Accelerated Orthodontics

- **Innovative Approaches to Shorten Treatment Time**
  Innovative Approaches to Shorten Treatment Time The Role of Vibration Devices in Faster Tooth Movement Micro Osteoperforation and Its Effects on Treatment 3D Printing Techniques for Customized Appliances Benefits of Digital Impressions in Modern Orthodontics AI Assisted Treatment Planning for Precise Outcomes Remote Monitoring and Virtual Consultations Incorporating New Tools for Patient Compliance Practical Considerations of Accelerated Techniques Research Trends Shaping Future Orthodontic Practices Combining Traditional Methods With Cutting Edge Solutions Adapting to Technological Shifts in Orthodontic Care
- **Indications for Surgical Alignment of the Jaw**
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The field of orthodontics has witnessed a remarkable evolution, especially in recent years, as technological advancements have significantly improved treatment options for children. One of the most notable developments is the use of clear aligners, which have become a popular choice for kids due to their comfort, aesthetic appeal, and ease of maintenance. Retainers are often needed after braces to maintain alignment **Child-friendly orthodontic solutions** malocclusion. Unlike traditional metal braces, clear aligners are removable, allowing for better oral hygiene and reduced discomfort during meals and brushing.

Technological innovations such as artificial intelligence (AI) have further enhanced the effectiveness of clear aligners. AI-powered systems can analyze a child's dental structure and predict the most efficient paths for teeth alignment, leading to customized treatment plans that are more precise and efficient. This approach not only streamlines the treatment process but also reduces the number of visits required to the orthodontist, making it more appealing for parents and children.

Advances in materials science are also transforming the comfort and durability of clear aligners. Future aligners are expected to be made from innovative materials that increase flexibility and durability, ensuring a less intrusive experience for young patients. Additionally, the integration of digital imaging and 3D printing technologies allows for precise customization of orthodontic appliances, ensuring a better fit and more effective treatment outcomes.

The integration of robotics and automation in orthodontics has improved the precision and safety of complex procedures. Virtual reality is also becoming a tool for treatment planning, enabling patients and orthodontists to visualize possible outcomes before starting treatment. This not only helps in making more accurate treatment plans but also enhances patient understanding and confidence in the treatment process.

Innovations like smart braces and self-ligating systems are further optimizing orthodontic care. These systems use specialized technology to monitor tooth movement and provide real-time data, allowing for adjustments that can shorten treatment times and improve results.

The future of orthodontics for kids is poised to become even more personalized and efficient, with technology at the forefront. As these advancements become more available and effective, they will redefine how early orthodontic treatments are approached, making

them more appealing and effective for young patients.

The field of orthodontics is experiencing a significant transformation, driven by technological advancements that are revolutionizing treatment options for children. These innovations not only enhance the precision and efficiency of orthodontic care but also offer more comfortable and personalized solutions. At the forefront of these developments is the integration of artificial intelligence (AI) and the use of advanced materials, which are significantly improving the effectiveness of both clear aligners and traditional braces.

AI integration in orthodontics allows for the analysis of vast amounts of patient data, enabling orthodontists to predict treatment outcomes with greater accuracy. This technology helps in crafting personalized treatment plans tailored to each patient's unique dental structure, leading to more efficient treatments and better results. Additionally, AI assists in monitoring treatment progress, providing real-time feedback that allows for timely adjustments and minimizes potential complications.

Advanced materials are also transforming the field by enhancing the comfort and aesthetics of orthodontic appliances. Clear aligners, for instance, have become a popular alternative to traditional metal braces, offering a virtually invisible and removable option that allows for easier maintenance of oral hygiene. The use of 3D printing technology further customizes these appliances, ensuring a precise fit that enhances both comfort and effectiveness.

Furthermore, technological advancements have made orthodontic care more patient-centric. Virtual consultations and remote monitoring technologies allow patients to receive expert advice and track their treatment progress without the need for frequent office visits. This not only saves time but also increases accessibility, making high-quality orthodontic care more convenient for children and their families.

In summary, technological innovations in orthodontics are creating a new era of patient care that is more precise, efficient, and comfortable. As these advancements continue to shape the field, children can look forward to more effective, aesthetically pleasing, and personalized treatment options that enhance their overall dental health and well-being.

The HealthyStart System

The advent of artificial intelligence (AI) in orthodontic treatment has revolutionized the field, transforming the way orthodontists diagnose, plan, and execute treatments. This technological shift is not only enhancing the precision and efficiency of orthodontic care but also improving patient outcomes.

