Design and Construction of Dental Prostheses: A Perspective from Mechanical Engineering

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Abstract

Over the past century, engineering principles have been utilized to improve treatment procedures and dental tool design. This approach leads to the development of new materials and technologies, improving the durability and functionality of dental restorations. Interdisciplinary collaboration between dentists and engineers has the potential to revolutionize dentistry and improve oral health. The emergence of computer-aided design (CAD) technology has made the production of dental prostheses more accurate. CAD technology allows for precise digital modeling of dental restorations, minimizing the need for manual measurements and reducing the margin of error. This not only saves time for both the dentist and the patient, but also ensures a more comfortable and precise fit for the prostheses. With the continuous advancements in engineering and dental technology, the future of dentistry holds great promise in providing patients with improved oral health and enhanced treatment experiences.

This article highlights the benefits of collaboration between dentists and engineers, which hopefully will encourage more engineers to actively participate in this fascinating field. However, despite technological advancements, the author stresses the necessity of adhering to biomechanical principles in clinical practice, and It's crucial to keep in mind that, even with technological advancements, dental prostheses have been shown to fail sometimes as a result of the design or construction process not adhering to biomechanical principles. This explains why the success of any dental restoration ultimately depends on the dentist's knowledge and skills, not just on recently developed machines alone. The author further argues that biomechanical principles are essential for all dentists to follow in order to provide the best care for their patients and reduce the likelihood of complications. Furthermore, introducing engineering concepts in dental education can equip future dentists with the necessary skills for clinical work. By incorporating courses in biomechanical engineering and materials science, encouraging collaboration between dentists and engineers, and promoting interdisciplinary research projects, we can improve the oral health of patients and advance dentistry.

Introduction

In clinical practice, new challenges arise every day that require far more involved and ingenious solutions, which may be solved through experimentation and experience. Treatment plans could be changed accordingly, as each patient has his own specific clinical situation [1]. Traditionally, the design of dental prostheses has depended on experiences passed down by dentists from generation to generation. The construction process is still very much one of trials and errors, altering the dimensions here and there to visually perceive what impact they have on the patients [2]. While in modern engineering, tools such as the finite element method have been used to improve the design process of any new mechanical device before it is actually used in the real world [3], they are also being applied to the design of dental implants to simulate the stresses and strains that will be placed on the bone, allowing engineers to optimize the design for maximum strength and durability [4].

Herein lies a great opportunity for interdisciplinary collaboration between dentists and engineers; working together could bring about innovative solutions for more complex dental cases. In fact, mechanical engineers in particular have extensive training in applying physical and mechanical principles to solve kinetic problems [5]. Their main focus is to make things work efficiently and effectively by applying the theories and principles of science and mathematics to the research and development of economical solutions to technical problems [6]. And therefore, interdisciplinary cooperation between mechanical engineers and dentists has the potential to transform the dental industry and enhance global oral health. A historical portrait is shown below as an illustration of the multidisciplinary cooperation between engineers and dentists:

Rudolph L. Hanau (1881–1930) was a mechanical engineer. He is credited with developing the Hanau articulator. He wrote many articles outlining the scope and application of dental engineering to dental practice. He used mathematical curves to determine the most suitable arch form for the individual, the relationship of the teeth in each jaw, and the kinematic and mechanical requirements [7]. This new method was promoted based on engineering principles. In 1929, William Williams, who is a metallurgist, explained the terms used in engineering (tensile) strength, elasticity, elastic limit, yield point, springiness, hardness, etc., to describe the physical properties of alloys used in dentistry. He elaborated on the methods of forming alloys, drawing the wires, and the instruments developed to test the various properties of dental archwire. He also discussed the factors that cause defects in those wires and suggested some clinical tips to improve the wire's properties [6]. In the late 18th century, French dentist Nicolas Dubois de Chemant collaborated with British engineer Matthew Boulton to develop a method for making porcelain dentures. Boulton's expertise in manufacturing and engineering allowed for the mass production of porcelain teeth, which were more durable and natural-looking than previous options [6]. The partnerships mentioned above and numerous others paved the way for future interdisciplinary collaborations, which marked a significant advancement in the field of dentistry [8]. These examples illustrate how engineers have been involved in the field of dentistry for over a century, using mathematical and mechanical principles to improve the design and functionality of some dental devices and treatment methods. It highlights how crucial it is for engineers and dentists to work together to provide patients with the best results possible, and hopefully this will inspire more engineers to actively engage in this fascinating field.

