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Aesthetic ceramic materials in the digital age: selection criteria and clinical-laboratory integration in the CAD/CAM workflow.

Aesthetic Ceramic Materials in the Digital Age: Selection Criteria and Clinical-Laboratory Integration in the CAD/ CAM Workflow

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Summary

The evolution of digital workflows in dentistry has profoundly transformed the selection criteria for ceramic materials used in aesthetic and functional restorations. In this context, materials such as lithium disilicate and zirconia have become widely used, often based on isolated parameters such as mechanical resistance or the professional's personal preference. However, clinical predictability in the digital age depends less on choosing an "ideal" material and more on the coherence between diagnosis, digital planning, prosthetic design, and integration between clinic and laboratory. The objective of this article is to discuss, based on the literature, how aesthetic ceramic materials behave in the CAD/CAM environment, presenting technical criteria, limitations, and protocols that favor predictable results. The analysis shows that the digital workflow enhances both successes and failures, making integrated decision-making a determining factor for the clinical and aesthetic success of ceramic restorations.

Keywords: Dental ceramics; CAD/CAM; Dental aesthetics; Digital workflow; Zirconia; Lithium disilicate.

ABSTRACT

The evolution of digital workflows in Dentistry has profoundly transformed the selection criteria for ceramic materials used in aesthetic and functional rehabilitations. In this context, materials such as lithium disilicate and zirconia have become widely used, often based on isolated parameters such as mechanical strength or professional personal preference. However, clinical predictability in the digital era depends less on choosing an "ideal" material and more on the coherence between diagnosis, digital planning, prosthetic design, and clinical-laboratory integration. This article aims to discuss, based on the literature, how aesthetic ceramic materials behave in the CAD/CAM environment, presenting technical criteria, limitations, and protocols that favor predictable results. The analysis shows that digital workflow enhances both successes and failures, making integrated decision-making a determining factor for the clinical and aesthetic success of ceramic restorations.

Keywords: Dental ceramics; CAD/CAM; Dental esthetics; Digital workflow; Zirconia; Lithium disilicate.

1 INTRODUCTION

The incorporation of digital technologies into restorative dentistry has redefined not only the The way treatments are planned and executed, but also the criteria used in selecting materials. ceramics. The advent of intraoral scanning, computer-aided design (CAD), and... Computer-aided manufacturing (CAM) has enabled a level of geometric control and reproducibility previously unattainable in analog workflows. As a consequence, materials Aesthetic ceramics have come to be used in a wider range of clinical indications. often associated with the promise of greater predictability and efficiency.

However, the increased use of ceramics such as lithium disilicate and zirconia also...

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This brought to light a recurring problem: the oversimplification of the decision-making process. In many cases... In these cases, the choice of material is still predominantly based on factors such as mechanical strength. maximum or market trends, disregarding fundamental variables such as substrate, Available thickness, prosthetic design, and limitations inherent to digital fabrication processes. This scenario contributes to aesthetic flaws, excessive adjustments, and results that fall short of expectations. even in highly digitized environments. Paradoxically, the increasing standardization of workflow Digital technology has exposed conceptual flaws in the selection of materials, highlighting that technology, by itself, It does not guarantee clinical predictability.

In the digital age, predictability is not a direct result of the material used, but of... Consistency between the steps in the workflow. Intraoral scanning is no longer just one step. The capture stage then transforms it into a three-dimensional diagnostic tool. Digital design takes on... central role in thickness distribution, contour control, and definition of areas of greater Mechanical stress. In turn, milling and sintering processes impose physical limitations. which need to be understood by both the clinician and the laboratory.

Therefore, clinical-laboratory integration becomes a determining factor in the use of... The rationale behind aesthetic ceramic materials. The material, in isolation, does not compensate for flaws in planning, communication, or execution. Conversely, the digital environment amplifies these flaws. making them more evident in the final result. Thus, this article proposes a critical analysis of Aesthetic ceramic materials in the context of the digital workflow, emphasizing selection criteria based on... in process, integration and conscious decision-making, and not in the search for material. supposedly universal.

2 METHODOLOGY

This study constitutes a narrative literature review, with a qualitative approach and character. descriptive-analytical. The choice of this method is justified by the objective of discussing concepts, Material properties and selection criteria related to aesthetic ceramics in the context of digital workflow, without the intention of performing statistical analysis or meta-analysis of clinical data.

