektni dizajn. Jednostavno rečeno, dobro dizajnirana osnova je redukovana reprodukcija oblika i morfologije zuba u prirodnoj veličini. Metalna osnova mora biti tako urađena da je neophodna debljina keramičkog sloja od 1 do 1,5mm. Da bi se ovo postiglo, treba obratiti pažnju na veličinu kontrakcije keramičkog sloja koji je direktno proporcionalan debljini. Preciznije objašnjeno to znači da je cervikalna regija precizno reprodukovana i da ostavlja dovoljno prostora za keramički sloj. Ukoliko je keramički sloj tanak, opaker prosijava kroz keramiku i daje neprirodan izgled. U prevenciji izbegavanja termalnog stresa voska, nožić za modelovanje mora da bude zagrejan na određenoj temperaturi (sl.2 i 3).

3. Livenje legura

Nakon izlivanja i sporog hlađenja, metalni objekat je izliven. Pri tome treba voditi računa da ne zaostane materijala za ulaganje u metalnoj osnovi. Prisutne mastikatorne sile, naročito u predelu prvog molara, kao i nedovoljno prostora, onemogućavaju fasetiranje keramičkim slojem. Najmanji prostor koji je dovoljan za keramičku fasetu je 1,1mm. Ukoliko to nije ispunjeno može da se uradi puna metalna krunica (sl.4). Nakon izlivanja, legura ne pokazuje poroznost, demonstrira glatku površinu i detaljni anatomski oblik.

Metalna osnova se konačno obrađuje karbidnim borerima nakon izlivanja. Metalna površina se dalje obrađuje finim borerima da se ne bi akcidentalno krunica otvorila. Ona mora biti tako urađena da je minimalna debljina 0,3 do 0,5 mm, tako da ne dođe do krivljenja metalne osnove, a kao posledica toga i pucanja keramičke fasete. Na kraju se metalna osnova

wax-up is prepared on a model with detachable segments (Fig. 1). Since the removable model dies still allow for minimum movement, the final adaption of the cervical region is made on a non-segmented stone model. Only in this way can an exact marginal fit after casting be achieved.

2. Framework fabrication in wax

For the fabrication of a stable framework, the corresponding design should be carried out in wax. What, however, constitutes the correct design? The attempt to answer this question might very well fill an entire book. Simply put, a well designed framework is a reduced reproduction of the shape and contours of the tooth in due proportion. A metal framework should have such a shape that the overlying ceramic layer demonstrates an even thickness of 1 to 1.5 mm. If we are able to achieve this ratio between the framework and the ceramic, three substantial advantages ensue: Stability of the restoration, even shade of the entire restoration (since the shade depends on the layer thickness) as well as controlled shrinkage – the thinner the ceramic layer, the less shrinkage occurs.

In detail, this means: The cervical area is precisely reproduced. It is extremely important to create enough space for the ceramic layer in the shoulder area. If the ceramic layer in the shoulder area is too thin, the opaquer will shine through the ceramic and the entire cervical area will appear opaque to too light in terms of shade. In order to prevent distortion of the wax through thermal stress, the wax knife should demonstrate the correct temperature (Figs 2 and 3).

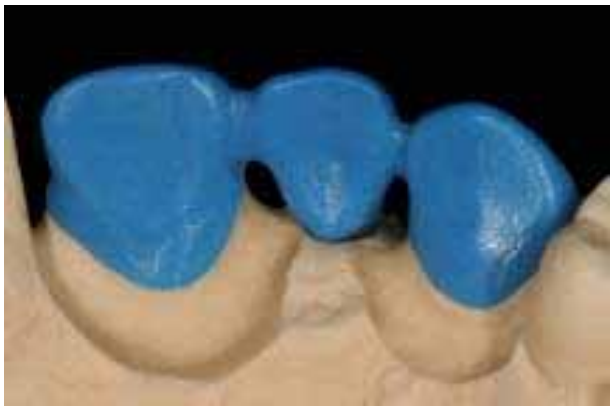
3. Processing the alloys

After casting and slow cooling, the metal object is divested. It has to be made sure that no investment material has been trapped in the metal. Given the high masticatory forces exerted on the first molars and the insufficient space, ceramic veneering is not possible. The entire metal-ceramic veneer requires at least 1.1 mm of space. This is not possible here. Therefore, I decided to fabricate a full cast crown (Fig. 4). The fully anatomical wax-up is sprued in accordance with H. Thiel and provided with cooling grooves. After divesting, the alloy does not show any porosity and demonstrates a smooth surface, light colour and a detailed anatomic shape.