There are no doubts that the integration of technology in dentistry has led to even more opportunities for engineers to contribute to the industry. Computer-aided design and manufacturing (CAD/CAM) systems have improved the way dental restorations are made, allowing for the precise and efficient production of crowns, bridges, and other dental prosthetics [9]. Engineers are also involved in the development of new materials, such as ceramics and composites, that offer improved aesthetics and durability compared to traditional metal restorations [10]. As technology continues to advance, the role of engineers in dentistry will only become more prominent, driving innovation and improving patient outcomes

How do mechanical engineers relate to the dental profession?

Indeed, mechanical engineers are proficient in analyzing the intended function of a new product, creating a design that achieves these functions, creating and testing new product prototypes, selecting machines to manufacture products when necessary, designing and building brand new machines, and checking and testing finished products [11]. The integration of mechanical designs into living tissues, such as the design of a hip joint prosthesis, falls within one of the branches of mechanical engineering represented in the Division of Biomechanics.

Biomechanics is concerned with the study of the structure, function, and movement of mechanical aspects of biological systems at any level, from whole living organisms to organs, cells, and cellular organelles [12]. The mechanical engineers use their knowledge of materials and mechanics to create a design that mimics the movement and function of the missing human organ and then conduct extensive testing to ensure its effectiveness.

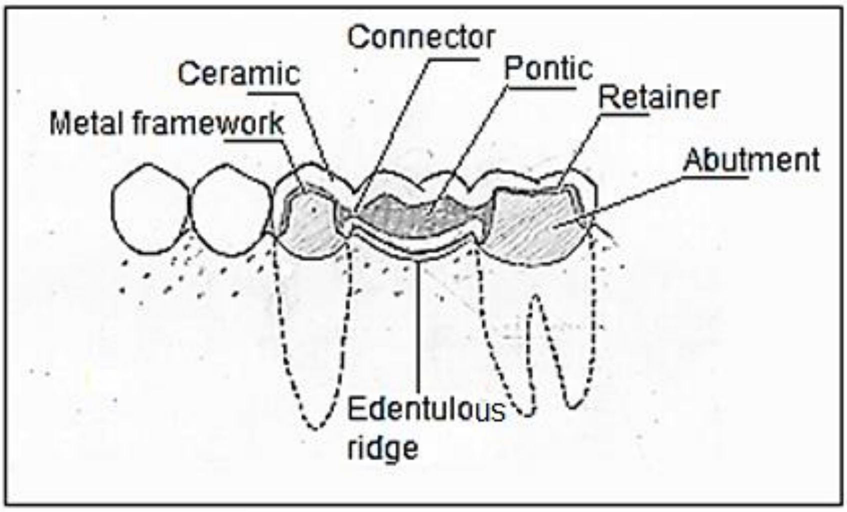

Fig. 1 demonstrates a PFM bridge cemented over a prepared natural tooth (abutment) consisting of two crowns connected with an artificial tooth in the middle (pontic) over the edentulous ridge, with the porcelain layer mimicking natural tooth color and translucency. The metal framework underneath provides strength and stability.

The good news is that porcelain fused to metal bridges (PFM) (Figure 1), as one example among many, are mechanical devices used to replace missing teeth by gaining support from either natural teeth or implants at both ends of an empty tooth space [13]. Just as steel bridges are used around the world, they are subject to similar types of loading on these structures [14], except that biological conditions within the oral cavity and structures associated with the jaw system are different in nature. The biomechanical principles of PFM are highly complex and require specialized knowledge to successfully design effective dental prostheses that maintain proper function over time [15]. The study of prosthodontic principles and the proper application of this knowledge of mechanical engineering and biology in conjunction with biomechanics offer clinicians the opportunity to consistently produce successful dental prostheses.