The literature search was conducted in the PubMed, SciELO, and Google Scholar databases. Using descriptors in Portuguese and English: dental ceramics, dental ceramics, dental disilicate lithium, lithium disilicate, zirconia, zirconia, CAD/CAM, digital workflow, digital workflow and selection of Materials included were scientific articles, literature reviews, and clinical studies that addressed Properties, indications, and limitations of ceramic materials in the context of digital dentistry. Duplicate posts, texts unrelated to the topic, and materials of a nonsensical nature were excluded. exclusively commercial.

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It is important to note that, since this is a narrative review, the statements throughout the text They seek to describe trends and patterns identified in the consulted literature, without the intention of... to establish definitive causal relationships. When numerical data are mentioned, they reflect Findings from specific studies cited are not statistical generalizations. This study does not intend to be a basis for comparison. establishing a quantitative hierarchy between ceramic materials, nor a direct statistical comparison of clinical performance, it is up to the reader to contextualize the information presented according to the specificities of each case.

3. THEORETICAL FOUNDATION

Understanding aesthetic ceramic materials in a digital context requires an analysis that articulate intrinsic properties of materials, characteristics of manufacturing processes and Specific clinical requirements. This section examines the evolution of the main ceramic systems, their optical and mechanical properties relevant to the CAD/CAM environment, and how the digital workflow influences the choice and performance of these materials.

3.1 Evolution of ceramic materials in restorative dentistry

The history of dental ceramics reflects a continuous search for balance between Aesthetics and mechanical strength. The first feldspathic ceramics, introduced in the 18th century, They offered excellent optical mimicry of natural enamel, but their fragility limited their use to veneers. and anterior crowns with metal substructure. The need to eliminate metal from restorations. Aesthetics have driven the development of ceramic systems with greater intrinsic strength. (GRACIS et al., 2015).

Glass-ceramics represented a significant advance in this trajectory. The Dicor system, Launched in the 1980s, it introduced the concept of fused ceramics with mica crystals. Fluorinated tetrasilicon. Although it has demonstrated superior optical properties compared to ceramics. conventional models, however, their resistance was still insufficient for use in high occlusal load areas. The next evolution came with leucite-reinforced ceramics, which broadened the applications to... anterior and posterior single crowns, although with limitations in extensions (KELLY; BENETTI, 2011).

Lithium disilicate, commercially known as IPS e.max (Ivoclar Vivadent), It represented a milestone in the evolution of aesthetic ceramics. With flexural strength in the range of 360-400 MPa in the pressed version and approximately 530 MPa in the CAD/CAM version after crystallization, the The material combines mechanical properties suitable for single crowns with optical characteristics.

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which allow for highly aesthetic restorations. Its microstructure, composed of crystals of Lithium disilicate dispersed in a glassy matrix provides controllable translucency that enhances... integration with adjacent dental tissues (SAKER; AL- 'WAHADNI, 2020).

Zirconia, in turn, followed a different trajectory. Initially developed as a material For structural engineering purposes, yttria-stabilized tetragonal polycrystalline zirconia (Y-TZP) was Adapted for dental use in the late 1990s. Its flexural strength is greater than 1000 MPa enabled applications previously impossible with glass-ceramics, such as prosthetic infrastructures. extensive fixed abutments and custom-made implant pillars. However, the inherent opacity of the former The limited production of zirconia stones restricted their aesthetic use, requiring them to be covered with ceramic veneer. previous regions (ZHANG; LAWN, 2018).

The microstructural evolution of zirconia over the last two decades has produced materials with Different balances between strength and translucency. High translucency (HT) zirconia, with greater Cubic phase content offers improved aesthetics at the cost of partially reducing strength. Zirconia Multilayer construction combines a high-strength core with highly translucent outer layers. gradient, seeking to optimize both properties. These variations significantly expanded The spectrum of indications has expanded, but it has also increased the complexity of selecting the appropriate material. for each clinical situation (ZHANG; LAWN, 2018).

The advent of CAD/CAM accelerated this evolution by standardizing manufacturing processes. Prefabricated blocks with controlled composition and microstructure reduced the variability that It characterized the traditional laboratory processes of casting and pressing. Subtractive milling And, more recently, 3D printing of ceramics makes it possible to translate digital designs into physical pieces. physics with previously unattainable dimensional precision. This standardization, however, transferred part of the Responsibility for the outcome relates to the planning and design stages, where design errors may occur. They are faithfully reproduced by the manufacturing system (MIYAZAKI et al., 2009).

