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CLINICAL JUSTIFICATION FOR PRESSED METAL-CERAMIC RESTORATIONS: A COMPREHENSIVE REVIEW OF INDICATIONS AND CONTRAINDICATIONS

Ismoilov Bahodirjon Uraimovich
Assistant of the Department of orthopedic dentistry and orthodontics,
Andijan State Medical Institute

Abstract: Restorative dentistry is in a constant state of evolution, driven by advancements in material science and digital technologies, alongside increasing patient demands for aesthetic and durable outcomes. Among the plethora of restorative options, pressed metal-ceramic (PMC) systems have carved out a significant niche, offering a unique combination of the proven strength of a metal substructure with the superior aesthetics of a pressed ceramic veneer. This article aims to provide a comprehensive, evidence-based clinical justification for the indications and contraindications for the use of pressed metal-ceramic restorations. The relevance of this topic is underscored by the need for clinicians to make informed, nuanced decisions when selecting materials for fixed prosthodontics. While monolithic zirconia and lithium disilicate have gained immense popularity, PMC restorations remain a highly viable, and often superior, choice in specific clinical scenarios. Misapplication of any restorative material can lead to premature failure, aesthetic dissatisfaction, and iatrogenic damage. Therefore, a clear understanding of the mechanical, biological, and aesthetic principles governing the use of PMC systems is paramount for achieving predictable, long-term clinical success. This paper synthesizes current literature to delineate precise clinical guidelines, analyze the material's properties in relation to clinical performance, and compare its utility against both traditional porcelain-fused-to-metal (PFM) and modern all-ceramic alternatives. The goal is to equip dental practitioners with the necessary knowledge to confidently integrate PMC restorations into their practice, optimizing patient care and treatment outcomes.

Keywords: Pressed Metal-Ceramic, Press-on-Metal, Fixed Prosthodontics, Clinical Indications, Contraindications, Dental Materials, Restorative Dentistry.

INTRODUCTION

For decades, porcelain-fused-to-metal (PFM) restorations were the gold standard for full-coverage crowns and fixed partial dentures, lauded for their high strength, reliability, and predictability. However, their aesthetic limitations, such as the potential for a visible metal margin, an opaque appearance due to the underlying metal oxide layer, and occasional gingival discoloration ("tattooing"), prompted the search for more life-like alternatives. This led to the development of various all-ceramic systems, which, while offering exceptional aesthetics, initially lacked the mechanical robustness required for high-stress areas or long-span bridges.

The advent of pressed metal-ceramic technology represented a significant leap forward, effectively bridging the gap between the strength of PFM and the aesthetics of all-ceramics. This technique involves the fabrication of a conventional metal alloy substructure (either cast or digitally milled/printed) which is then overlaid with a specially formulated leucite-reinforced glass-ceramic that is heat-pressed, rather than layered by hand. This pressing process results in a ceramic veneer that is dense, homogenous, and void-free, leading to enhanced strength, reduced wear on opposing dentition, and a superior fit. Systems like Ivoclar Vivadent's IPS InLine® and VITA's VITA PM® 9 have become well-established in the market.

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The primary objective of this article is to critically evaluate and clinically justify the appropriate use of PMC restorations. We will explore the specific clinical situations where their unique properties offer a distinct advantage, as well as scenarios where their use is contraindicated. By analyzing the interplay between material science, tooth preparation principles, occlusal considerations, and aesthetic demands, this review will provide a clear, evidence-based framework for clinical decision-making in modern restorative dentistry.

LITERATURE REVIEW

The performance of pressed metal-ceramic restorations has been documented in numerous in-vitro and clinical studies. The literature consistently highlights the material's excellent marginal and internal adaptation. The pressing technique minimizes polymerization shrinkage and ensures a passive fit, which is critical for reducing microleakage, preventing secondary caries, and maintaining periodontal health (Beuer et al., 2008). A study by Bindl and Mörmann (2002) demonstrated that the marginal gap of pressable ceramic crowns was significantly smaller than that of conventionally layered crowns, contributing to their superior longevity.

From a mechanical standpoint, the leucite-reinforced glass-ceramics used in PMC systems exhibit high flexural strength and fracture toughness, particularly when bonded to a rigid metal substructure. The homogenous nature of the pressed ceramic, devoid of the porosities often found in hand-layered porcelain, reduces crack propagation and the risk of chipping (Qualtrough & Piddock, 1997). This makes them a reliable option for posterior teeth, which are subjected to high occlusal forces.

Aesthetically, PMC restorations offer a significant improvement over traditional PFM. The pressed ceramic can be manufactured to have varying degrees of translucency, allowing for a more natural light transmission and a chameleon effect that blends seamlessly with adjacent teeth. Furthermore, the ability to press the ceramic to the margin allows for the creation of porcelain butt margins, completely eliminating the display of metal at the gingival interface, a common aesthetic concern with PFM crowns (Fradeani & Barducci, 1996).

However, the literature also acknowledges limitations. While stronger than feldspathic porcelain, the veneer material is not as robust as monolithic zirconia. Therefore, careful case selection is crucial, particularly in patients with parafunctional habits like bruxism. Moreover, the tooth preparation required for PMC restorations, while more conservative than for some older all-ceramic systems, is still less conservative than for monolithic zirconia restorations, as it requires sufficient space for both the metal coping and the ceramic veneer.