The Importance of Biomechanical Principles in Dentistry

Actually, Digital modeling has improved dental prosthesis production by reducing the margin of error and minimizing manual measurements in dental restorations. With the emergence of computer-aided design (CAD) technology, the process of producing dental crowns and bridges has become more accurate and less reliant on guesswork by dental technicians. Today, the dentist could use 3D scanning to capture the anatomy of the patient's oral cavity and the prepared tooth to send it to the dental laboratory, and the dental technician could use CAD technology to create digital models of the prepared teeth and surrounding tissue, enabling manipulation to find the ideal crown shape and size to produce dental restorations that are actually more accurate than conventional methods. However, a dentist may need to design a prosthesis that not only matches the color and shape of the surrounding teeth but also functions properly with the patient's unique bite and chewing patterns. Furthermore, the use of computer-aided design technology may not necessarily eliminate the need for trial and error, as there may still be variations in how patients respond to the prostheses [17]. Also, Understanding the biomechanical principles underlying the preparation of the abutment tooth and the principles that should be followed during that process are other factors that affect a restoration's success. Incorrect or Insufficient tooth preparation appears to be responsible for premature failures due to biological aspects, such as caries and endodontic or periodontal disease complications [18]. Even with technological advancements, there have been documented cases of dental prostheses failing, mostly because biomechanical principles were not followed during the design or construction phases [19]. Evidently, if these principles are not taken into account, dental prostheses are likely to cause additional damage to nearby teeth or even their loss due to excessive force and pressure on the supporting structures. Therefore, it is important for a dental prosthesis to not only be aesthetically pleasing but also to function properly with the patient's bite and chewing patterns. While computer-aided design technology can be helpful in designing prostheses, it may not completely eliminate the need for trial and error due to individual variations in patient response. Additionally, understanding the biomechanical principles involved in preparing the abutment tooth and following the appropriate principles during the process are also important factors in its success.

Moreover, maintaining gingival health is one of the keys to the resilience of dental prostheses [20]. Understanding the relationship between periodontal tissues and dental prostheses is extremely important for maintaining good dental health. For instance, ectodermal tissue serves to protect against invasion from bacteria and other foreign materials; both teeth and dental implants must penetrate this defensive barrier. The natural seal that develops around both, protecting the alveolar bone from infection and disease, is known as the biologic width. The biological width is defined as the dimension of the soft tissue that is attached to the portion of the tooth or implant coronal to the crest of the alveolar bone. The biological width (Figure 2) regulates the removal of inflammation that might impair the periodontium and the preservation of periodontal health [21]. The millimeter that must exist between the base of the junctional epithelium and the tip of the alveolar bone is responsible for preventing inflammation and bone resorption. As a matter of fact, restorations exceeding the biologic width may lead to inflammation and bone resorption, which could ultimately lead to the failure of the restoration.

According to the aforementioned, it is extremely important to take biomechanical principles into account when designing and placing dental prostheses. This includes understanding the relationship between periodontal health and dental restoration. By doing so, the risk of damage to nearby teeth and loss of supporting structures can be prevented while ensuring the success and longevity of the dental restoration. By maintaining a proper balance between the restoration and periodontal health, the risk of inflammation, bone resorption, and ultimately the failure of the restoration can be minimized. This demonstrates the importance of biomechanical principles during all stages of dental prosthetic design and construction, even with modern technological advancements. Therefore, despite these advancements in dental technology, healthcare professionals still need to have a firm understanding of the application of the biomechanical principles underlying dental prostheses. Also, it is important to gain an understanding of the biological mechanisms behind it [22]. Although the majority of practitioners are aware of biomechanical principles, many have not used them to their full potential [23], and there is still confusion over certain ideas [24]. Certainly, with rapidly evolving science and technology, information becomes more readily available, creating challenges for dentists to obtain, understand, evaluate, and integrate all this information into their daily clinical practice [25]. As professionals, it is our duty to draw attention to the fact that all dentists must prioritize the application of biomechanical concepts in their daily practice and adopt a mechanical engineer's perspective when designing and manufacturing dental prostheses in order to ensure the best outcomes for their patients and reduce the potential for complications. Even though it may not be possible to cover all concepts in one article, we will address some of the most important ones, starting with the mechanism of natural tooth support.

