Pathological wear of enamel in ceramic based rehabilitation.

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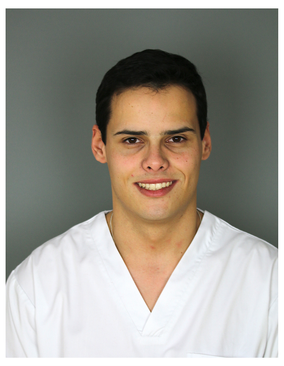

Introduction

The term "wear" applies to a volumetric loss of material existing on a surface under function. Tooth wear is the loss of dental structure in a tooth by a non-carious process, being identified as attrition, abrasion, and erosion. It occurs when there is contact between opposing surfaces, resulting in wear that takes place on the surface of the enamel or dentin, originating from physiological or pathological factors. (Aljomard et al., 2022; Heintze et al., 2008; León Velastegui et al., 2022)

This loss can occur between tooth-tooth or tooth-restorative material contact, and it can be accelerated by the introduction of restorative materials whose properties differ from those of the dental structure: hardness, fracture resistance, surface roughness.(León Velastegui et al., 2022)

TW is a progressive phenomenon, and it is expected to continue increasing with the rising demands from patients. It can lead to various clinical complications such as enamel and dentin loss, hypersensitivity, loss of vertical dimension, TMD, loss of chewing efficiency, and ultimately to an aesthetic compromise. In order to recover this loss of structure ceramic, restorations have become increasingly common, not only being aesthetically pleasing but also biocompatible with our organism." (Aljomard et al., 2022; Solá-Ruíz et al., 2020)

This literature review seeks to assess the most common factors associated with the pathological process of wear in enamel and ceramic-based rehabilitations.

Matherials and Methods

Bibliographic research was conducted on PubMed using the following search key: ("enamel wear" OR "antagonist wear") AND ceramic. A total of 133 articles were found, published between 1983 and 2023. The following inclusion criteria were applied: systematic reviews and English language. The exclusion criteria was non-open access article. This resulted in a total of 7 systematic reviews included in this research.

Development

Tooth wear (TW) is a complex phenomenon involving the removal of dental material from antagonistic teeth due to direct contact. (Heintze et al., 2008)

Several studies demonstrate that natural teeth also exhibit dental wear as a result of a physiological process, with an expected wear ranging from 15 μm to 29 μm over a year. (León Velastegui et al., 2022)

Among all the factors influencing enamel wear, hardness and surface roughness have traditionally been prominent. It would be expected that zirconia, with its superior hardness, would cause greater wear; however, several studies demonstrate the contrary. (Gou et al., 2019) When comparing zirconia to feldspathic ceramic, we can observe that the wear caused by zirconia is lower than that caused by feldspathic ceramic. One possible explanation for this phenomenon is that zirconia particles are smaller, resulting in a more polished surface. Another reason for this occurrence is the high surface hardness of zirconia, which makes the existence of surface microfractures less likely. These microfractures are responsible for increasing surface roughness and consequently increasing wear on the antagonistic tooth. (Ghaffari et al., 2022)

The ceramic materials itself affect dental wear behavior, yet various other factors influence the interaction between the restorative material and the antagonistic enamel. These factors include the abrasive nature of the diet, parafunctional movements, neuromuscular forces, and the characteristics of the opposing material (thickness, roughness, fracture resistance, hardness), furthermore, even the position of the tooth may have influence on the level of dental wear include the position of the teeth within the oral cavity. It's known that in the premolar area, wear is less, when compared to the molar region. (Passos et al., 2014; Solá-Ruíz et al., 2020)

Studies demonstrate that polished zirconia promotes less wear when compared to glazed zirconia, as the thin glaze layers wear off within the first 6 months after placing the restorative material into function. This is due to the surface underneath the glaze having higher surface roughness, thereby increasing the potential for wear. Furthermore, particles from the glaze can act as an external source of abrasion. (Gou et al., 2019)

Conclusions

Studies show that the existing correlation between the hardness of the restorative material and the wear of the opposing enamel is weak, with this effect being more dependent on the type of surface finish of the restoration, physical and microstructural factors of the material, and the chemical degradation of the material. Chairside occlusal adjustments increase the surface roughness, therefore increasing the wear rate of the antagonist tooth. Zirconia, despite its higher hardness is related to lower rates of tooth wear.

Bibliographic References

Aljomard, Y. R. M., Altunok, E. Ç., & Kara, H. B. (2022). Enamel wear against monolithic zirconia restorations: A meta-analysis and systematic review of in vitro studies. Journal of Esthetic and Restorative Dentistry, 34(3), 473–489. https://doi.org/10.1111/jerd.12823

Ghaffari, T., Rad, F., Goftari, A., Pashazadeh, F., & Ataei, K. (2022). Natural teeth wear opposite to glazed and polished ceramic crowns: A systematic review. Dental Research Journal, 19(1), 108. https://doi.org/10.4103/1735-3327.363567

Gou, M., Chen, H., Kang, J., & Wang, H. (2019). Antagonist enamel wear of tooth-supported monolithic zirconia posterior crowns in vivo: A systematic review. The Journal of Prosthetic Dentistry, 121(4), 598–603. https://doi.org/10.1016/j.prosdent.2018.06.005

Heintze, S. D., Cavalleri, A., Forjanic, M., Zellweger, G., & Rousson, V. (2008). Wear of ceramic and antagonist—A systematic evaluation of influencing factors in vitro. Dental Materials, 24(4), 433–449. https://doi.org/10.1016/j.dental.2007.06.016

León Velastegui, M., Montiel-Company, J., Agustín-Panadero, R., Fons-Badal, C., & Solá-Ruíz, M. (2022). Enamel Wear of Antagonist Tooth Caused by Dental Ceramics: Systematic Review and Meta-Analysis. Journal of Clinical Medicine, 11(21), 6547. https://doi.org/10.3390/jcm11216547

Passos, S. P., Torrealba, Y., Major, P., Linke, B., Flores-Mir, C., & Nychka, J. A. (2014). In Vitro Wear Behavior of Zirconia Opposing Enamel: A Systematic Review. Journal of Prosthodontics, 23(8), 593–601. https://doi.org/10.1111/jopr.12167

Solá-Ruíz, M. F., Baima-Moscardó, A., Selva-Otaolaurruchi, E., Montiel-Company, J. M., Agustín-Panadero, R., Fons-Badal, C., & Fernández-Estevan, L. (2020). Wear in Antagonist Teeth Produced by Monolithic Zirconia Crowns: A Systematic Review and Meta-Analysis. Journal of Clinical Medicine, 9(4), 997. https://doi.org/10.3390/jcm9040997