

## THE RECOVERY OF THE ESTHETIC AND MASTICATORY FUNCTIONS BY MINIMAL INVAZIVE RESTORATIONS: A REVIEW

Andrei Kozma<sup>1</sup>, Cristina Bodnar<sup>2\*</sup>, Mădălina Dobre<sup>3</sup>, Doriană Agop-Forna<sup>4</sup>, Claudiu Topoliceanu<sup>5\*</sup>, Horia Lăzărescu<sup>6</sup>, Norina Forna<sup>7</sup>

<sup>1</sup> CS II, PhD, MMD, MDHC – National Institute for Recovery, Physical medicine and Balneoclimatology, Bucharest; member of Academy of Romanian Scientists and of Romanian Academy of Medical Sciences

<sup>2</sup> Conf.univ.PhD. MD – „Carol Davila” University of Medicine and Pharmacy, Bucharest, Faculty of Dental Medicine

<sup>3</sup> MD - „Carol Davila” University of Medicine and Pharmacy, Bucharest, Faculty of Dental Medicine

<sup>4</sup> Lecturer, PhD, Faculty of Dental Medicine, University of Medicine and Pharmacy ”Grigore T.Popa”, Iasi

<sup>5</sup> Univ.assist, PhD, Faculty of Dental Medicine, University of Medicine and Pharmacy ”Grigore T.Popa”, Iasi

<sup>6</sup> CS II, PhD, MD – National Institute for Recovery, Physical medicine and Balneoclimatology, Bucharest

<sup>7</sup> Prof.univ.Dr. – Dean of Faculty of Dental Medicine, University of Medicine and Pharmacy ”Grigore T.Popa”, Iasi; member of Academy of Romanian Scientists and of Romanian Academy of Medical Sciences

corresponding authors:

\*Claudiu Topoliceanu: [claudiutopoliceanu@yahoo.com](mailto:claudiutopoliceanu@yahoo.com)

\*Cristina Bodnar: [bodnar.cristina@gmail.com](mailto:bodnar.cristina@gmail.com)

\*\*all authors have same contribution

### Abstract.

*As dental caries is a common disease with high prevalence worldwide, many researches are focused nowadays on the longevity of direct composite restorations and indirect restorations both in the anterior and posterior dental substance loss. The mean survival rates of the direct composite restorations, after follow-up period of 3-10 years, are between 85,10% and 97,40%. The mean survival rates of the indirect coronal restorations, after follow-up period of 8-10 years, are between 90,40% and 100%. In the recovery of the esthetic and masticatory functions affected by coronal substance loss, the direct composite restorations and ceramic inlays or onlays have advantages and limits. The dentists must focus on factors related to material and technique as well as on clinical and biological factors, when a repair versus replacement decision must be taken.*

**Key words:** recovery, dental substance, mastication, restorations

The development of the dental materials allowed the implementation of new conservative approaches in the treatment of the carious or non-carious dental substance loss associated to esthetic and masticatory functions disorders. As dental caries is a common disease with high prevalence worldwide, many researches are focused on the longevity of direct composite restorations and indirect restorations both in anterior and posterior dental substance loss. The ceramic and composite inlays or onlays restorations (with higher resistance to mechanical stress) are recommended but higher price and more treatment sessions, comparing with direct composite restorations, limit the use of these

therapeutic approach (1). Some factors may influence the clinical performance of ceramic and composite inlays and onlays (resistance to compressive forces and shear stresses, tooth type, tooth vitality dentist experience, the use of the computer-assisted design/computer-assisted manufacturing system) (2). The researches that evaluate the quality and longevity of the recovery of the esthetic and masticatory functions by using direct and indirect coronal restorations are usually focused on the assessment of various esthetic, functional and biologic parameters (colour stability, surface status, occlusal and proximal anatomy, marginal integrity, secondary caries). Most researches used

Ryge criteria to assess the longevity and survival rate of the direct and indirect restorations but, in the last decade, FDI system was suggested as most effective and accurate both in the research field and

dental practice (3) (table I). The literature data was reviewed in relation to the longevity of the direct coronal composite restorations and indirect coronal restorations (ceramic inlay, ceramic onlay).