Mechanism of Natural Tooth Support

The periodontium is a complex structure composed of the cementum, gingiva, periodontal ligament (PDL), and alveolar bone. It is responsible for supporting the tooth's attachment to the bone and acting as a partition between the underlying structures and the oral microflora. The gingival epithelium is composed of stratified squamous epithelium, and the PDL is a fibrous connective tissue that connects the cementum of the tooth to the alveolar bone [26]. The alveolar bone is the bone that surrounds and supports the teeth and is constantly remodeling to adapt to the forces placed on it during chewing and other activities [27]. The gingival sulcus is a shallow crevice that is apically bound by the coronal aspect of the junctional epithelium, laterally by the sulcular epithelium, and medially by the tooth surface, and superiorly exits into the oral cavity (Figure 2).

The PDL connects the root cementum to the alveolar bone, supporting the tooth within the mandible or maxilla [28]. The PDL fibers are able to adapt to changes in force over time, which allows for proper distribution and absorption of the forces during chewing and biting. Bite force ranges from 80 N in the anterior teeth to 800 N in the posterior teeth [29], while enamel is typically a brittle material that offers low resistance against tension, whereas dentin has a higher modulus of resilience and the ability to deform elastically [30]. Additionally, the PDL

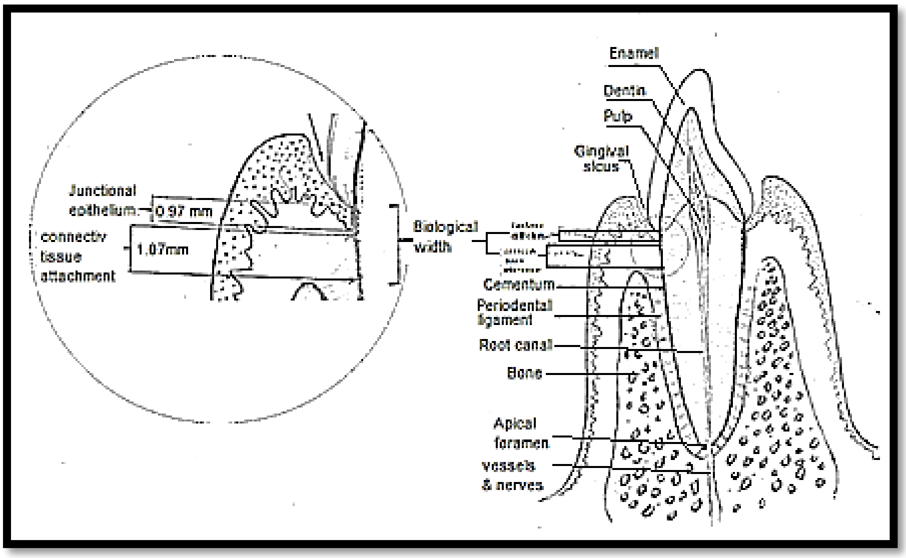

Fig. 2 demonstrates a shallow crevice (the gingival sulcus) apically surrounded by the coronal aspect of the junctional epithelium, laterally by the sulcular epithelium, medially by the tooth surface, and superiorly exiting into the oral cavity

contains a network of blood vessels, nerves, and lymphatic vessels that provide essential nutrients and oxygen to the tooth and surrounding tissues and act as a sensory organ, allowing individuals to perceive pressure and pain when chewing or biting [28]. in conclusion Any issues with the periodontium, such as inflammation or infection, can have significant consequences for the overall health of the mouth and the durability of the prostheses.

