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How Variations in Orthodontic Treatment Access, Materials, and Prescription Practices Across Countries Contribute to Social Inequality in Dental Health

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Abstract. This paper examines the medical necessity of orthodontic braces and the significant discrepancies in the availability of orthodontic care between urban and rural areas in the United States. Using studies on malocclusion, oral health risks, geographic barriers to treatment, and shortages in rural dental care, this paper further analyzes how these factors contribute to significant disparities in oral health outcomes and access to orthodontic services. Finally, a few suggestions regarding the care framework to reduce the gap, which include easing travel restrictions, expanding local treatment capacity, and improving access to orthodontic treatments through technology and community-based assistance, are examined. These approaches are especially practical solutions to underserved communities that can lessen disparities in oral health and preserve long-term dental wellness.

Keywords. Orthodontics, Disparities, Access, Inequality, Public Health

Introduction

Orthodontic braces, which are commonly used to repair various dental issues, such as crooked, gapped, twisted, or crowded teeth, are essential not only for improving dental aesthetics but also for oral function and long-term oral health. Even though orthodontic treatment is available in urban and suburban areas, social injustice and significant gaps still exist in rural areas of the United States. As the primary focus of this paper is the United States, international studies also provide additional context and highlight trends in rural dental care that apply broadly. To clarify, I defined rural areas as those with a population density of fewer than 2,500 people, which are outside urban boundaries, and urban areas as those with over 2,500 people. Although about 67.6% of individuals under the age of 18 in the United States reported wearing orthodontic braces ([pmc.ncbi](https://pubmed.ncbi.nlm.nih.gov/)), treatment access is limited in rural regions. Geographic isolation and systemic barriers are the primary issues that make it difficult to obtain dental treatment. Individuals in these areas often face longer travel distances, fewer dental practitioners, and limited insurance coverage, resulting in postponed or missed treatment opportunities. Even if these issues appear minor, delaying orthodontic treatment may have serious long-term consequences for dental health. This paper will first discuss the medical necessity of orthodontic braces, along with the differences between aesthetic and functional

braces, and an outline of each treatment. The challenges to accessing orthodontic care in rural America will then be examined, with a focus on receiving treatment. Finally, the paper will propose realistic and evidence-based solutions to address these disparities and enhance access to necessary orthodontic services. Enhancing teledentistry infrastructure with user-friendly systems that can accommodate restricted internet connectivity will be represented as an effective approach to addressing limited access to remote locations (pmc.ncbi). These solutions will fulfill the demands of people who may not be tech-savvy while also addressing the challenges that rural communities face by raising public awareness. Long-term oral health can also be improved by teaching local dentists in the area how to manage basic orthodontic needs, offering financial assistance for in-person visits when needed, and providing ongoing education about how important orthodontic treatment is from a medical standpoint.

Necessity of Braces

While standard dental care is more common and easier to access, orthodontic care is equally important for long-term oral health. In fact, misaligned teeth can lead to a variety of oral health complications, such as increased plaque production and a higher risk of periodontal disease. According to studies, those without orthodontic treatment had higher levels of plaque and harmful germs, which can lead to periodontitis, a serious gum infection (undark.org). Malocclusion, which includes overbite, underbite, and incorrect alignment, can have an impact on psychological health through impaired chewing, speech difficulties, temporomandibular joint (TMJ) disorders, and bruxism (pmc.ncbi). Additionally, it could influence aesthetic appearance, which can impair mental health. Recent clinical studies have found a link between malocclusion and adverse oral health outcomes in children and adolescents. According to research, the “Mann-Whitney U test” helped to analyze the average malocclusion rank among adolescents with cavities (23.15) and teens without cavities (12.83). The test concluded that teens with cavities were more likely to develop malocclusion by illustrating how unhealthy dental habits make alignment and oral health worse (AmeGroups). Not just in the US, but also among Nigerian children aged 6 to 12, the pattern shows that children with crowded teeth and buccal crossbites are more likely to develop cavities (pmc.ncbi). Similarly, children who had more overjet or anterior open bites were more likely to get gingivitis, and the worse the malocclusion, the higher this risk became, emphasizing the importance of orthodontic care for improved dental health. The goal of basic dental treatment is to quickly and effectively restore oral health. Orthodontic braces, on the other hand, are a long-term way to maintain dental health. Once treatment is finished, braces help straighten teeth and reduce the risk of plaque buildup and periodontal inflammation, making it easier to clean the teeth (mdpi.com). Orthodontic treatment is also important in preserving teeth and improving long-term outcomes since orthodontists, general dentists, and periodontists work together to provide the best potential results for their patients. This shows orthodontic care is equally essential because it addresses underlying structural issues that can prevent future problems and improve overall oral health.