Table 1. FDI Assessment criteria for direct restorations (3)

<b>A. Esthetic criteria</b>	1. Surface status; Roughness 2. Colour: a) surface b) marginal. 3. Colour correspondence and translucency 4. Anatomic form (esthetics)
<b>B. Functional criteria</b>	5. Restoration fracture and retention 6. Marginal adaptation 7. Occlusal contour. 8. Proximal contact point 9. Radiographic examen 10. Patient opinion: a) esthetics, b) function
<b>C. Biological criteria</b>	11. Reccurence of carious lesions 12. Tooth fracture; retention 13. Effect on periodontal tissues

Demarco et al.(2015) found for direct composite esthetic restorations in frontal dental group a 4.1% failure rate, due especially to fracture, colour changes, the change of anatomical form, and other factors like adhesion failure, mechanical properties of the composite resin, retreatment risk (4). Regarding anterior esthetic direct restorations, Demarco et al. (2012) also found that 90% of the clinical studies indicated annual failure rates between 1% and 3% for Class I and II posterior composite restorations, depending on several factors such as tooth type and location, operator, and socioeconomic, demographic, and behavioral elements. The material properties showed a minor effect on longevity. The main reasons for failure in the long term are secondary caries, related to the individual caries risk, and fracture, related to the presence of a lining or the strength of the material used as well as patient factors such as bruxism. The

conclusion was that a long survival rate for posterior composite restorations can be expected provided that patient, operator and materials factors are taken into account when the restorations are performed (5). Heintze et al (2015) found for direct composite restorations localised to anterior dental group, with a minimum 10 years age, a failure rate between 5% for class III restorations and 10% for class IV restorations, with highest failure rate represented by marginal and bulk fracture (6).

In a review of the studies performed in the last two decades, Mjor et al.(2000) found the decrease of the direct coronal restorations replacement due to the fatigue and degradayion and an increase of the replacement due to the marginal fracture, bulk fracture or recurrent caries (7). Tyas (2005) found a 7.1 years mean replacement age for direct coronal esthetic restorations, superior to glassionomer cements (5.7

years), but inferior to amalgam restorations (13.6 years) (8). Opdam et al (2014) investigated the influence of patient-, materials-, and tooth-related variables on the survival of posterior resin composite restorations, using 12 longitudinal studies of direct posterior resin composite restorations with at least 5 years' follow-up. The review found for patients with high cariogenic risk, 2-3 times increase of the annual failure rate comparing with low cariogenic risk patients, in the treatment of coronal loss to molars and premolars. Also, the presence of a liner or base from glass-ionomer cement was shown to have a negative influence on survival of the restoration (9).

A study that evaluated the clinical performance of class I and II hybrid composite restorations after 4 years, found a cumulative failure frequency of 7.5%, with reasons for failure partial material fracture, cusp fracture, and endodontic treatment. The conclusion of this study was that an annual failure rate of 1.9% provided a good clinical performance during the 4-year period (10). Van Dijken et al (2009) evaluated longevity of low-shrinkage composite resins restorations in class II cavities and found failure rate between 10.4% and 14.3%, with secondary caries the main reason for failure, followed by composite fracture, and tooth fracture (12). Van Dijken et al (2010) compared the longevity of composite resin, polyacid-modified composite resin (PRMC), and resin-modified glassionomer restorations (RMGIC) in class IV cavities, and found mean longevity age of 4,5 years for composite resins, 4.3 years for PRMC, and 3,3 years for RMGIC, with composite resins restorations presenting the lowest failure frequency and the highest longevity (13). Manhart et al.(2010) found, in a 4-years evaluation of class I and II hybrid posterior composite restorations, a significant increase in marginal discoloration and decrease in marginal integrity, with small restorations exhibiting

significantly less marginal discoloration than large restorations. However, the conclusion of this study was that the posterior composite restorations showed good clinical results with predominantly alfa scores for both materials (14). Van Dijken et al.(2011) evaluated proximal-occlusal hybrid composite restorations for 7 years of functioning in the oral cavity and they found a 14.9% failure rate, with fracture of resin composite, secondary caries and cusp fracture as main reasons for failure (15).

The same group of research found, in 4-years evaluation of nano-hybrid composite restorations, a 6,8% failure rate, with annual failure rates between 1.9% and 1.4%, and fracture of restoration the main reason for failure (16). Van Dijken et al.(2013) found, in a 6-years assessment of the proximo-occlusal direct composite restorations, an annual failure rate at 6 years between 1.4% for micro-hybrid composite resin restorations, and 3.0% for giomer restorations. The most failures were associated to bulk fracture of material for giomer and tooth fracture for micro-hybrid composite resin (17).