Evaluation of the abutment tooth for fixed dental prostheses from the biomechanical perspective

The evaluation of an abutment tooth for fixed dental prostheses is crucial for its proper function and long-term performance. Proper evaluation and treatment planning ensure successful outcomes for patients. For example, the abutment must have sufficient remaining tooth structure to support the prosthesis and withstand chewing and biting forces [31]. Additionally, the abutment tooth should be free from any periodontal diseases or infections to ensure a stable foundation for the prosthesis.

During the evaluation process, it is also necessary to take the prosthesis' type, placement within the arch, and occlusal pattern into account [32].

Before proceeding with a prosthesis, it is crucial to address any preexisting periodontal or endodontic conditions [33]. Vital teeth are preferred to be used as an abutment as they have a better prognosis and are less likely to develop complications like root resorption or inflammation [34, 35]. Non-vital teeth can be used as an abutment if there is a good seal and complete obturation of the canal. Additional restorations, like posts and cores, may be necessary for adequate retention of the final restoration [36]. Teeth that have been pulp capped in the process of preparation should not be used as fixed partial denture abutments unless they are endodontically treated. There is too great a risk that they will require endodontic treatment later, with the resultant destruction of the retentive tooth structure and of the retainer itself [37]. It is preferable to handle this situation before the dental prosthesis is established. The supporting tissues surrounding the abutment teeth must be in good health and free of inflammation. If there is any periodontal disease present, it must be treated before proceeding with dental prostheses. This is important because the success of the prosthesis depends on the stability of the abutment teeth and their supporting structures. Any underlying pathology can compromise the long-term success of the restoration [37]. In addition, the occlusion must be carefully evaluated and adjusted for every abatement tooth individually to ensure that the forces of mastication are evenly distributed across all of the teeth. This can help prevent excessive wear and tear on the restoration and on the natural teeth [38]. Finally, but not final, if a tooth adjacent to an edentulous space needs a crown because of damage to the tooth, the restoration can usually double as a fixed partial denture retainer [39]. If several teeth are missing in one arch, there is a strong argument for the selection of a fixed partial denture rather than a removable partial denture [40].

crown-root ratio evaluation (CRR)

The crown-root ratio is a crucial aspect of the biomechanical evaluation of abutments, determining the stability and longevity of the restoration. According to the Glossary of Prosthodontic Terms, Ninth Edition (GPT 9) "the physical relationship between the portions of the tooth not within the alveolar bone, as determined by a radiograph, compared with the portion of the tooth within the alveolar bone". A healthy ratio is around 2:3, meaning the root is about two-thirds the length of the crown (Figure 3). A ratio higher or lower than this indicates potential issues like periodontal disease, trauma, or improper tooth eruption. A ratio as high as 1:1 may be considered adequate for dental prosthetics that supply opposing forces instead of natural teeth [39]. Studies have shown that artificial teeth create significantly lesser occlusal forces, resulting in decreased wear and tear on the prosthetic appliance and potentially increasing its lifespan [41].

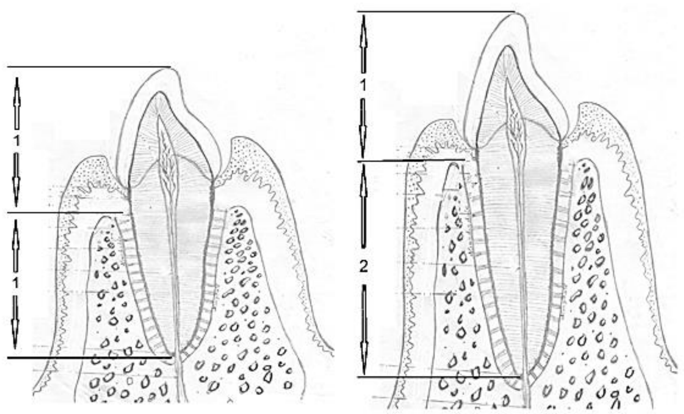

Fig. 3 A healthy ratio is around 2:3, meaning the root is about two-thirds the length of the crown.

