International Journal of Applied Dental Sciences 2023; 9(1): 31-34

ISSN Print: 2394-7489
ISSN Online: 2394-7497
IJADS 2023; 9(1): 31-34

www.oraljournal.com
Received: 01-11-2022
Accepted: 05-12-2022

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Indications for the use of endocrowns, design and selection of materials: Literature review

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DOI: https://doi.org/10.22271/oral.2023.v9.i1a.1652

Abstract
Introduction: Endocrowns are a valuable rehabilitation option in dental pieces that have suffered extensive tissue loss, being retained to the internal portion of the pulp chamber through the use of adhesive cementation Objective: To carry out a review of the literature on the criteria endocrown use, preparation designs for this type of restoration and the selection of materials for this restoration.
Methodology: A review was carried out in the Scopus, Pubmed and Scielo databases with the keywords "endocrown", "design", "fit", "materials", "restoration"
Results: Within the best studied design criteria are at least 2 mm of occlusal reduction and extension towards the pulp chamber, elements such as a 1 mm splint and stabilization notches seem to improve performance. Lithium disilicate is the most widely used material, but hybrid ceramic and composite CADCAM blocks are promising. Materials such as zirconia or metal increase the risk of irreparable fracture.
Conclusion: Knowing the design criteria supported by evidence, as well as an adequate selection of materials, makes the endocrown a valuable restorative option.

Keywords: Endocrown, design, fit, materials, restoration

Introduction

The endocrown is a type of monoblock restoration in which a part of it encompasses part of the pulp chamber of the piece in which it is used, this component being a replacement for intraradicular posts, its design being described by Dr. Pissis in nineteen ninety five; subsequently being coined the term endocorona by Drs. Bindl and Mormann in 1999. The fabrication materials of this restoration have varied from metallic, to porcelain metal and finally to metal-free, currently hybrid materials are available for the manufacture of these.

With proper preparation, endocrowns have similar clinical success rates to traditional crowns in clinical performance [1]. The main advantage of endocrowns is preservation of dental tissue that is achieved by keeping the design limited to the cavity of the pulp chamber, preserving intact as much of the remaining root tissue as possible [2], avoiding an increase in the risk of fracture of the piece [3]. Advances in adhesion, materials, and manufacturing methods of the restorations themselves have allowed the use of increasingly conservative restorations, and a preparation design oriented toward maximum tissue preservation and removal of only present lesions [4].

According to the current literature, this type of restoration depends on the selection of materials and precise cementation to guarantee their clinical success and durability, due to their adhesive cementation, in addition to the requirement that the material be able to withstand the forces to which it will be subjected. submitted [5]. Due to the clinical importance of knowing the applications and limitations of this type of restorations, it is necessary to analyze the updated literature on them in order to have an alternative within clinical applications in a safe and optimal way.

The objective of this research is to be able to provide an updated review on the clinical indications of endocrowns, the design of preparations for this type of restoration, as well as the selection of both conventional and digitally manufactured materials.

Methods

A review was carried out in the Scopus, Pubmed and Scielo databases with the keywords "endocrown", "design", "fit", "materials", "restoration" to evaluate the current criteria for indications for the use of endocrowns, the design of preparations for endocorona as well as the most used materials for these restorations

Results

Indications for the use of endocrowns

They can be used in posterior teeth that have suffered an extensive loss of coronary tissue, mainly limiting their use in molars [6]; although in recent studies, research has been elaborated about its use in premolars, the main challenge in the use of this type of restoration in premolars is the orientation of the forces against these pieces [7], in addition to a smaller chamber surface to which a adhesive procedure [8]. Despite the previously mentioned, it is feasible to restore premolars with endocrowns if there is enough remaining dental tissue to carry out adequate preparation and selection of material [9].

Currently, dentistry adheres to the trend of minimal invasion with a subsequent preservation of the remaining dental tissue thanks to adhesion [10], for which the endocrown is an attractive option for those cases in which it is not possible to use crown restorations due to a significant loss of integrity, but it is desired to preserve the greatest amount of remaining root tissue [11].

Due to the nature of its adhesive cementation, with a lack of mechanical retention in most cases in which its use is ideal, it is important that there is a favorable occlusion, without lateral forces that can lead to failure of the restoration. [12]; Due to its low resistance to non-axial forces, up to now its use is reserved for later pieces [13].

Based on the most current literature, we can understand that this restoration is an extremely valuable option in our list of treatment options for posterior teeth, always taking each case into account individually. It is necessary to continue the development of research protocols that open up the possibility of their use in anteriors, given that up to now they are contraindicated due to the risk of catastrophic fracture.