At the forefront of these advancements is AI's role in diagnosis. By leveraging machine learning algorithms, AI systems can analyze radiographic images with high accuracy, correcting noise and providing detailed cephalometric reports in minutes. This not only aids in the identification of malocclusions but also facilitates better visualization of treatment outcomes, thereby enhancing decision support for orthodontists[1][3]. AI's ability to quickly and reliable diagnose conditions allows for more personalized treatment plans, which are crucial in orthodontics where every case is unique[1][3]. Moreover, AI-powered software can assist in simulating tooth movements and predicting treatment outcomes, which helps in optimizing treatment sequences[3][4]. This approach is especially significant in managing complex cases where AI can provide guidance to inexperienced orthodontists and support surgical planning for maxillofacial deformities[1][3]. AI also aids in the surgical planning of orthognathic surgeries by providing precise data, which is essential for comprehensive treatment[1]. Furthermore, AI's face-driven treatment planning approach focuses on enhancing facial aesthetics, which is a key aspect of orthodontic care[1][3]. This personalized approach not only results in better clinical outcomes but also enhances patient satisfaction by aligning treatment with individual facial features[1][3]. AI's impact on orthodontics also includes the automated fabrication of orthodontic appliances such as clear aligners and indirect bonding trays. These advancements offer better esthetics, comfort, and acceptability for patients, replacing traditional methods with more precise and customized solutions[1][5]. The use of 3D printing technology, often in alignment with AI, allows for the fabrication of customized brackets and aligners that fit each patient's unique dental and facial features. This not only enhances the treatment's efficiency but also provides a more personalized and effective treatment plan[5]. Another significant aspect of AI in orthodontics is its role in operational efficiency. AI can automatically schedule staff, organize patient appointments, and perform tasks like dental coding and billing, thereby increasing operational efficiency and patient satisfaction[1]. This efficiency also allows for cost-savings, as labor-intensive processes are automated, and treatment planning time is drastically reduce[4]. In the future, AI is set to further transform orthodontics by potentially predicting patient outcomes more precisely and customizing treatments based on genomic factors, which is part of the evolving paradigm of precision orthodontics[1][3]. Despite these advancements, it is crucial to remember that AI should augment, not replace, the role of orthodontists. AI tools are best used as powerful resources to assist in decision support and

planning, while human professionals guide and oversee the treatment process[5]. As technology advances, it is clear that AI in orthodontics is not just a tool but a key to a brighter future in healthcare, enhancing both the quality of care and patient satisfaction.

This non-invasive approach targets the natural development of children's

teeth and jaw, using soft dental appliances to align teeth and address breathing issues, reducing the need for more invasive treatments.

The integration of artificial intelligence (AI) in orthodontic care represents a significant technological shift, enabling personalized treatment plans that accurately model a child's dental structure and optimize teeth alignment paths. This approach not only streamlines the treatment process but also allows for minimally invasive adjustments, enhancing both the efficiency and effectiveness of orthodontic interventions.

AI systems analyze vast amounts of patient data, including X-rays, scans, and dental impressions, to identify patterns and abnormalities that might not be immediately apparent to human practitioners. This capability allows orthodontists to develop highly tailored strategies that cater specifically to each patient's unique dental needs. By leveraging AI, clinicians can predict treatment outcomes more accurately, ensuring that each child receives a treatment plan that best suits their individual requirements.

The use of AI in orthodontics also significantly enhances the precision and efficiency of treatments. AI algorithms can simulate various treatment outcomes, helping orthodontists identify potential complications and adjust their approach accordingly. This predictive capability minimally invasive adjustments by allowing practitioners to visualize and plan the optimal movement of teeth, reducing the risk of human error and improving patient outcomes.

In addition to improving treatment outcomes, AI integration in orthodontics offers substantial time savings. By automatically analyzing data and providing treatment recommendations, AI systems free up valuable time for orthodontists, enabling them to focus on more complex aspects of patient care. This efficiency not only benefits clinicians but also enhances the

overall patient experience, as treatments become more personalized and effective.

As technology in orthodontics and dentistry as a field, AI-driven innovations are reshaping how dental professionals approach diagnosis, treatment planning, and patient care. The integration of AI has transformed the landscape of dental practices, making them more transparent, efficient, and patient-centered. By providing detailed 3D models for surgical planning and evidence-based treatment recommendations, AI is revolutionizing both clinical practice and patient engagement, leading to better clinical outcomes and increased patient satisfaction.

In the future, AI is expected to further augment orthodontic care by developing algorithms that assist with all steps of the diagnosis process, from taking measurements to interpreting data. This comprehensive approach will ensure that orthodontists have the tools necessary to provide the most accurate and effective treatments, further enhancing the quality of care for patients.

Myobrace: A No-Braces Approach

The integration of 3D imaging and digital technology into orthodontic care has revolutionized the field, transforming traditional methods into more precise, efficient, and patient-friendly approaches. This shift is not just about technology; it's about enhancing patient outcomes and satisfaction. At the very beginning of the process, 3D imaging provides detailed visuals of the patient's teeth, jaw, and skull, offering a comprehensive view that was previously unattainable with conventional X-rays. This capability allows orthodontists to identify issues like impacted teeth and bone abnormalities early on, enabling timely intervention and reducing the risk of complications.

One of the most significant advantages of 3D imaging is its role in treatment planning. By creating precise digital models, orthodontists can design custom appliances such as braces and aligners that fit perfectly, ensuring optimal comfort and effectiveness. This customization extends to all orthodontic devices, making treatments more efficient and reducing the need for

adjustments. Additionally, 3D imaging enables the simulation of various treatment scenarios, allowing clinicians to predict outcomes more accurately and make informed decisions about the most effective approach for each patient.

The use of digital technology also streamlines the treatment process. Digital intraoral cameras can capture high-resolution 3D models of teeth and gums, making traditional dental impressions less necessary. This not only reduces chair time but also enhances patient comfort. The integration of CAD/CAM systems and robotic wire bending further enhances the accuracy and efficiency of orthodontic appliance manufacturing.