Proper alignment of artificial teeth in the opposing arch is crucial to preventing unwanted forces or interferences [42]. A less-than-desirable crown-root ratio might support a fixed partial denture if the opposing occlusion consists of teeth that are mobile and periodontally compromised. Conversely, if the opposing occlusion consists of sound, stable teeth, a less-than-ideal crown-root ratio may result in increased forces and possible harm to the prosthetic appliance. Therefore, it is important to consider the condition of the opposing teeth when determining the appropriate crown-root ratio for a fixed partial denture [37]. Other factors, such as remaining tooth structure quality, periodontal support, occlusal forces, and aesthetic considerations, should also be considered when selecting an abutment tooth for a dental prosthesis [39].

Root configuration

When evaluating an abutment's suitability from a periodontal perspective, root configuration plays a significant role. For example, roots that are broader labiolingually than they are mesiodistally are preferable to roots that are round in cross-section, fused, or generally present a conical configuration. Multirooted posterior teeth with widely separated roots will provide better support compared to roots that converge, fuse, or generally have a conical shape [43]. If all other conditions are ideal, it is possible to use the tooth with conical roots as an abutment for a short-span fixed partial denture [44]. A single-rooted tooth with evidence of irregular configuration or with some curvature in the apical third of the root is preferable to a tooth that has a nearly perfect taper. However, the irregular configuration or curvature of the apical third of a single-rooted tooth may pose challenges during the preparation and cementation of the restoration [39]. Anyway, the material above was only intended to serve as a brief review of some of the most important concepts; there are many more biomechanical principles that are used in dentistry. More articles are needed to fully address all topics.

Tooth preparation for fixed prosthodontics

The purpose of fixed prosthodontic therapy may vary from the restoration of a single tooth to the rehabilitation of a complete occlusion. The most typical procedure for crowning a tooth is to make the crown outside of the mouth (indirect restorations) using a dental impression of the prepared tooth [45], which is then sent to a dental laboratory, where the crown is fabricated using various materials, such as porcelain, metal, or a combination of both. Once the crown is ready, it is cemented onto the prepared tooth, providing a natural-looking and long-lasting restoration. This indirect form of tooth replacement enables the use of durable restorative materials that would not be possible within the mouth (direct restorations), such as casting metal or burning porcelain. During the preparation process, the removal of a portion of the tooth structure can affect the strength and longevity of the tooth, so it's essential to carefully consider the amount of structure needed to be removed and use proper techniques to minimize damage [46]. The amount of tooth structure needed depends on the type of restoration and the tooth's condition. For example, if a full coverage crown is being placed, more tooth structure will need to be removed than if a veneer is being placed [47]. Additionally, if the tooth has decay or damage, more tooth structure may need to be removed to ensure that the restoration fits properly and does not cause further damage to the tooth [46].

Most commonly, the dentist uses local anesthesia to numb the area before removing any tooth structure. This helps to ensure that the patient is comfortable throughout the procedure. The dentist will carefully shape the tooth to create a stable foundation for the restoration. This involves smoothing rough edges and adjusting the shape of the tooth to the ideal geometrical contour. The dentist will then take an impression of the prepared tooth or teeth and send them to a dental laboratory, where the restoration will be custom-made to fit the patient's prepared tooth precisely. From the aforementioned, we can deduce that suitable tooth preparation is crucial for the fitting of fixed prosthodontics (Figure 4), which is meant to provide smooth, uniform preparation that has no undercuts. Insufficient tooth preparation appears to be responsible for premature failures due to biological aspects, such as caries and endodontic or periodontal disease complications [48].

Fig. 4 is an example of tooth preparation for the fitting of fixed prosthodontics, which is meant to provide smooth, uniform preparation that has no undercuts.

Tooth preparation for a fixed prosthesis is a common procedure that all general dentists are supposed to perform correctly. However, it can be difficult to obtain a predictable result, especially for dental students or young doctors [49]. Effective preparations can be achieved by meticulously adhering to the procedures and instructions outlined in dental textbooks and by experienced dentists. It is important to keep in mind that every case is different and can require specific adjustments to the method of preparation. To achieve an optimum, high-quality final restoration that will serve the patient for a very long time [46].