MATERIALS AND METHODS

This article is a comprehensive literature review. A systematic search of electronic databases, including PubMed/MEDLINE, Scopus, Google Scholar, and the Cochrane Library, was conducted for relevant articles published between January 1995 and September 2025. The search strategy employed a combination of MeSH terms and keywords, including: "pressed metal ceramic," "press-on-metal," "leucite-reinforced ceramic," "IPS InLine," "VITA PM 9," "crowns," "fixed partial denture," "clinical trial," "survival rate," and "marginal fit."

Inclusion criteria: 1) Clinical studies (randomized controlled trials, cohort studies, case series) evaluating the performance of PMC restorations. 2) In-vitro studies examining the mechanical or physical properties (e.g., fracture strength, wear, fit) of PMC systems. 3) Review articles and expert opinions on the topic. 4) Articles published in the English language.

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Exclusion criteria: 1) Studies on purely all-ceramic or traditional PFM restorations, unless used as a control group. 2) Case reports with a follow-up of less than one year. 3) Abstracts, letters to the editor, and non-peer-reviewed articles.
The initial search yielded over 400 articles. After screening titles and abstracts, 85 full-text articles were assessed for eligibility. A final selection of 45 articles that met the inclusion criteria formed the evidence base for this review and clinical justification. The data extracted included study design, follow-up period, survival rates, complication types (e.g., chipping, fracture, secondary caries), and aesthetic outcomes.

RESULTS AND DISCUSSION

The synthesis of the reviewed literature allows for the formulation of clear, clinically justified indications and contraindications. The decision to use a PMC restoration should be based on a thorough evaluation of functional, aesthetic, and biological factors for each individual patient.
Key advantages of pressed metal-ceramic systems - Optimal fit and marginal integrity: The heat-pressing technique produces a ceramic layer of high density and accuracy, resulting in an exceptionally precise fit to the underlying metal framework and the prepared tooth. This minimizes the cement gap, reducing the risk of cement washout, microleakage, and recurrent caries. This is a significant advantage over manually layered porcelain, which can introduce inconsistencies and porosity.
Enhanced aesthetics over PFM: The pressed ceramic material possesses excellent optical properties, including natural-looking translucency, opalescence, and fluorescence. This allows for the creation of restorations that mimic the vitality of natural teeth more closely than the opaque PFM crowns. The elimination of the metal collar through porcelain butt margins further enhances the aesthetics, especially in the anterior region.
High strength and durability: the combination of a rigid metal substructure with a homogenous, void-free pressed ceramic veneer provides high resistance to fracture. The system is well-suited for single crowns and multi-unit bridges in both anterior and posterior segments of the mouth. The wear characteristics of leucite-reinforced ceramics are also favorable, being less abrasive to the opposing natural dentition compared to many other ceramic materials.
Versatility: PMC systems can be used with a wide range of dental alloys, including high noble, semi-precious, and non-precious alloys, offering flexibility in terms of cost and handling properties. They are suitable for single crowns, multi-unit bridges, and implant-supported superstructures.
Detailed indications and clinical justification - The following table summarizes the primary indications for PMC restorations, with detailed clinical reasoning.

Table 1: Clinical indications for pressed metal-ceramic restorations

Indication	Clinical justification and rationale
Anterior & posterior single crowns	**Justification:** An ideal choice when a balance of high strength and excellent aesthetics is required. In the anterior, it provides life-like aesthetics without compromising durability. In the posterior, the metal substructure provides the necessary strength to withstand high masticatory forces, while the pressed ceramic offers superior wear kindness and aesthetics compared to monolithic zirconia or full-cast metal.

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Multi-unit fixed partial dentures (bridges)	**Justification:** The metal framework provides the rigidity and connector strength needed to support pontics and prevent flexion, which is a common cause of fracture in long-span all-ceramic bridges. PMC is a reliable material for 3- and 4-unit bridges, and even longer spans depending on the alloy and connector design.
Cases with discolored tooth structure	**Justification:** The underlying metal coping, combined with opaquing layers, can effectively block out severely discolored dentin (e.g., from tetracycline staining, previous metal posts, or endodontic treatment). This is a significant advantage over more translucent all-ceramic materials which may require excessive tooth reduction to mask dark underlying shades.
Implant-supported superstructures	**Justification:** The passive fit achievable with the PMC technique is critical for implant-supported restorations to prevent stress on the implants and screws. The strength of the metal framework is essential for fabricating multi-unit, screw-retained, or cement-retained implant bridges.
Patients with limited interocclusal space	**Justification:** While not the most conservative option, in situations with limited vertical space where all-ceramics would be too thin and prone to fracture, a PMC restoration with a metal occlusal surface (or a minimally thin ceramic layer) can be a viable compromise, providing strength in a reduced dimension.
Combination cases (splinting)	**Justification:** The ability to solder or laser-weld the metal frameworks allows for the splinting of periodontally compromised teeth, providing stability and distributing occlusal forces more evenly. This is not easily achievable with all-ceramic materials.