As technology continues to advance, the future of orthodontics with 3D imaging and digital technology is promising. Innovations in imaging software, along with integrations with artificial intelligence and machine learning, will enable even more personalized and effective care. Patients can expect more customized treatments that cater to their unique needs, leading to better outcomes and higher satisfaction. This ongoing transformation in orthodontic care is not just about technology; it's about creating a more collaborative and successful patient-practitioner relationship.

Myobrace offers a brace-free solution that corrects poor oral habits, guiding jaw and teeth

alignment development in children, promoting natural growth and oral health.

The orthodontic care of today has made a bold step forward with the help of 3D imaging and digital scanning technologies. These advanced technologies allow orthodontists to create detailed models of a child's teeth, which are not only beneficial for precise diagnosis but also for comprehensive treatment planning. By using 3D scanning, orthodontists can view the structure of teeth, jaws, and surrounding tissues in a highly accurate and interactive manner. This not only ensures predictable outcomes but also provides patients with a clear and confident view of their treatment plan.

The benefits of 3D imaging in orthodontics are diverse. It is non-invasive, quick, and provides a comprehensive view of the oral cavity, which can help in the diagnosis of hidden issues that may not be easily detectable with traditional imaging. This technology also eliminates the need for traditional dental impressions, which can be uncomfortable and less accurate. Instead, digital impressions taken with 3D intraoral scanners are precise and instant, allowing for the quick design and customization of orthodontic devices.

The customization of orthodontic devices like braces and aligners is one of the most important applications of 3D imaging. By creating precise digital models, orthodontists can design and fit these devices perfectly to each patient's teeth, ensuring optimal results. For example, Invisalign aligners can be precisely custom-fitted using these digital impressions, which not only ensures a better fit but also a more efficient treatment process.

The future of orthodontic care is clearly aligned with these advanced technologies. As 3D imaging and digital scanning technologies improve, we can look forward to even more precise and personalized treatment plans. This not only benefits patients by improving outcomes but also makes the treatment process more efficient and less uncomfortable. In the end, the use of 3D imaging and digital scanning in orthodontics is a clear example of how technology can revolution the health care experience by creating more personalized, precise, and efficient care.

Comprehensive Orthodontic Solutions

The field of orthodontics has been revolutionized by the advent of clear aligners, which have significantly transformed the way teeth are straightened. This technological shift has brought about a more discreet, comfortable, and efficient alternative to traditional metal braces. Clear aligners, such as those provided by Invisalign and ClearCorrect, are custom-made from transparent, medical-grade plastic. They are designed to fit snugly around the teeth, ensuring minimal visibility and enhanced aesthetic appeal, making them particularly appealing to adults and teens who are self-conscious about the appearance of traditional braces.

One of the most significant advantages of clear aligners is their removability. Unlike fixed metal braces, which can trap food particles and make oral hygiene more complicated, clear aligners can be removed for eating, brushing, and flossing. This feature not only allows for better oral hygiene but also eliminates dietary restrictions, enabling patients to enjoy a broader diet without fear of damaging their orthodontic appliances. Additionally, the smooth plastic used in clear aligners reduces mouth irritation, providing superior comfort compared to the sharp edges and wires of traditional braces.

The use of advanced 3D imaging technology has further enhanced the precision and effectiveness of clear aligners. This technology allows for the detailed assessment of a patient's dental structure, enabling orthodontists to create personalized treatment plans. Each set of aligners is custom-made to incrementally adjust the position of teeth over time, providing a methodically precise approach to achieving desired alignment. This predictability often leads to efficient treatment processes and may even reduce overall treatment time compared to conventional braces.

In contrast, traditional metal braces remain an important option, particularly for complex cases where they may offer faster and more effective results. However, clear aligners have made orthodontic treatment more accessible and appealing to a broader audience, especially those who value aesthetics and convenience. As technology continues to progress, innovations such as smart materials and teledentistry platforms are on the horizon, further enhancing the capabilities of clear aligners and transforming them into a potentially standard method of orthodontic care.

In conclusion, the integration of clear aligners into modern orthodontic care represents a significant technological shift. By offering a discreet, comfortable, and efficient alternative to traditional braces, clear aligners have transformed the way people approach teeth straightening. This transformation not only aligns with patient needs for aesthetics and convenience but also signifies a broader shift towards patient-centered care, where comfort and effectiveness are no longer sacrificed for one another.

The orthodontic treatment options of clear aligners and modern braces, such as clear braces with light-colored brackets, have made significant in-roads in terms of aesthetic appeal and comfort. These options are particularly appealing for kids due to their discreet appearance and easy wear. Clear aligners, for example, are nearly invisible, which can be a significant advantage for children who may feel self-conscious about the appearance of traditional metal braces. Made from smooth plastic, they reduce the risk of irritation to the gums and cheeks, making them more comfortable than metal brackets and wires[2][4]. Additionally, their removability allows for easier maintenance of oral hygiene, as kids can brush and floss their teeth without any obstacles[2][5]. This not only simplifies daily dental routine but also reduces the risk of cavities and gum disease during treatment.

In the case of modern clear braces with light-colored brackets, they offer a more subtle appearance than traditional metal braces. While they may not be as discreet as clear aligners, they are less noticeable and can be appealing to children who prefer a more traditional orthodontic solution but with a less noticeable aesthetic. However, clear aligners generally provide a more comfortable and practical solution due to their removability and the absence of metal components[3][4]. This flexibility in treatment options allows children and their orthodontists to select the most appropriate method based on their specific needs and lifestyle.