Types of Braces

Braces are widely used for two major purposes: aesthetic improvement and medical necessity. Braces, such as clear aligners (\$4,000-\$6,000), ceramic braces (\$4,000-\$8,000), and lingual braces (\$5,000-\$13,000), are often chosen for aesthetic purposes. Aesthetic braces are less visible but generally more expensive than functional braces, as they are typically designed with tooth-colored brackets and wires that blend with natural teeth. Functional braces, which

typically include standard metal braces (\$3,000-\$7,000), are used for medically necessary orthodontic treatment rather than for aesthetic purposes. While both aesthetic and medical braces can help with alignment, aesthetic braces are less successful at managing serious oral health problems, such as appropriate occlusal contacts, controlling tooth torque, and long-term retention (BMC Oral Health). Clear aligners are only suitable for mild to moderate malocclusion, and patients require more appointments in fixed appliance therapies since overall treatment time is shorter in the Invisalign group. Functional appliances, on the other hand, have been shown to improve both considerable OHRQoL (oral health-related quality of life) and patient cooperation (pmc.ncbi). They provide more clinical benefits than aesthetic braces in critical situations that may impact oral health.

Using braces for both aesthetic and medical reasons can be clearly communicated to patients to enhance treatment outcomes. Without this understanding, patients may underestimate the importance of orthodontics in maintaining long-term oral health. Emphasizing the fundamental health-related importance of orthodontic care beyond appearance helps ensure they appreciate its full benefits. Braces can lower the risk of long-term dental complications, enhance speech function, and encourage better oral hygiene by making teeth easier to clean. This approach may improve treatment outcomes and raise public awareness that braces are an important aspect of preventive dental care. Research shows that adults aged 18–64 in rural areas are nearly twice as likely to lose their teeth compared to those in non-rural communities. Rural adults are also more likely to have untreated tooth decay (32.6% vs. 25.7%) and less likely to have visited a dentist in the previous year (57.6% vs. 66.7%). Consistently worse oral health outcomes also contribute to rural regions, making up 74% of the 2,235 designated Dental Health Professional Shortage Areas. These disparities matter because braces can directly improve oral health (ruralhealth.us). The fact that braces contribute to the maintenance of lifetime oral health clarifies the importance of orthodontic treatment for all populations, especially underprivileged rural communities.

Medical Conditions That Require Braces

Class I, II, and III malocclusions are several types of misaligned teeth and jaws that are treated with braces. Class I malocclusion occurs when the teeth misalign due to spacing issues, while overbites resulting from the upper jaw overlapping the lower jaw are classified as Class II malocclusion. Class III malocclusion is characterized by the upper jaw not overlapping the lower jaw. Oral function can be significantly impacted by additional diseases such as temporomandibular joint (TMJ) issues, speech problems, chewing difficulties, and uneven jaw alignment (northvalleymiles.com).

Orthodontists treat these disorders with a range of functional appliances, both fixed and removable. Some, like the Herbst Appliance and Palatal Expander, are fixed in place and help the jaw grow over time. Twin Block and Bionator are removable appliances that help adjust the jaw for better alignment. In more extreme cases, orthognathic surgery may be required to move or restructure the jaw structure if orthodontic appliances are unable to resolve jaw discrepancies.

The medical significance of braces is clear, but restricted access to treatment, particularly for rural populations, can create significant barriers to orthodontic care not only in the United States but also in other countries.

Limited Access in Rural Areas

This section will cover three major factors that contribute to limited access to orthodontic care in rural areas. First, it will examine the geographic barriers that come from increased travel distances and time requirements for dental care. Second, it will look into financial challenges, such as higher costs, insufficient insurance coverage, and a lack of care that impacts productivity. Finally, it will address the shortage of dental specialists, as well as regional and racial disparities that further limit access to necessary orthodontic treatment.

First, studies conducted in the United States found that the average travel distance for medical/dental care increased from 15.16 miles in 2001, 16.94 miles in 2009, and 17.93 miles in 2017. In 2017, rural residents traveled 2.5 miles farther and spent 5.3 minutes longer in transit for medical and dental care than urban residents. For those with limited access and high costs, this small gap could significantly impact their ability to receive treatment. Furthermore, the proportion of dental visits in rural areas that lasted 30 minutes or longer increased from 36% in 2001 to 47.4% in 2017, indicating an increasing geographic burden in getting care (PMC).