3.2 Optical and mechanical properties relevant in the digital context

The selection of ceramic materials for aesthetic restorations involves a balance between optical properties (which determine appearance) and mechanical properties (which determine the (durability). In the context of digital workflow, these properties need to be considered in relation to of case-specific variables, not as absolute values that define the superiority of one material about another.

Translucency is the optical property most frequently cited when comparing... Ceramic materials. More translucent materials allow light to pass through and interact with the environment. underlying substrate, which promotes visual integration with natural teeth in situations of

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light-colored substrates. However, this same translucency makes darkened substrates visible, such as cores. metallic or fiber pins of unsuitable color. Lithium disilicate, with intermediate translucency, It adapts well to natural or slightly altered substrates. High-translucency zirconia approximates... If it falls within that range, conventional zirconia remains more opaque and therefore more suitable. when masking is necessary (SAKER; AL-'WAHADNI, 2020).

The thickness of the material directly modulates the final translucency of the restoration. A blade Lithium disilicate with a thickness of 0.3 mm exhibits very different optical behavior from same ceramic with 1.5 mm. In digital planning, the analysis of available thicknesses after the Preparation becomes a diagnostic tool: if the prosthetic space allows only minimum thicknesses, More translucent materials can result in excessive transparency; if the space is large, materials More opaque colors can be compensated for with stratification or characterization techniques. The software of CAD allows visualization of these thicknesses in a color map, anticipating problems that previously would only be identified in clinical trials (GÜTH et al., 2012).

From a mechanical point of view, bending strength is the most commonly used parameter for Comparison between materials is possible, but their interpretation requires caution. As pointed out in the literature, Resistance values obtained in a laboratory, under standardized test conditions, do not translate directly affects clinical behavior. A ceramic with 400 MPa flexural strength can fail. prematurely if the material thickness in the region of greatest stress is insufficient, while Another device with 200 MPa may have satisfactory performance if the prosthetic design distributes it appropriately. the loads. In line with this perspective, Kelly and Benetti (2011) argue that resistance It is a design-dependent variable, not an absolute attribute of the material.

The modulus of elasticity directly influences how stresses are distributed in Interface between restoration and dental substrate. Materials with a high modulus, such as zirconia, They exhibit greater structural rigidity and less elastic deformation, resulting in less heat dissipation. of stresses on the underlying dental structure under compressive loads. Materials with a modulus of... Elasticity closer to that of dentin, such as lithium disilicate, tends to exhibit More homogeneous biomechanical behavior when integrated into the substrate through adhesion.

This difference has direct implications for cementation protocols. Zirconia must, Whenever possible, it should be used in preparations with adequate mechanical retention, in which the Conventional cementation meets the clinical requirements of the material. Although the development of primers containing functional monomers, such as MDP, and specific resin cements have While the possibilities for chemical bonding with zirconia have been expanded, adhesion is no longer its primary function. structural performance mechanism. In contrast, lithium disilicate consistently depends of well-established adhesive protocols to optimize stress distribution, increase Strength of the restoration-tooth assembly and reduce the risk of clinical fractures (ZHANG; LAWN,

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2018).

Mechanical fatigue is an aspect that is often underestimated in the selection of materials. Ceramic restorations are subject to repeated load cycles during chewing, accumulating Microcracks that can evolve into catastrophic fractures over time. Fatigue studies. Studies show that the effective strength of ceramic materials after thousands of cycles is significantly lower than the initial static resistance. This phenomenon affects the various ceramic systems and reinforces the importance of considering not only the nominal strength, but the context of clinical use, including the presence of parafunctions, extent of restoration, and quality of the remaining substrate (HOLAND et al., 2012).

3.3 The digital flow as a modulator of material selection

The digital workflow has introduced a qualitative shift in the relationship between diagnosis, planning and selection of materials, as documented in recent studies on the transition Technology in restorative dentistry. In the analog model, the choice of ceramic material. This often occurred in a way that was disconnected from the geometric analysis of the case. The clinician performed the To prepare the mold, I would send it to the laboratory and indicate the desired material on a request form. The evaluation of thicknesses, convergence angles, and load distribution depended on experience. The coach's tactic, which empirically compensated for any inadequacies in the preparation.