The technology used in clear aligners, such as advanced 3D imaging, allows for precise planning and predictability in treatment. This means that both children and adults can have a clear view of their treatment progress and expected results from the outset[1][3]. This predictability is comforting for patients and their orthodontists, as it aligns with modern lifestyles where time and outcome are important.

In the end, the choice between clear aligners and modern braces depends on the specific orthodontic needs and the lifestyle of the person. However, both options offer a more appealing and comfortable solution than traditional metal braces, making them highly suitable for children and adults seeking discreet and effective orthodontic treatment.

The integration of technology in orthodontic care has revolutionized the way treatments are delivered, significantly enhancing patient-centric benefits. At the forefront of this transformation are advancements in digital imaging, computer-aided design and manufacturing (CAD/CAM) systems, and clear aligner therapy. These technologies not only improve the precision and efficiency of treatments but also enhance patient comfort and engagement.

One of the most significant patient-centric benefits of technological integration in orthodontics is the ability to create personalized treatment plans. With tools like 3D imaging and digital scanning, orthodontists can design custom-made appliances and aligners that fit each patient's unique dental needs. This level of precision ensures that treatments are more effective and often result in shorter durations, which is a major convenience for patients.

Technology also plays a crucial role in improving patient comfort. Clear aligner therapy, such as Invisalign, offers a discreet and virtually invisible alternative to traditional braces, making the treatment experience more comfortable and less visually appealing. Additionally, digital imaging technologies reduce the need for uncomfortable X-rays and dental molds, further enhancing patient comfort.

Enhanced communication and remote monitoring are other significant benefits. Advanced software and apps allow for real time tracking of treatment progress, which can be especially beneficial for patients with busy schedules or those who live far from the orthodontist's office. This increased accessibility ensures that patients can stay engaged with their treatment plans and address any concerns more effectively.

In today's digital era, patients are more informed and have higher expectations for their care. The integration of technology in orthodontic practices not only aligns with these expectations but also elevates the overall patient experience. By providing a blend of cutting-edge care with the convenience and comfort that modern technology offers, orthodontic practices can create a more positive and collaborative patient-doctor relationship, ultimately leading to better treatment outcomes and higher patient satisfaction.

The integration of modern technology in orthodontics has revolutionized the way patient engagement is structured, making it more personalized and patient-centered. One of the most

significant advancements is the ability to provide real-time tracking of treatment progress. This is particularly effective through digital monitoring systems and AI-powered tools that allow patients to send regular photographs of their teeth, which are then analyzed to assess treatment status. This real-time feedback not only ensures that any necessary adjustments can be made promptly but also empowers patients to be more actively engaged in their care.

The use of personalized treatment plans is another area where technology has made a profoundimpact. With the help of advanced digital tools and software, such as Invisalign's ClinCheck, orthodontists can create customized plans that are tailored to each patient's unique dental needs. This predictive capability allows patients and their parents to visualize potential treatment outcomes before the process begins, fostering a collaborative relationship between the patient and the orthodontist. It also helps in setting clear expectations and reducing any potential discomfort or complications during the treatment.

For kids and their parents, this approach is especially reassuring. It not only makes the treatment more comfortable and efficient but also provides a sense of comfort and trust in the care they are receiveing. Virtual consultations and online scheduling tools further enhance this experience by allowing patients to have initial consultations and follow-up appointments remotely, saving time and reducing the need for physical visits to the clinic.

In the broader sense, the technological advancements in orthodontics have transformed the field into a more patient-centric and interactive process. By providing more accurate diagnostics, reducing treatment times, and improving patient comfort, technology has become the cornerstone of modern orthodontic care. As technology continue to evolve with innovations like AI and machine learning, the future of orthodontics holds great promise for even more personalized and efficient treatments.

In recent years, orthodontic care has experienced a significant technological shift, especially in innovations that make the process more comfortable and efficient for kids. One of the most notable advancements is the use of **3D imaging and digital simulations**. These technologies allow orthodontists to create detailed, customized treatment plans that not only enhance the effectiveness of the treatment but also provide patients with a clear view of how their teeth will look over time. This approach is especially helpful for kids, as it allows them to see the progress and potential results of their treatment, making the process more interactive and less anxious.

Invisible and clear aligners have also become a leading choice for orthodontic treatment in children. These aligners are custom-made using advanced robotics and 3D printing, allowing for precise adjustments that gradually align teeth over time. The use of **AI in treatment**

planning further streamlines this process by optimizing the design and delivery of aligners based on each child's unique dental structure. This AI-driven approach not only makes treatment more precise but also potentially shortening the number of visits needed for adjustments.

Additionally, innovations like **Temporary Anchorage Devices (TADs) and comprehensive smile design systems** are enhancing the orthodontic experience. TADs provide additional anchorage points, making treatments more effective, while smile design systems allow patients and dentists to envision and plan the final result of a smile makeover together.

In terms of making the experience more comfortable for kids, **technology integration** in orthodontic care includes the use of noise-canceling headphones and flat-screen monitors. These tools help create a stress-free and more appealing experience by allowing children to watch movies or music during their treatment, making the process less anxious and more positive.

These technological advancements are not only making orthodontic care more effective but also more appealing and stress-free for children. By adopting these innovations, orthodontists can provide a more comfortable and efficient treatment experience, making it easier for kids to look after their dental health.