Second, many vulnerable populations within the US healthcare system had a harder time paying for dental care than for most other types of healthcare. In 2022, 17% of working-age adults reported not receiving necessary dental care treatments due to cost, and the percentage increased to about 30% for those who were at or below the federal poverty level, a group disproportionately represented in rural areas (ada.org). Additionally, slightly more than one-third of rural individuals (34%) lack dental insurance coverage, which is significantly higher than the rates in cities (29%) and suburbs (24%). 67% of the rural areas also had a shortage of dental health professionals. Employers in rural areas are less likely to provide dental insurance than those in more densely populated regions, indicating limited access to care (carequest.org). A lack of dental care also leads to a significant loss of productivity, such as missed work and school hours. Each year, an estimated 320.8 million work or school hours are lost in the US due to dental care, including 92.4 million hours for unplanned treatment, 159.8 million hours for scheduled or orthodontic care, and 68.6 million hours for cosmetic care. Emergency dental appointments caused adults with bad oral health to lose more time, sometimes for more than one hour (cdc.gov).

Third, underprivileged and rural populations face significant challenges in accessing orthodontic care due to a shortage of dental professionals. A cross-sectional study of US dentists found that 24.7 million people lived in areas without dental care, while nearly 1.7 million people within a 30-minute drive of dental clinics lacked access to them. Urban communities with high levels of segregation and socioeconomic deprivation had a higher likelihood of receiving dental treatment due to a dental care shortage than rural communities and groups with low levels of segregation and socioeconomic deprivation. As a result, rural and underprivileged areas experience a shortage of dental specialists and have limited access to essential care (jamanetowork.com). As of 2021, the number of dentists per 100,000 people is 65.8 in cities and 29.9 in rural areas, resulting in a “retirement cliff” (ada.org). Limited access and regional and racial disparities are also significant issues in rural areas. For example, a national study in Brazil found that 53.2% of Brazilian teenagers require orthodontic treatment, particularly females, non-white adolescents, and those who had negative self-perceptions of their appearance or a self-perceived need for braces. Even though this statistic comes from Brazil, it demonstrates how orthodontic needs often align with social and demographic factors, which are also seen in rural and underserved populations in the United States. Furthermore, adolescents in underdeveloped regions with more urgent dental requirements, such as the Northeast and

Central West, were less likely to receive care than those in the more developed Southeast (PMC).

Solution

As technology advances quickly, it's important to overcome the continuous gap in orthodontic care for rural communities. When routine in-person visits became challenging during the COVID-19 pandemic, teledentistry emerged as an essential tool for both urban and rural communities. Teledentistry is the use of telecommunications technology to deliver dental care remotely, such as virtual consultations, digital diagnostics, and regular follow-ups. The establishment of this new model for orthodontic care helped reduce the need for frequent travel and enabled professionals to connect with patients more easily. Studies show that implementing teledentistry in rural orthodontic programs significantly reduces barriers to care. Programs that combined virtual checkups with occasional mobile clinics had 77% patient satisfaction and 72% treatment completion rates, resulting in high satisfaction among patients who experienced teledentistry (CareQuest Institute). Another study showed that teledentistry reduced rural patients' travel distances, thereby enabling earlier detection and treatment of oral health issues (Wiley Online Library).

Despite this achievement, the US encountered significant obstacles that made teledentistry a viable option for rural communities. According to the 2018 Broadband Deployment Report, only 71% of rural residents owned a smartphone in 2019, while 30.7% of the rural population lacked access to fixed broadband (ruralhealth.us). 2.7 million rural families lack internet connectivity, and just 61.9% of rural households have fixed broadband, which limits access to continuous care. Low-income families and minority communities, such as Black, Indigenous, and People of Color (BIPOC) households, are especially affected, with up to 40% of households earning under \$25,000 lacking high-speed internet (ChangeLab).

To solve this, the solution must focus on creating user-friendly, free or cheap telehealth platforms that can function in low-connectivity environments and provide mobile applications for orthodontic clinics to offer essential care with regular check-ups. Providing affordable or free teledentistry services would benefit public health but could also strengthen the nation's global reputation for innovation and equity, contributing to long-term national growth. To further reduce gaps, general dentists from urban regions can be trained and given career-boosting certificates in basic orthodontic care and financial assistance for their journey to rural areas. As teledentistry becomes more widely used, regular checkups may be reduced, but better treatment can result in positive outcomes. Although the suggestion for this might not guarantee a 100% accurate solution, improving teledentistry with easy methods will definitely help to solve the limited access.

Conclusion

Braces are necessary to avoid oral health problems. Orthodontic treatment not only improves function and appearance but also helps prevent the need for additional dental care in the future. Although treatment may seem expensive, it can lower long-term medical costs by preventing more complex problems later on. However, rural communities are still unable to access orthodontic care. Significant barriers still frequently exist in rural areas, including a shortage of dental specialists, long travel times, and limited insurance coverage. These challenges are even more severe for minorities, low-income families, the elderly, individuals with disabilities, and those with special health needs. Research consistently shows that rural residents who live far from medical clinics often have worse health outcomes. To reduce this

gap, by combining technology with community-based solutions, rural populations can gain consistent access to essential orthodontic care, resulting in better dental health outcomes and overall improvements in quality of life.

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