The frameworks are finished with tungsten carbide burs after divesting. In a next step, the surface is finished with ceramic-bonded grind-

Sl. 1. Model sa separiranim segmentima
Fig. 1. Model with detachable segments

Sl. 2. Labijalni izgled voštane osnove
Fig. 2. Labial view of the wax framework



Sl. 3. Palatinalni izgled voštane osnove (neseparirani model)
Fig. 3. Palatal view of the wax framework (non-segmented model)

Sl. 4. Puna livena kruna
Fig. 4. Full cast crown

peskira aluminijum-oksidom pod preporučenim pritiskom. On zavisi od tipa legure i treba se držati uputstva proizvođača. Tokom peskiranja voditi računa da brizgaljka aparata za peskiranje bude pravilno usmerena ka objektu. U tom smislu, voditi računa da ne dođe do ugrađivanja partikula peska u površinu objekta, što može dovesti do formiranja vazdušnih mehurića tokom pečenja keramike.

Sledeće fotografije predstavljaju važnost poštovanja svih prethodnih procedura. Prvi red slika pokazuje metalnu osnovu nakon izlivanja i obrade na modelu (sl.5a-c). Drugi red slika pokazuje metalne osnove nakon obrade metalne površine finim borerima (sl.6a-c) gde vidimo da nema poroznosti legure. Treći red slika pokazuje izgled legura nakon peskiranja korišćenjem peksa veličine čestice od 100 mikrometara (sl.7a-c). Peskiranje je vrlo važan korak tokom kojeg je legura pripremljena za mehaničku i hemijsku retenciju. Četvrti red pokazuje legure nakon oksidacije (sl.8a-c). Svaka

ing instruments. The metal surface is finished in one direction only to prevent overlaps and holes. It must be made sure that a minimum thickness of 0.3-0.5 mm is maintained so that the framework does not distort, the ceramic does not loosen due to tensions and cracks do not develop. The framework is finally blasted with aluminium oxide with the recommended pressure. This pressure may differ depending on the alloy type – I usually follow the respective instructions from Ivoclar Vivadent. During blasting, the nozzle of the blasting device should be held in a flat angle to the object surface. In this way, no blasting medium particles are embedded in the surface, which may then lead to the formation of bubbles during ceramic firing.

Oxidation – even if oxidation is not stipulated by the alloy manufacturer, this step belongs to my standard procedure before the application of the first opaquer layer. This permits a visual

Colado CC *Callisto CP+* *4all*

Sl. 5. a-c Metalne osnove nakon postave na modelu
Fig. 5. a-c Metal frameworks after fitting on the model

Sl. 6. a-c Nakon poliranja i finiširanja sa brusnim instrumentima
Fig. 6. a-c After surface finishing with grinding instruments

Sl. 7. a-c Legure nakon peskiranja
Fig. 7. a-c Alloys after sandblasting

Sl. 8. a-c Legure nakon oksidacije
Fig. 8. a-c Alloys after oxide firing

legura ima originalnu boju koja zavisi od sastava legure. Ne zahtevaju sve legure oksidaciju, ali boja oksida nas ponovo uverava da nema kontaminacije.

Krunica molara je jedan primer kako se ponašaju legure, naročito u kliničkim slučajevima kada nema dovoljno prostora i kod pacijenata koji pate od bruksizma. U takvim slučajevima, molarna krunica treba biti izrađena bez keramičke fasete. Sa dobrom legurom poliranje nakon pečenja je vrlo lako i sprovodi se za nekoliko minuta[4] (sl.10a-c).

inspection with regard to a possible contamination of the metal.

These two pages show all the important steps after casting in detail. The first row of pictures shows the metal frameworks after precise fitting on the model ready for try-in (Figs 5 a-c). The second row shows the frameworks after surface finishing with ceramic-bonded grinding instruments (Figs 6 a-c). It is clearly visible that finishing was carried out in one direction only so that no porosity developed. The third row shows the appearance of the alloys after

Colado CC *Callisto CP+* *4all*

Sl. 9. a-c Provera boje oksida
Fig. 9. a-c Checking the oxide colour

Sl. 10. a-c Pune livene krune polirane do visokog sjaja
Fig. 10. a-c Full cast crowns polished to a high gloss

Sl. 11. a-b Površinska tekstura prednjeg mosta
Fig. 11. a-b Surface texture of the anterior bridge

Izrada prednjeg mosta sa IPS InLine fasetirajućom keramikom

Peskiranje, čišćenje i oksidacija moraju biti ponovljeni ukoliko nije prisutan oksidni sloj. Ovo je jedna od važnijih faza u pažljivoj obradi površine osnove. Dok peskiranje poboljšava mehaničku retenciju povećanjem hrapavosti površine, oksidacija je važna za ostvarivanje

sandblasting using the recommended grain size of 100 µm (Figs 7 a-c). Blasting is an important step during which the alloy is prepared for chemical and mechanical retention.

The fourth row shows the alloys after oxidation firing (Figs 8 a-c). Every alloy has its own oxide colour which depends on the composition of the alloy. Not all alloys require oxidation, but an even oxide colour is a reassurance that no contamination took place.