The landscape of orthodontic care is evolving rapidly, with technological innovations playing a pivotal role in enhancing patient experiences. In recent years, there has been a significant focus on reducing anxiety and stress during orthodontic visits, especially for children. However, the specific use of noise-canceling headphones and digital distraction tools in orthodontic practices is not well-documented. These tools, while beneficial in other healthcare and mental health situations, could be part of a more comprehensive approach to making orthodontic visits less anxiety-driven.

In orthodontics, advancements such as AI, digital imaging, and 3D printing have transformed the field by offering more precise and efficient treatments. AI, for example, helps orthodontists analyze vast amounts of patient data, leading to personalized treatment plans that cater to individual needs. Digital imaging allows for detailed examinations without invasive procedures, while 3D printing enables the creation of custom-made appliances that fit perfectly, enhancing comfort and effectiveness.

Another significant innovation is the integration of virtual consultations and remote monitoring. These technologies allow patients to have initial consultations via video calls and send regular updates of their teeth using smartphone app, reducing the need for frequent in-office visits. This approach not only saves time but also makes orthodontic care more approach and stress-free.

Innovations like clear aligners and smart braces further enhance the patient experience. Clear aligners are aesthetically pleasing and allow for easier maintenance of oral hygiene, while smart braces equipped with sensors can monitor the progress of teeth movement, ensuring treatments are on track.

If noise-canceling headphones and digital distraction tools are incorporated into orthodontic practices, they could provide a calming environment for children during treatments. Noise-canceling headphones have been proven to reduce anxiety and pain by creating a more personalized and calming experience, which could be beneficial in high-stress situations like orthodontic visits. By embracing such technologies, orthodontic practices can create a more stress-free and comfortable experience for their patients, aligning with the evolving expectations of modern healthcare.

In summary, while specific tools like noise-canceling headphones may not be a well-documented part of orthodontic care, the overall shift in orthodontics is clearly heading in the same positive, patient-centered, and technology-driven path. As technology continues to evolve, the future of orthodontics promises to be more efficient, personalized, and stress-free for patients.

The future of orthodontic care for kids is undergoing a significant evolution, with technological advancements at the forefront of these changes. In recent years, innovations such as artificial intelligence (AI) and 3D imaging have revolutioned the way orthodontic treatments are approached. AI, for example, allows for personalized treatment plans by accurately predict the most effective paths for teeth alignment, leading to more precise and efficient orthodontic outcomes. This technology not only streamlines the treatment process but also enhances communication between orthodontists and parents, ensuring better tracking of progress and adjustments as needed.

Another crucial development is the use of clear aligners, which have seen a significant increase in popularity due to their aesthetic appeal and comfort. Innovations in materials science are expected to further enhance these aligners, making them more comfortable and less intrusive than traditional braces. This is particularly important for children, as it reduces discomfort and allows them to continue their regular activities without worrying about the

aesthetic or discomfort of metal braces.

Digital imaging and 3D printing technologies also offer a higher level of precision in diagnosis and treatment planning. These tools allow orthodontists to create customized models of a patient's teeth, which can be used to develop custom aligners that gradually shift teeth over time. This not only makes the treatment more efficient but also more comfortable for young patients.

Additionally, technologies like noise-canceling headphones and digital monitors in orthodontic treatment have made the process less anxiety-driven for children. These tools provide a distraction during appointments, allowing kids to relax while undergoing treatment.

In 2025, these technological advancements are expected to further refine the effectiveness of orthodontic treatments, making it an even more appealing time for children to start their orthodontic journeys. With quicker treatment times, improved comfort, and enhanced precision, the future of orthodontic care for kids is set to be more efficient, effective, and patient-centered than it has been in the past.

The future of orthodontic care for children is on the horizon of a technological revolution, promising to significantly enhance treatment outcomes and reduce the time needed for orthodontic interventions. This transformation is driven by the integration of cutting-edge technologies such as 3D printing and teledentistry, which are revolutionizing the way orthodontic care is delivered.

One of the most exciting developments in orthodontics is the use of 3D printing technology. This innovative method allows for the production of custom-made orthodontic appliances, such as brackets and aligners, that are tailored to each child's unique dental anatomy. Unlike traditional methods, which often rely on standardized solutions, 3D printing ensures that appliances fit perfectly and work more effectively, leading to more efficient treatment plans and better alignment. This level of customization not only reduces treatment times but also increases patient comfort, making the orthodontic experience more enjoyable for children.

Another significant trend is the rise of teledentistry, or teleorthodontics, which is transforming the accessibility of orthodontic care. With the ability to consult remotely, children can receive professional guidance from the comfort of their homes, reducing the need for frequent in-person visits. This convenience is especially beneficial for busy or remote patients, as it allows them to stay on track with their treatment plans without the need for regular office visits.

Remote monitoring technologies also enable orthodontists to track progress and make timely adjustments, ensuring that treatments stay on track and that any issues are quickly address.

The integration of these technologies is not only about improving efficiency and accessibility but also about enhancing patient outcomes. By offering personalized solutions and real-time monitoring, orthodontists can ensure that treatments are optimized for each child's specific needs, leading to better results and higher patient engagement. As these technological advancements continue to evolve, the future of orthodontic care for kids promises to be more effective, convenient, and patient-friendly than ever before.