In conclusion, researches performed between 2005-2013 found mean survival rates of the direct esthetic restorations as follows: 92,50% (10), 89,60% (11), 87,60% (12), 97,40% (13), 94% (14), 85,10%-93,20% (15, 16), 88,10% (17) (fig.1).

Fradeani et al (1997) evaluated ceramic inlays parameters after 4,5 years follow-up and found a 95,63% survival rate, with marginal discoloration recording the lowest percentage of alpha ratings (65.3%) (19). Van Dijken et al.(1999), in a review of ceramic restorations, found fracture the main reason for failure for inlays, very low frequency of secondary caries. The research group highlighted that the use of certain ceramic materials as well as luting agents should be contraindicated in molar teeth and newer reinforced ceramics showed better durability then the earlier fired ceramic reconstructions (20).

Pallesen et al., in a 8-year evaluation of ceramic inlays, found a survival rate of 91%, no secondary caries adjacent to the inlays, and concluded that ceramic inlays functioned well during the 8-yr follow-up period (21). Otto et al., in a 10-year study of ceramic inlays, found a rate of 8% failures, from which 73% were caused by either ceramic fractures (53%), tooth fractures (20%), caries (20%) and endodontic problems (7%) (22). Kramer et al. (2005), in a 8-years study on ceramic inlays, found 8% failure rate, with most frequent failure reason cohesive bulk fractures, and significant deterioration of

Beta and 2% were rated Delta (failures) at re-examination. Regarding the direct composite restorations, 67% were judged Alpha, 26% were rated Beta and 4% were judged as failures (Delta). The survival rate was 94% for ceramic inlays and 93% for composite restorations. The conclusion of this study was the absence of significant statistical differences between direct and indirect coronal restorations, despite that ceramic inlays performed clinically better than direct hybrid composite restorations in marginal adaptation, color match and anatomic form (25).

In conclusion, the researches performed between 1997-2009 found mean survival rates of the indirect esthetic restorations as follows: 97% (Berg et al.1997), 100% (van Dijken et al.1999),

marginal adaptation of the 98% of remaining restorations. Also, ceramic inlays were successful in most cases of large coronal defects (23).

Another study also found 10% failure rate for ceramic inlays after 10-years follow-up periode (24). Lange et al. (2009) compared functional, esthetic and biological parameters of ceramic inlays and hybrid composite restorations in a 3-years follow-up of the posterior teeth. On the basis of USPHS criteria, 88% ceramic inlays were assessed as Alpha, 10% were judged

95,63% (Fradeani et al.1997), 90,60% (Pallesen et al.2000), 90,40% (Otto et al.2002), 91,60% (Kramer et al.2005), 90,00% (Kramer et al.2008), 94,00% (Lange et al.2009) (fig.2). According to literature data, the parameters cavity type, localisation and age are the most influential factors for the longevity of the direct composite resins restorations. Considering these values from literature data, the conclusions are as follows:

-for studies performed between 2005-2011, the mean survival rate of 910 esthetic restorations (restorations age between 4-12 years) was 90,94%, with 1,64% failure rate/year;

-for studies performed between 1997-2009, on 1063 esthetic restorations, the mean survival rate was over 90%.