Intraoral scanning has transformed this dynamic by providing geometric diagnosis. Precise scans are needed before, during, and after preparation. Overlapping pre- and post-preparation scans allows... To precisely quantify the space available for restoration in each region of the tooth. Software for Planning displays show thickness maps that indicate where the material will have appropriate dimensions and where it will be at critical limits. This information, available even in the planning phase, allows adjustments in the preparation or reconsideration of the chosen material before any manufacturing (GÜTH et al., 2012).

An example illustrates this change: in a case of ceramic veneer, the post-scan... The preparation reveals a thickness of only 0.25 mm in the middle third of the vestibular region. In the analog flowchart, This information would not be available in an objective way; the laboratory would produce the part and any eventual... Problems with excessive translucency or fragility would only appear in testing or clinical use. In the digital workflow, the thickness map immediately alerts the clinician to the situation. The clinician can then make a decision. between deepening the preparation (if structure is available), accepting the thickness with a thicker material resistance (such as high-translucency zirconia), or reconsider the indication for the case.

CAD plays a central role in translating clinical decisions into actionable parameters. The restoration design in the software defines contours, occlusal anatomy, margin position, and...

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thicknesses in each region. This step requires simultaneous knowledge of the material properties. selected (minimum thickness for adequate strength, optical behavior in different thicknesses) and the clinical demands of the case (aesthetic requirements, expected occlusal loads, condition (of the substrate). A design that ignores the limitations of the material will produce a technically flawed part. incorrect, regardless of the quality of the manufacturing equipment (MIYAZAKI et al., 2009).

CAM, in turn, imposes physical limitations that need to be incorporated into the planning. Subtractive milling operates with milling cutters of specific diameters, which limits the reproduction of... very fine anatomical details or acute internal angles. The minimum millable thickness varies. Depending on the material: lithium disilicate blocks allow for more delicate structures than blocks Zirconia, due to differences in brittleness during machining. Zirconia sintering. This involves a dimensional contraction of approximately 20-25%, which needs to be compensated for by... Software; errors in this compensation result in the final piece being ill-fitting. These technical factors These factors are not visible to the clinician who is only selecting the material, but they directly affect the outcome. (ZHANG; LAWN, 2018).

3.4 Clinical-laboratory integration in the selection and use of aesthetic ceramics

Communication between the clinic and the laboratory determines whether material selection decisions are made. They will be implemented in a manner consistent with the original intention. In the context of aesthetic ceramics, This communication needs to include information that goes beyond simply specifying the system. desired ceramic.

The color of the substrate is critical information that is often not conveyed accurately. A preparation on a vital tooth with shade A2 behaves optically in a way that... completely different from a preparation on a metal core or on a treated tooth. Endodontically discolored. The laboratory that does not have this information will select the translucency of the ceramic block based on assumptions, which may result in a restoration that The substrate becomes undesirably transparent or, at the opposite extreme, excessively opaque. which contrasts with the adjacent teeth (GRACIS et al., 2015).

Standardized clinical photographs are an indispensable tool in this communication. A minimum protocol for cases involving anterior ceramics would include: recording the substrate color after Preparation, recording of adjacent teeth for characterization reference, frontal view of the smile. For evaluating proportions, a side view is used for emergency profile analysis. When these images... They are not provided, or when they are captured without standardization of lighting and angle, the The ceramicist works with incomplete data, and the aesthetic result depends more on assumptions than on reality. planning (SAKER; AL-'WAHADNI, 2020).

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Accurate specification of the ceramic system also requires detailing, which is often... omitted. Specify "zirconia" without indicating whether it is conventional zirconia, high translucency zirconia, or multilayer testing leaves a decision to the laboratory that should be made clinically. Similarly, indicating "lithium disilicate" without specifying the translucency of the block (HT, LT, MO, MT) transfers Responsibility that belongs to integrated planning. A structured communication protocol. This would include: specific ceramic system, translucency of the block or disc, base color, need for Extrinsic characterization, planned cementation technique, and information about the substrate.

The error in indication represents a specific category of failure that deserves attention. It refers to... situations in which the selected material is unsuitable for the clinical context, regardless of Quality of laboratory workmanship. A lithium disilicate indicated for patient molar. A witch doctor with a history of previous ceramic fractures is a mistake in prescription, not manufacturing. A conventional zirconia indicated for an ultra-thin anterior veneer on a light substrate is a mistake. This is a technical, not a technical, indication. These errors often stem from a disconnect between the selection of... material and complete case analysis (KELLY; BENETTI, 2011).