About dental braces

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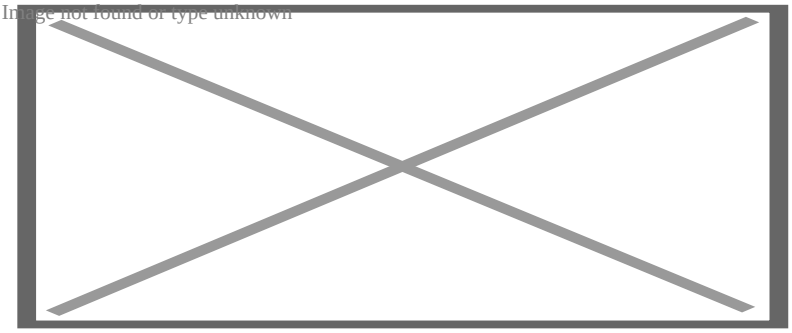

Dental braces

Dental braces (also known as **orthodontic braces**, or simply **braces**) are devices used in orthodontics that align and straighten teeth and help position them with regard to a person's bite, while also aiming to improve dental health. They are often used to correct underbites, as well as malocclusions, overbites, open bites, gaps, deep bites, cross bites, crooked teeth, and various other flaws of the teeth and jaw. Braces can be either cosmetic or structural. Dental braces are often used in conjunction with other orthodontic appliances to help widen the palate or jaws and to otherwise assist in shaping the teeth and jaws.

Process

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The application of braces moves the teeth as a result of force and pressure on the teeth. Traditionally, four basic elements are used: brackets, bonding material, arch wire, and

ligature elastic (also called an "O-ring"). The teeth move when the arch wire puts pressure on the brackets and teeth. Sometimes springs or rubber bands are used to put more force in a specific direction.[1]

Braces apply constant pressure which, over time, moves teeth into the desired positions. The process loosens the tooth after which new bone grows to support the tooth in its new position. This is called bone remodelling. Bone remodelling is a biomechanical process responsible for making bones stronger in response to sustained load-bearing activity and weaker in the absence of carrying a load. Bones are made of cells called osteoclasts and osteoblasts. Two different kinds of bone resorption are possible: direct resorption, which starts from the lining cells of the alveolar bone, and indirect or retrograde resorption, which occurs when the periodontal ligament has been subjected to an excessive amount and duration of compressive stress.[2] Another important factor associated with tooth movement is bone deposition. Bone deposition occurs in the distracted periodontal ligament. Without bone deposition, the tooth will loosen, and voids will occur distal to the direction of tooth movement.[3]

Types

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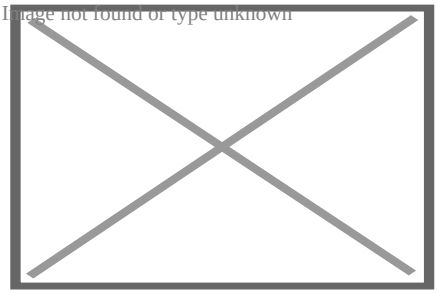
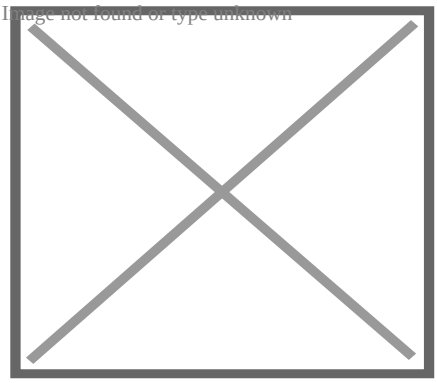


"Clear" braces



Upper and Lower Jaw Functional Expanders

- ***Traditional metal wired*** *braces* (also known as "train track braces") are stainless-steel and are sometimes used in combination with titanium. Traditional metal braces are the most common type of braces.[4] These braces have a metal bracket with elastic ties (also known as rubber bands) holding the wire onto the metal brackets.

The second-most common type of braces is self-ligating braces, which have a built-in system to secure the archwire to the brackets and do not require elastic ties. Instead, the wire goes through the bracket. Often with this type of braces, treatment time is reduced, there is less pain on the teeth, and fewer adjustments are required than with traditional braces.

- ***Gold-plated stainless steel*** braces are often employed for patients allergic to nickel (a basic and important component of stainless steel), but may also be chosen for aesthetic reasons.
- ***Lingual*** *braces* are a cosmetic alternative in which custom-made braces are bonded to the back of the teeth making them externally invisible.
- ***Titanium*** *braces* resemble stainless-steel braces but are lighter and just as strong. People with allergies to nickel in steel often choose titanium braces, but they are more expensive than stainless steel braces.
- ***Customized orthodontic treatment systems*** combine high technology including 3-D imaging, treatment planning software and a robot to custom bend the wire. Customized systems such as this offer faster treatment times and more efficient results.[5]
- ***Progressive, clear removable aligners*** may be used to gradually move teeth into their final positions. Aligners are generally not used for complex orthodontic cases, such as when extractions, jaw surgery, or palate expansion are necessary.[*medical citation ne* [6]

Fitting procedure

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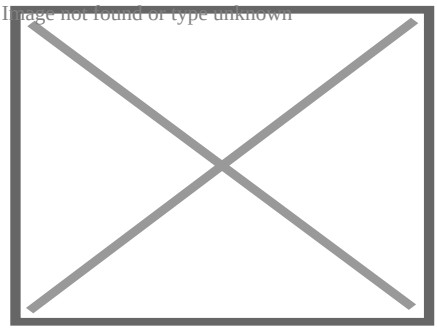


A patient's teeth are prepared for the application of braces.