Design of endocrown preparations

One of the key points of the endocrown is that the preparation is mainly kept fixed by adhesion, since it is mainly used in pieces with extensive coronary destruction where mechanical retention is poor. Despite this, it is critical to preserve as much dental tissue as possible when making the preparation because this allows for proper distribution of forces, concentrating it on the restoration and the tooth itself, and not on the adhesive interface [3]. The fundamental design of the endocrown is a cavity where the intracameral and/or intraradicular component will be integrated into the coronal portion, extending in the apical direction to provide a greater adhesive surface to improve the monoblock cementation interface [14].

This aforementioned extension towards the pulp chamber should be at least 2 mm deep, but although 3 and 4 mm extensions improve the resistance of the restoration itself, their fractures tend to be non-restorable [15] The preparation, regardless of the degree of damage, or the affected walls, must have at least 2 mm of occlusal reduction for an adequate restorative space that allows the uniform use of the material that will work in monobloc mode. Margins should ideally lie perpendicular to the axial force, with no undercuts for ideal force distribution [16]. This preparation has the inherent advantage of its monoblock design that the stress distribution is extremely favorable for the material due to its volume and quantity [17]. Regarding the ferrule of the preparation, the presence of this element improves the resistance of the restoration against fracture, and a 1mm ferrule offers this advantage without presenting a greater risk of catastrophic fracture, as can be seen in those with a 2mm ferrule [18]. The interproximal margin should be as close as possible to the level of the bone crest, ideally with measurements of .5mm or less [19].

A modification to the conventionally used design consists in the use of notches or channels in the mesiobuccal and distolingual dentin wall. In one study, this modification was found to improve the distribution of forces and increase the fracture resistance of the endocrown [20]. The design of endocorona preparations should always be aimed at maximum preservation of remaining healthy tissue, but it is important to take into account design elements that have shown to improve clinical success in recent studies.

Materials selection

The restorative material must be resilient enough to withstand the forces and wear it will be subjected to when replacing healthy, functioning dental tissue. Due to the location of the restoration within the chamber cavity, a possible irreparable fracture of the piece must also be taken into account in case of failure, for which an excessively Hard e can also pose a risk [21]. More solid materials with less flexibility will receive a greater stress load directly on the restoration itself [22]; while those with a flexibility modulus similar to that of the tooth will distribute the forces in an equivalent way throughout the piece [23]. Although metallic materials can be used in this type of restoration, the predominant materials used are ceramics, in addition to current alternatives such as hybrid materials and CADCAM-machined composites. Glass-ceramics and composites have a lower elastic modulus than metals and crystalline ceramics, which can lead to lower luting interface strength; but lower risk of catastrophic fractures [24].

Lithium disilicate is one of the most used and studied materials for the manufacture of endocrowns, its main advantage being an excellent combination of aesthetics with mechanical resistance [25]. It is characterized by a high elastic modulus, which protects the adhesive interface, reducing the risk of adhesion failure. The counterpoint to this is that, in case of restorative failure, there may be a non-restorable fracture of the affected piece [26].

Zirconia is another material that can be used to manufacture endocrowns, its high elastic modulus and mechanical resistance being useful for this type of restoration, but it is important that the dentist who prescribes it take into account that there is a greater risk of irreparable fracture than with other materials [27].

CADCAM-manufactured hybrid ceramic and composite materials are a valuable option for indirect restorations, being strong enough for use in endocrowns [28], and although they have lower mechanical strength than ceramics or metals, their pattern of fracture are generally more favorable [29].

The selection of materials is a critical part of any restoration. In the case of endocrowns, there is the additional factor that they have a greater risk of catastrophic fracture than other types of restorations, for which reason it is necessary to weigh whether a material that provides greater resistance to the restoration, coupled with a greater risk of these fractures; or failing that, a material that provides greater flexibility, which, although it reduces the resistance of the restoration, provides a lower proportion of irreparable damage.

Conclusions

There is no perfect design for the preparation of endocrowns, but there are several design elements that can improve their survival and clinical success, such as a ferrule effect of 1 mm and an occlusal reduction of at least 2 mm. Lithium disilicate continues to be the most widely used material for its manufacture due to its adequate resistance and aesthetics, although composite and hybrid materials can offer the advantage of fewer irreparable fractures of the dental piece.

Acknowledgments

We express gratitude to the prosthodontics postgraduate course of the UANL and CONACYT for the financing provided, likewise any conflict of interest of the present authors is denied.

Conflict of Interest

Not available

Financial Support

Not available

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How to Cite This Article
Zardoni JLC, Flores de León MA, Fierro NC, Palencia PG. Indications for the use of endocrowns, design and selection of materials: Literature review. 2023;9(1):31-34.