The profile of the professional working at the clinical-laboratory interface gains relevance in this context. context. Professionals with training that combines clinical knowledge and understanding of Laboratory processes are better able to identify incompatibilities between the proposed indication and the limitations of the material or manufacturing process. This integrated competence may reside in A clinician who deepened their laboratory knowledge, and a technician who expanded their understanding. clinical, or in teams that work in a genuinely collaborative way from the planning stage of case (HOLAND et al., 2012).

4. DISCUSSION

The analysis of aesthetic ceramic materials in the context of the digital workflow allows us to identify Patterns of appropriate and inappropriate use, with direct implications for clinical predictability. This This section discusses comparisons between the main ceramic systems, situations of overuse, and... sub-indication, and the role of the integrated process in achieving consistent results.

4.1 Lithium disilicate versus zirconia: a rational clinical comparison

The comparison between lithium disilicate and zirconia is often presented in a way Simplified, it's seen as a dispute between aesthetics and resistance. This dichotomy obscures the real complexity. from the clinical decision. Both materials have specific indications where they demonstrate performance. superior, and the rational choice depends on the analysis of multiple variables of the case, not on preference.

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generic by a system.

Lithium disilicate offers clear advantages in situations requiring: integration Refined optics with adjacent natural teeth, reduced thickness while maintaining aesthetics. Adequate adhesion as the primary mechanism for retention and stress distribution. Anterior crowns Regarding enamel preparations, veneers with controlled thickness, and onlays in high-visibility areas. Aesthetically, these represent indications of where the material expresses its potential. The possibility of Conditioning with hydrofluoric acid and silanization allows for a well-established adhesive protocol that contributes to the strength of the restoration-tooth assembly (SAKER; AL-'WAHADNI, 2020).

Zirconia, in turn, offers advantages in situations that demand high resistance. to withstand intense occlusal loads, masking of darkened or metallic substrates, Indications where adhesion is not possible or reliable, infrastructures for extensive prostheses. Crowns In posterior patients with documented bruxism, implant-supported crowns with zirconia abutments are used. Fixed prostheses of three or more elements represent indications where the material demonstrates... Superior performance. The evolution of high-translucency zirconia has broadened the indications for the region. previous, although with reservations regarding the minimum thickness required for aesthetic expression. adequate (ZHANG; LAWN, 2018).

Recent literature documents comparable survival rates between the two materials. when used within their appropriate indications. Prospective clinical studies show rates Success rates exceeding 95% at five years for lithium disilicate crowns in posterior teeth, and rates Similar results were obtained for monolithic zirconia crowns. A statistically significant difference appears. when materials are used outside of their ideal indications: lithium disilicate in molars of Parafunctional patients or those with extensive prostheses present increased fracture rates; zirconia Conventional use of ultra-thin veneers results in aesthetic compromise due to excessive opacity. (GRACIS et al., 2015).

4.2 Overuse of zirconia and underindication of disilicate

Observation of contemporary clinical practice reveals a tendency towards overuse of zirconia. in situations where lithium disilicate would be more suitable. This phenomenon appears to be related to Multiple factors: marketing emphasizing durability as an absolute value, perception of safety. associated with higher MPa numbers, and simplification of the decision-making process through the adoption of a "Universal" material.

A typical case of overuse: a single crown on an upper premolar, over a vital tooth. with a light natural color, in a patient with no history of parafunction. The indication for multilayer zirconia. In this case, although technically feasible, it involves the use of more complex materials and

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potentially less aesthetically pleasing than necessary. Lithium disilicate, with its translucency Natural and established adhesive protocol would produce equivalent or superior results in strength. clinically, with better optical integration. The choice of zirconia in this context reflects more the search based on perceived safety rather than rational analysis of the demands of the case (KELLY; BENETTI, 2011).

On the other hand, there is also an under-indication of disilicate in situations where it would be clearly preferable, with replacement by zirconia for reasons of laboratory practicality or Lack of knowledge of optical properties. Laboratories that invested predominantly in Equipment for zirconia may have an economic incentive to recommend this material even when It is not the best clinical option. The decision regarding materials, in these cases, is influenced by external variables. in the patient's best interest.