Orthodontic services may be provided by any licensed dentist trained in orthodontics. In North America, most orthodontic treatment is done by orthodontists, who are dentists in the diagnosis and treatment of *malocclusions*—malalignments of the teeth, jaws, or both. A dentist must complete 2–3 years of additional post-doctoral training to earn a specialty certificate in orthodontics. There are many general practitioners who also provide orthodontic services.

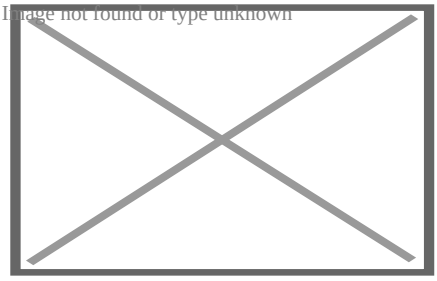
The first step is to determine whether braces are suitable for the patient. The doctor consults with the patient and inspects the teeth visually. If braces are appropriate, a records appointment is set up where X-rays, moulds, and impressions are made. These records are

analyzed to determine the problems and the proper course of action. The use of digital models is rapidly increasing in the orthodontic industry. Digital treatment starts with the creation of a three-dimensional digital model of the patient's arches. This model is produced by laser-scanning plaster models created using dental impressions. Computer-automated treatment simulation has the ability to automatically separate the gums and teeth from one another and can handle malocclusions well; this software enables clinicians to ensure, in a virtual setting, that the selected treatment will produce the optimal outcome, with minimal user input.[*medical citation needed*]

Typical treatment times vary from six months to two and a half years depending on the complexity and types of problems. Orthognathic surgery may be required in extreme cases. About 2 weeks before the braces are applied, orthodontic spacers may be required to spread apart back teeth in order to create enough space for the bands.

Teeth to be braced will have an adhesive applied to help the cement bond to the surface of the tooth. In most cases, the teeth will be banded and then brackets will be added. A bracket will be applied with dental cement, and then cured with light until hardened. This process usually takes a few seconds per tooth. If required, orthodontic spacers may be inserted between the molars to make room for molar bands to be placed at a later date. Molar bands are required to ensure brackets will stick. Bands are also utilized when dental fillings or other dental works make securing a bracket to a tooth infeasible. Orthodontic tubes (stainless steel tubes that allow wires to pass through them), also known as molar tubes, are directly bonded to molar teeth either by a chemical curing or a light curing adhesive. Usually, molar tubes are directly welded to bands, which is a metal ring that fits onto the molar tooth. Directly bonded molar tubes are associated with a higher failure rate when compared to molar bands cemented with glass ionomer cement. Failure of orthodontic brackets, bonded tubes or bands will increase the overall treatment time for the patient. There is evidence suggesting that there is less enamel decalcification associated with molar bands cemented with glass ionomer cement compared with orthodontic tubes directly cemented to molars using a light cured adhesive. Further evidence is needed to withdraw a more robust conclusion due to limited data.[7]

An archwire will be threaded between the brackets and affixed with elastic or metal ligatures. Ligatures are available in a wide variety of colours, and the patient can choose which colour they like. Arch wires are bent, shaped, and tightened frequently to achieve the desired results.



Dental braces, with a transparent power chain, removed after completion of treatment.

Modern orthodontics makes frequent use of nickel-titanium archwires and temperature-sensitive materials. When cold, the archwire is limp and flexible, easily threaded between brackets of any configuration. Once heated to body temperature, the arch wire will stiffen and seek to retain its shape, creating constant light force on the teeth.

Brackets with hooks can be placed, or hooks can be created and affixed to the arch wire to affix rubber bands. The placement and configuration of the rubber bands will depend on the course of treatment and the individual patient. Rubber bands are made in different diameters, colours, sizes, and strengths. They are also typically available in two versions: Coloured or clear/opaque.

The fitting process can vary between different types of braces, though there are similarities such as the initial steps of moulding the teeth before application. For example, with clear braces, impressions of a patient's teeth are evaluated to create a series of trays, which fit to the patient's mouth almost like a protective mouthpiece. With some forms of braces, the brackets are placed in a special form that is customized to the patient's mouth, drastically reducing the application time.

In many cases, there is insufficient space in the mouth for all the teeth to fit properly. There are two main procedures to make room in these cases. One is extraction: teeth are removed to create more space. The second is expansion, in which the palate or arch is made larger by using a palatal expander. Expanders can be used with both children and adults. Since the bones of adults are already fused, expanding the palate is not possible without surgery to separate them. An expander can be used on an adult without surgery but would be used to expand the dental arch, and not the palate.

Sometimes children and teenage patients, and occasionally adults, are required to wear a headgear appliance as part of the primary treatment phase to keep certain teeth from moving (for more detail on headgear and facemask appliances see Orthodontic headgear). When braces put pressure on one's teeth, the periodontal membrane stretches on one side and is compressed on the other. This movement needs to be done slowly or otherwise, the patient risks losing their teeth. This is why braces are worn as long as they are and adjustments are only made every so often.