The success of a restoration depends on the principles followed during the preparation process, and understanding the biomechanical principles behind abutment tooth preparation is essential to ensuring longevity. Tooth preparation should have specific geometrical characteristics to provide the necessary retention and resistance to the vertical and lateral forces acting on the restoration [50]. The most important element of retention is the presence of two opposing vertical surfaces. The axial walls of the preparation should taper slightly to allow the cementation of the artificial crown. The occlusocervical length is another fundamental factor for both retention and resistance. Proper occlusal and axial reductions are essential to provide enough space, allowing a good functional morphology and structural durability. At the same time, no more than necessary dental tissues should be removed to not jeopardize tooth structure and the retention of the restoration [51].

Considering Biomechanical Principles When Preparing Teeth

Before starting the tooth preparation process, experts recommend creating depth-orientation groves on the vestibular and incisal surfaces and using a round-end tapered diamond as a guide to remove tooth structure. The occlusal reduction is performed by removing tooth portions between the orientation groves with the same bur. Three vertical groves are performed in the vestibular surface with a flat-end tapered diamond, and then all tissues between the depth-orientation groves are removed [50]. The proximal reduction is performed with a needle narrow diamond, and the lingual and proximal surfaces are cut with a torpedo diamond. Different finishing lines can be created, such as a chamfer for veneer metal restorations, a shoulder finishing line for all-ceramic crowns, and a knife edge for over-contoured restorations. Retention and resistance are crucial for the longevity of a tooth restoration [51]. The dentist must balance retention and resistance to achieve a stable and durable restoration that meets the functional and aesthetic needs of the patient. The finishing line is the junction between a cemented restoration and the tooth, and the more accurately the restoration is adapted to the tooth, the lower the chance of failure. The margins should be easily discernible and accessible on casts submitted to the technician. Chamfer's finishing line has a distinct margin and adequate bulk, and the shoulder finishing line provides bulk restorative material for the facial margin of ceramo-metal crowns and all-ceramic crowns [52]. Finally, it is important to communicate clearly with the technician to ensure that the desired margin is achieved and that the restoration fits properly. Considering the aforementioned, it is clear that a dentist cannot prepare teeth that evenly distribute occlusal stresses, protect remaining tooth structure, lower the likelihood of failure, and guarantee the restoration is aesthetically pleasing and long-lasting without taking biomechanical concepts into account.

Discussion

This article makes the point that, despite these developments in computer-aided design technology, dental treatment may not be successful if biomechanical principles are not taken into consideration during the design or construction stages of dental prostheses. This will undoubtedly cause additional damage or the loss of neighboring teeth. The term "biomechanics" refers to the study of the mechanical properties of biological systems, including the stresses and forces that act on them. The primary purpose of this article is to underline the significance of comprehending biomechanical principles and the factors that should be taken into account in order to guarantee the durability and efficacy of prostheses. For example, the design of the prosthesis should allow for easy access to the surrounding teeth and gums for cleaning and maintenance, fundamentally because the buildup of bacteria and plaque can lead to gum disease and other oral health issues. Additionally, a poorly designed removable denture can result in sore spots, bone loss, and even oral cancer due to the constant irritation of the tissue, whereas an improperly constructed implant-supported bridge can cause bone loss and gum recession, leading to implant failure. Similarly, a long-span dental bridge can put too much pressure on the teeth it supports, which can cause tooth mobility or even tooth loss in the long run.

Another example of a biomechanical concept in dental bridges is the crown-to-root ratio, which refers to the ratio of the length of the tooth's crown to the length of its root. Dentists must carefully evaluate and plan for a balanced crown-to-root ratio when designing dental bridges to ensure long-term success and stability for their patients. A tooth and its supporting structures may be put under more stress due to a less-than-ideal crown-to-root ratio, which might result in issues including root fracture or a loss of periodontal support. Additional elements include the number and quality of the tooth structures still present, periodontal health, and occlusal forces. The aforementioned facts suggest that in order to achieve good results, dental practitioners need to not only make use of the most recent technology but also have a solid grasp of biomechanics. Overall, by taking biomechanics into account during the design and construction of dental prostheses, dental professionals can ensure that their patients receive effective and long-lasting treatment that improves their oral health and overall well-being.