4.3 When disilicate fails due to indication error

Lithium disilicate failures documented in the literature can be classified into two categories. Categories: failures related to the intrinsic properties of the material and failures related to errors. of indication or execution. The distinction is important because each category demands responses. different.

Intrinsic property defects are those that occur even when the material is used within its indicated parameters and with proper technique. They represent the real limits of the system. Ceramic. Failures due to incorrect specification are those that result from an inappropriate choice of material. for the specific clinical context. In this case, the material did not fail because it was intrinsically insufficient, but because it was used where it shouldn't have been (HOLAND et al., 2012).

Examples of misuse of lithium disilicate include: use in three-pronged fixed prostheses. or more elements without additional support infrastructure; use in molars of patients with Severe bruxism without adequate provisionalization for load assessment; use in thicknesses below 1.0 mm in high occlusal load areas; use on substrates without conditions for adequate adhesion. (contamination, moisture, predominantly dentin substrate without appropriate treatment). In In all these cases, material fracture does not indicate an intrinsic deficiency, but rather an incompatibility between... the indication and known limitations of the system (SAKER; AL-'WAHADNI, 2020).

The digital workflow offers tools to prevent some of these errors. Thickness analysis. The CAD software can alert you to regions with insufficient dimensions. The patient's history, When properly documented, it allows for the identification of risk factors for fracture. Structured communication between the clinic and the laboratory can signal incompatibilities before... manufacturing. However, these tools only work when they are effectively used and when The professionals have the knowledge to interpret the information provided.

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4.4 Aesthetic predictability as a process outcome

Aesthetic predictability in ceramic restorations is not an attribute of the chosen material, but The result of a process that coherently articulates multiple variables. High-quality materials. They produce mediocre results when used without proper planning; more Simple things can produce excellence when the process is well managed.

The process that produces aesthetic predictability includes: correct diagnosis of color and translucency. of the substrate; analysis of available thicknesses and their optical implications; selection of translucency of Ceramic block compatible with the substrate and thickness; communication of references to the laboratory. necessary characterization; validation of the result through intermediate tests when indicated. Each step omitted or performed inadequately introduces variability in the final result (GÜTH et al., 2012).

The digital workflow amplifies both successes and failures in this process. When executed well, It allows for a preview of the result, simulation of different material and color options, and Documentation that facilitates communication. When poorly executed, it faithfully reproduces errors of planning, generating pieces that are technically perfect from a dimensional point of view, but aesthetically... Inadequate. The accuracy of CAD/CAM does not compensate for design flaws (MIYAZAKI et al., 2009).

4.5 The mistake of reversing the logic: material before design.

A common logical reversal in clinical practice involves selecting the ceramic material. Before analyzing the specific demands of the case, the professional decides whether to use zirconia or... Lithium disilicate is chosen as a preliminary decision, and then the design is adapted to the material's characteristics. chosen. This approach reverses the rational decision-making sequence and can result in compromises. unnecessary or foreseeable inadequacies.

The rational sequence begins with case analysis: what is the aesthetic demand? What is the situation? From the substrate? What prosthetic space is available? What are the risk factors for fracture? Which What is the occlusal context? Based on these answers, the material that best meets the set of requirements... It is selected. It can be lithium disilicate, high-translucency zirconia, conventional zirconia with coverage, or even a combination of materials in complex cases. The decision is a consequence of analysis, not its premise (GRACIS et al., 2015).

The digital environment favors this rational approach by providing analytical tools. before decision-making. Thickness maps, optical simulations, data overlay of different sources: all these resources allow you to assess whether a given material is compatible with the

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In this case, before any irreversible commitment. Professionals who use these tools of Those who systematically approach decisions tend to make more informed decisions than those who define the... material according to prior preference or established routine.

Table 1: Comparison between lithium disilicate and zirconia by clinical context.

Clinical Context	Lithium disilicate	Zirconia
Anterior facets	Ideal indication (natural translucency)	Limited (opacity in thin layers)
Previous crowns	Excellent (light substrate)	Suitable HT; conventional for masking.
Posterior crowns	Suitable (without parafunction)	Preferable (greater resistance to fatigue)
Witchcraft patient	High risk of fracture	Preferred indication
Darkened substrate	Limited (may become transparent)	Preferred indication (masking)
Extensive fixed prosthesis	Contraindicated	Preferred indication
Membership required	Well-established protocol	More complex protocol (specific primers)

Source: Prepared by the author based on the literature consulted (2025).