The molar crown is only one example for the behaviour of the alloy, since the molar crown often constitutes the last bridge abutment in clinical cases if space is insufficient or the patient suffers from bruxism. In such cases, the molar crown should be fabricated without ceramic veneer. Once the crown is placed into the furnace after high-gloss polishing with metal grinding tools and polishers, oxides form on the surface (Figs 9 a-c). With a good alloy, polishing after glaze firing is very easy and takes only a few minutes (Figs 10 a-c).

Fabrication of an anterior bridge with the IPS InLine veneering ceramic

Blasting, cleaning and oxidizing must be repeated if the oxide layer is not even. This is a decisive step of careful surface finishing and important basic work.

While sand blasting improves the mechanical bonding strength by increasing and rough-

hemijske veze. Prvo pečenje opakerom ostvaruje prvi preduslov za postavu keramičkog sloja. Opaker se nanosi u tankom sloju četkicom. Voditi računa da hrapava površina bide vlažna rastvorenim opakerom. Drugi sloj opakera se aplikuje samo za definisanje nijanse i nije absolutno važan za ostvarivanje veze. Prema tome, drugi sloj opakera treba aplikovati u tankom sloju, tako da maskira sivu boju metalne legure. Ukoliko legura i nakon drugog pečenja prosijava, treba aplikovati i treći sloj[5].

Nakon izrade optimalne metalne osnove i ciklusa pečenja opakera, keramika se slojevito nanosi u cilju postizanja prirodnih karakteristika zuba. Ove tri legure su kompatibilne sa IPS InLine keramikom (Ivoclar Vivadent), što omogućava karakterizaciju veštačkih zuba u prirodne restauracije[6] (sl.11a-b).

Zaključak

Postizanje prirodne nijanse i oblika zuba, imitacija različitih iregularnosti (rotacija, malpozicija), kao i struktura površine su odlučujući faktor za ostvarivanje estetskih indirektnih restauracija. Estetski aspekt protetske restauracije je odlučujući za zadovoljstvo pacijenta. Međutim, ukoliko metalna osnova nije korektno dizajnirana i ispolirana, dugotrajni uspeh restauracije ne može biti osiguran.

ening the surface, oxidizing is important for the chemical bond. The first opaquer firing creates the necessary prerequisites for the ceramic bond. For that reason, this step should be executed with particular care. The opaquer is applied in a thin layer using a brush. It must be ensured that the entire roughened surface is wetted with the diluted opaquer.

The second opaquer layer is only applied to define the shade and is not absolutely crucial for the bond. Therefore, the second opaquer layer should be applied in a thin, even layer that entirely masks the grey colour of the metal alloy. If the alloy still shines through in certain areas after the second firing, a third layer can be applied. If this is not done, the final shade of the restoration is affected.

After optimum framework design and the opaquer firing cycles, the ceramic is layered as usual and provided with the true-to-nature characteristics of the adjacent teeth. Since all three alloys are compatible with the IPS InLine ceramic from Ivoclar Vivadent, the advantages provided by the various characterization materials can be used to fabricate lifelike restorations. This true-to-nature appearance is clearly evidenced by the completed maxillary bridge (Figs 11 a-b).

Conclusion

In addition to a natural shade and shape, the imitation of irregularities (rotation, wear) and the surface structure are decisive for the lifelike appearance of a restoration.However, if the framework has not been correctly designed and the alloy cast and finished carefully, the long-term success of the restorations cannot be ensured. Hence, the correct framework design is the basis for a durable, esthetic restoration.

LITERATURA / REFERENCES

1. Ivoclar – Vivadent: Manual instructions for Colado CC. Ivoclar Vivadent AG, Schaan, 2005.

2. Ivoclar- Vivadent: Scientific documentation for dental alloys. Ivoclar Vivadent AG, Schaan, 2008.

3. Ivoclar-Vivadent: Scientific documentation clinical products. Ivoclar Vivadent, Schaan, 2006

4. Wataha JC. Alloys for prosthodontic restorations. J Prosthet Dent 2002;87:351-363

5. Anusavice KJ. Phillip's Science of Dental Materials. Philadelphia: WBSaunders, 1996.

6. Setcos JC, Mahani BA, DiSilvio L, Mjord IA, Wilson HN: The safety of nickel containing dental alloys. Dental Materials 2006; 22(12): 1163-1168.

Adresa za korespondenciju:
Prof.dr Saša Stanković
Ul. Mije Petrovića 9, 18000 Niš, Republika Srbija
e-mail:petras@nadlanu.com

Address of correspondence:
Assoc. Prof. Saša Stanković, D.D.S., MSD, Ph.D.
Mije Petrovica str. 9, 18000 Nis, Serbia
e-mail:petras@nadlanu.com