Additionally, tooth preparation is crucial for fixed prosthodontics, ensuring a smooth and uniform fit. Tooth preparation should have specific geometrical characteristics to provide retention and resistance to vertical and lateral forces, ensuring proper fit and stability of the final restoration. Preserving healthy tooth structure and minimizing tissue damage are also important considerations. Insufficient preparation can lead to premature failures due to biological factors like caries and endodontic or periodontal disease complications. Inadequate tooth preparation can also result in mechanical failures such as fractures or dislodgement of the prosthesis. Therefore, it is essential for dental professionals to carefully evaluate the biomechanical factors involved in tooth preparation to achieve optimal outcomes. Mastering tooth preparation requires a combination of theoretical knowledge, practical skills, and experience. General dentists should perform tooth preparation correctly, but it can be challenging for dental students or young doctors. They may lack experience or have limited knowledge of the proper techniques and principles of tooth preparation. Dental students and young doctors must be committed to continuous learning and professional development, staying updated with the latest advancements in dental materials and technologies, and refining their hand-eye coordination and motor skills through practice. This is why dental education programs must emphasize the importance of comprehensive training in this area. By providing students with hands-on practice and guidance from experienced faculty, they can develop the skills necessary to perform effective and successful tooth preparations. With proper education and training, dental professionals can minimize the risk of complications and ensure the longevity and functionality of prosthetic restorations.

Even though mechanical engineers in particular have had extensive training in applying physical and mechanical principles to solve kinetic problems, they might not have the necessary knowledge of dental anatomy and biology to design a dental prosthesis that is specific to each patient's needs. However, by combining their skills, dentists and mechanical engineers might lead to the development of new materials and technologies that can enhance the durability and effectiveness of dental prostheses. It is possible that a dentist can acquire the necessary knowledge of physical and mechanical principles through further education and training, but it may take a significant amount of time and effort. On the other hand, a mechanical engineer can learn about dental anatomy and function through collaboration with dentists and other dental professionals. By working together, dentists and mechanical engineers can develop a deep understanding of each other's fields and create innovative solutions that can improve patient outcomes. Ultimately, the collaboration between dentists and mechanical engineers has the potential to revolutionize the field of dentistry.

Finally, incorporating engineering concepts into dental education can enhance the understanding of mechanical forces in the oral cavity and the materials used in dental procedures. Biomechanical engineering courses can teach dentists how to analyze and optimize the design of dental prostheses and implants, ensuring their longevity and functionality. Materials science courses can provide dentists with knowledge of different materials and their properties, enabling them to select the most suitable materials for specific dental applications. This interdisciplinary approach can result in more effective and durable dental treatments, ultimately benefiting patients. By incorporating courses in biomechanical engineering and materials science, encouraging collaboration between dentists and engineers, and promoting interdisciplinary research projects, we can improve the oral health of patients and advance dentistry.

Conclusion

Despite the advancements in computer-aided design technology, dental professionals still need to have a firm understanding of the biomechanical principles that underlie dental treatment to guarantee the best results for their patients and decrease the incidence of complications. Dentists must prioritize the application of biomechanical principles in their everyday practice and take a mechanical engineer's perspective when designing and making dental prosthetics. Likewise, mastering tooth preparation requires a combination of theoretical knowledge, practical skills, and experience in order to achieve optimal results.

The collaboration between dentists and mechanical engineers has the potential to revolutionize and advance dentistry. By combining their skills, they can create cutting-edge tools and methods that improve patient care. This collaboration can also lead to the development of new materials and techniques that can enhance the durability and effectiveness of dental prostheses.

Other biomechanical concepts are applied in dentistry on a daily basis. To properly address all subjects, further articles are necessary.

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Conflict of Interest:

No conflict of interest exists.

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