5 CONCLUSION

The analysis developed throughout this article allows for some conclusions regarding the selection and The use of aesthetic ceramic materials in the context of contemporary digital workflow.

The ceramic material is not the sole factor in the clinical outcome. Both disilicate and Lithium and zirconia are high-quality materials that, when used according to their indications, are... Appropriate methods, when used with proper technique, produce predictable and lasting results. The differences between They are contextual in nature: one material is preferable in certain situations, another in others. different. The search for a "universal" material that eliminates the need for case analysis is scientifically unfounded and clinically risky.

The digital workflow amplifies both successes and failures. Digital tools offer superior diagnostic capabilities and execution precision compared to analog workflows. However, these The tools faithfully reproduce what is planned, regardless of the quality of the planning. An inadequate material choice, a prosthetic design with thicknesses Insufficient resources, incomplete communication with the laboratory: all these errors will translate into... Physically accurate parts, but clinically inadequate. Technology does not replace reasoning. clinical.

Clinical-laboratory integration is a decisive factor for consistent results. The selection of The choice of aesthetic ceramic materials is not a decision made solely by the clinician or the laboratory, but rather the result of... A process that articulates information from both parties. The clinician who does not communicate the color of the substrate. It transfers to the laboratory a decision that should be its own. The laboratory that does not signal incompatibilities. The material, with the proposed design, ceases to fulfill its technical role. Predictability emerges from quality of this articulation.

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For contemporary clinical practice, these conclusions imply a need for revision of Decision-making processes. The selection of material should be a consequence of the case analysis, not a premise. Her. Digital tools should be used to support decisions, not just to... execute them. Communication between the clinic and the laboratory should include information that allows Well-founded choices, not just generic specifications.

For future studies, it would be relevant to investigate structured decision protocols that guide the selection of ceramic materials based on objective case criteria. It would also be useful to evaluate the impact of integrated training programs (clinical and laboratory) on the rate of Success of ceramic restorations in longitudinal follow-up.

In the digital age, aesthetic ceramic materials represent high-quality resources that... When used judiciously and in an integrated manner, they produce excellent results. The achievement of this... Potential depends less on choosing the "right" material and more on the quality of the process that connects it. Diagnosis, planning, communication, and execution. Ultimately, in the digital age, the choice of The material ceases to be an isolated technical act and becomes an expression of the maturity of the clinical process. The future of ceramic restorations doesn't belong to the most durable material, but to the professional. capable of integrating diagnosis, design, communication, and execution into a coherent and conscious flow.

REFERENCES

GRACIS, S.; THOMPSON, VP; FERENCZ, JL; SILVA, NRFA; BONFANTE, EA A new classification system for all-ceramic and ceramic-like restorative materials. *International Journal of Prosthodontics,* vol. 28, no. 3, p. 227-235, 2015.

GÜTH, JF; KEUL, C.; ZOLINE, M.;3D accuracy of digital models obtained by direct and indirect data capture. *Clinical Oral Investigations,* vol. 17, no. 4, p. 1367-1378, 2013.

HOLAND, W.; SCHWEIGER, M.; WATZKE, R.; PESCHKE, A.; KAPPERT, H. Ceramics as biomaterials for dental restoration. *Expert Review of Medical Devices,* vol. 9, no. 4, p. 357-367, 2012.

KELLY, JR; BENETTI, P. Ceramic materials in dentistry: historical evolution and current practice. *Australian Dental Journal,* vol. 56, Suppl. 1, p. 84-96, 2011.

MIYAZAKI, T.; HOTTA, Y.; KUNII, J.; KURIYAMA, S.; TAMAKI, Y. A review of dental CAD/CAM perspectives: current status and future from 20 years of experience. *Dental Materials Journal,* vol. 28, no. 1, p. 44-56, 2009.

SAKER, S.; AL-'WAHADNI, A. Ceramic materials: classification and uses. In: *Dental Ceramics: From the Fabrication Technique to Clinical Application.* Cham: Springer, 2020. p. 1-25.

ZHANG, Y.; LAWN, BR Novel zirconia materials in dentistry. *Journal of Dental Research,* vol. 97, no. 2, p. 140-147, 2018.