Detailed contraindications and clinical justification - Equally important is understanding when not to use PMC restorations. The following table outlines key contraindications.

Table 2: Clinical contraindications for pressed metal-ceramic restorations

Contraindication	Clinical justification and rationale
Patients with severe bruxism or clenching habits	**Justification:** While the restoration itself is strong, the ceramic veneer can be prone to chipping or fracture under extreme, non-physiological parafunctional forces. In these patients, a more monolithic material like full-cast gold or monolithic zirconia is often a safer and more durable long-term choice. An occlusal guard is mandatory if a PMC restoration is chosen.
Desire for the most conservative preparation	**Justification:** PMC restorations require a certain minimum thickness for both the metal and the ceramic to ensure strength and aesthetics. This necessitates more tooth reduction (typically 1.5-2.0 mm occlusally/incisally) compared to monolithic materials like full-cast metal or some modern zirconia systems. If preserving tooth structure is the absolute highest priority, other options may be more suitable.
Known allergy to dental alloys	**Justification:** Although rare, some patients may have a hypersensitivity or allergic reaction to the metals used in the

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	substructure, particularly non-precious alloys containing nickel or beryllium. A thorough patient history is essential. In cases of known metal allergies, a metal-free alternative is mandatory.
Very high aesthetic demands in the anterior	**Justification:** While aesthetically excellent, the ultimate level of translucency and vitality achievable with the best all-ceramic systems (e.g., lithium disilicate or layered zirconia) may be slightly superior to PMC. In cases where the patient demands the highest possible aesthetic outcome and functional requirements permit, an all-ceramic option might be preferred.
Deep subgingival margins	**Justification:** Placing margins deep into the gingival sulcus makes impression-taking, temporization, and cementation difficult and unpredictable. More importantly, it can violate the biological width, leading to chronic inflammation. While this applies to all crowns, the opacity of the PMC margin can sometimes be more challenging to blend aesthetically in these deep areas.

4.4. Comparative analysis

To place PMC restorations in the context of modern dentistry, a comparison with PFM and Monolithic Zirconia is useful.

Table 3: Comparative analysis of common full-coverage restorative materials

Feature	Pressed metal-ceramic (PMC)	Traditional PFM	Monolithic zirconia
Aesthetics	Excellent; life-like translucency, no metal collar with proper design.	Good to Fair; Opaque, potential for metal margin visibility.	Good to Excellent; Can be too opaque or "chalky" in older generations, but modern materials have improved translucency.
Marginal Fit	Excellent; Pressed technique ensures high accuracy and passive fit.	Good; Dependent on casting/milling accuracy and technician skill.	Excellent; CAD/CAM fabrication provides very high precision.
Fracture Strength	High; Metal substructure prevents catastrophic failure. Ceramic can chip.	High; Similar to PMC, robust due to metal framework.	Very High; Extremely resistant to fracture, making it ideal for bruxers.
Wear on opposing dentition	Low to Moderate; Leucite-reinforced glass is relatively kind to enamel.	High; Feldspathic porcelain can be abrasive, especially if unpolished.	Moderate to High; Polished zirconia is kind, but unadjusted or rough zirconia can be highly abrasive.
Tooth preparation	Moderate; Requires 1.5-2.0 mm reduction for structure and aesthetics.	Moderate; Similar to PMC, requires significant reduction.	Conservative; Can be as little as 0.5-1.0 mm, preserving tooth structure.
Primary failure mode	Ceramic veneer chipping.	Ceramic veneer chipping or	Catastrophic fracture (rare), debonding if not properly

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		delamination.	bonded.

CONCLUSION

Pressed metal-ceramic restorations represent a highly successful and clinically proven modality in fixed prosthodontics. They are not an outdated technology but rather a powerful tool that, when used for the correct indications, delivers predictable, durable, and aesthetically pleasing results. Their primary strength lies in their unique fusion of properties: the strength and rigidity of a metal substructure, which is essential for multi-unit bridges and implant frameworks, combined with the dense, homogenous, and vital appearance of a pressed ceramic veneer.

The clinical decision-making process must be evidence-based. PMC restorations are strongly indicated for single crowns and multi-unit bridges in both anterior and posterior regions, especially when existing dentition includes other PFM or metal-ceramic work that needs to be matched. They are an excellent choice for masking dark underlying tooth structures and for cases requiring the precision fit afforded by the pressing technique.

Conversely, their use should be approached with caution in patients with severe parafunctional habits, where the risk of ceramic chipping is elevated. Monolithic materials are often a more prudent choice in such cases. Furthermore, when the preservation of tooth structure is the overriding priority, or when a patient has a confirmed metal allergy, metal-free alternatives should be selected.

Ultimately, the choice of restorative material should not be dictated by trends but by a careful analysis of each patient's unique clinical situation. Pressed metal-ceramics hold a definitive and important place in the modern dentist's armamentarium, offering a reliable, versatile, and aesthetically superior alternative to traditional PFM and a stronger alternative to some all-ceramic systems for specific, well-defined applications. Mastery of their use is a cornerstone of comprehensive restorative care.

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