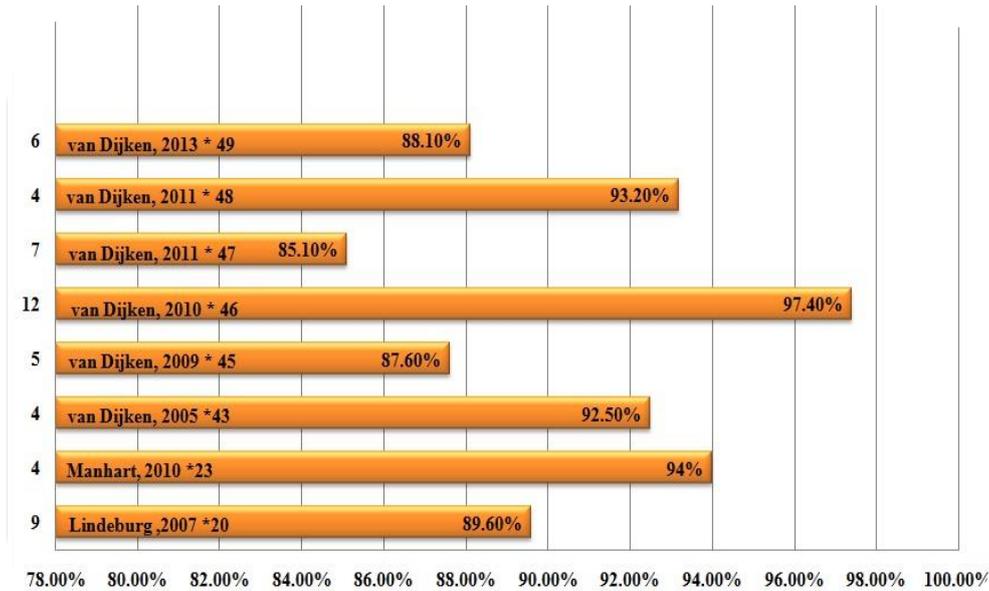


Figure 1. Mean survival rate of the direct coronal restorations (researches performed between 2005-2013)

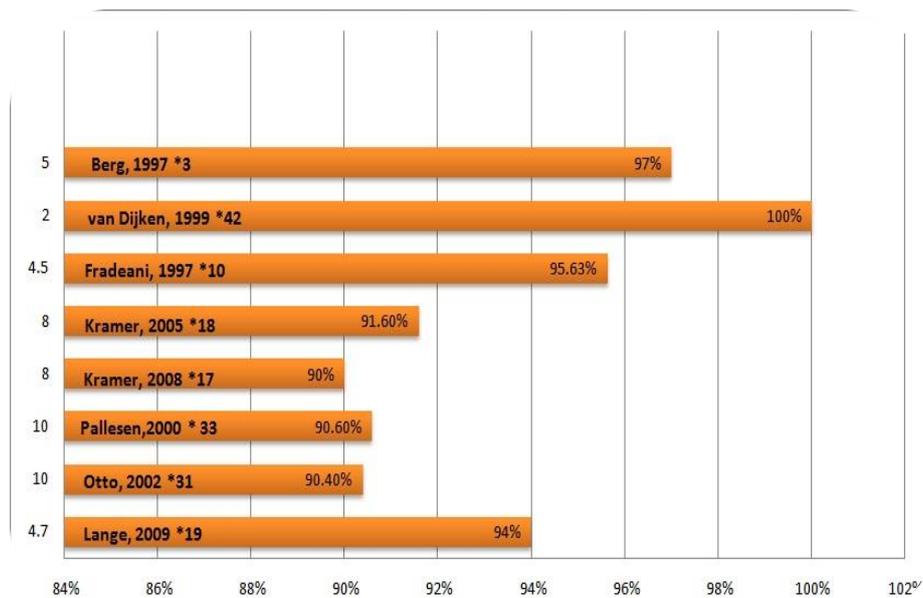


Figure 2. Mean survival rate of the indirect coronal restorations (researches performed between 1997-2009)

In conclusion, in the recovery of the esthetic and masticatory functions affected by the coronal substance loss of posterior and anterior teeth, each type of coronal restoration has advantages and limits and dentists must focus on factors related to material and technique as well as on clinical and biological factors, when a repair versus replacement decision must be taken.

**Conclusions.**

1. The recovery of the esthetic and masticatory functions of the stomathognathic system is performed at optimal parameters if the coronal direct and indirect restorations respect two basic principles: esthetic and functionality.
2. The treatment of the dental coronal lesions must be approached

- according to individualised clinical situation, practitioner experience, technical equipment as well as the patients' socio-economic factors.
3. The indirect coronal restorations ( ceramic inlay, ceramic onlay) will ensure higher longevity and optimal recovery of the esthetic and functional parameters.
  4. The direct composite restorations can bring a rapid recovery of the masticatory functions but the the initial functional parameters level diminishes faster comparing with indirect coronal restorations.
  5. Regarding the recovery of the esthetic parameters, the highest report quality/price is ensured by direct composite restorations.
  6. The technical equipment and execution are highly related to the long term success of the indirect coronal restorations.

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