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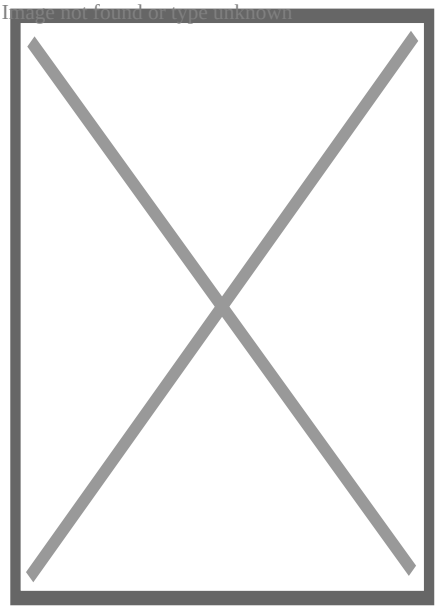

Young Colombian man during an adjustment visit for his orthodontics

Braces are typically adjusted every three to six weeks. This helps shift the teeth into the correct position. When they get adjusted, the orthodontist removes the coloured or metal ligatures keeping the arch wire in place. The arch wire is then removed and may be replaced or modified. When the archwire has been placed back into the mouth, the patient may choose a colour for the new elastic ligatures, which are then affixed to the metal brackets. The adjusting process may cause some discomfort to the patient, which is normal.

Post-treatment

[edit]

Patients may need post-orthodontic surgery, such as a fiberotomy or alternatively a gum lift, to prepare their teeth for retainer use and improve the gumline contours after the braces come off. After braces treatment, patients can use a transparent plate to keep the teeth in alignment for a certain period of time. After treatment, patients usually use transparent plates for 6 months. In patients with long and difficult treatment, a fixative wire is attached to the back of the teeth to prevent the teeth from returning to their original state.[8]

Retainers

[edit]
Main article: Retainer (orthodontic device)

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Hawley retainers are the most common type of retainers. This picture shows retainers for the top (right) and bottom (left) of the mouth.

In order to prevent the teeth from moving back to their original position, retainers are worn once the treatment is complete. Retainers help in maintaining and stabilizing the position of teeth long enough to permit the reorganization of the supporting structures after the active phase of orthodontic therapy. If the patient does not wear the retainer appropriately and/or for the right amount of time, the teeth may move towards their previous position. For regular braces, Hawley retainers are used. They are made of metal hooks that surround the teeth and are enclosed by an acrylic plate shaped to fit the patient's palate. For Clear Removable braces, an Essix retainer is used. This is similar to the original aligner; it is a clear plastic tray that is firmly fitted to the teeth and stays in place without a plate fitted to the palate. There is also a bonded retainer where a wire is permanently bonded to the lingual side of the teeth, usually the lower teeth only.

Headgear

[edit]
Main article: Orthodontic headgear

Headgear needs to be worn between 12 and 22 hours each day to be effective in correcting the overbite, typically for 12 to 18 months depending on the severity of the overbite, how much it is worn and what growth stage the patient is in. Typically the prescribed daily wear time will be between 14 and 16 hours a day and is frequently used as a post-primary treatment phase to maintain the position of the jaw and arch. Headgear can be used during the night while the patient sleeps.[9][*better source needed*]

Orthodontic headgear usually consists of three major components:

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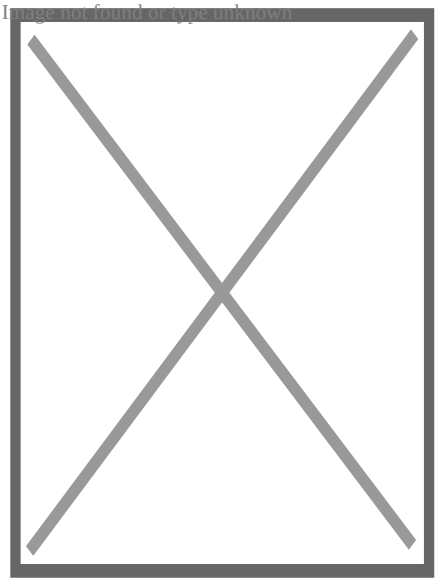


Full orthodontic headgear with head cap, fitting straps, facebow and elastics

1. Facebow: the facebow (or J-Hooks) is fitted with a metal arch onto headgear tubes attached to the rear upper and lower molars. This facebow then extends out of the mouth and around the patient's face. J-Hooks are different in that they hook into the patient's mouth and attach directly to the brace (see photo for an example of J-Hooks).
2. Head cap: the head cap typically consists of one or a number of straps fitting around the patient's head. This is attached with elastic bands or springs to the facebow. Additional straps and attachments are used to ensure comfort and safety (see photo).
3. Attachment: typically consisting of rubber bands, elastics, or springs—joins the facebow or J-Hooks and the head cap together, providing the force to move the upper teeth, jaw backwards.

The headgear application is one of the most useful appliances available to the orthodontist when looking to correct a Class II malocclusion. See more details in the section Orthodontic headgear.

Pre-finisher

[edit]

The pre-finisher is moulded to the patient's teeth by use of extreme pressure on the appliance by the person's jaw. The product is then worn a certain amount of time with the user applying force to the appliance in their mouth for 10 to 15 seconds at a time. The goal of the process is to increase the exercise time in applying the force to the appliance. If a person's teeth are not ready for a proper retainer the orthodontist may prescribe the use of a preformed finishing appliance such as the pre-finisher. This appliance fixes gaps between

the teeth, small spaces between the upper and lower jaw, and other minor problems.

Complications and risks

[edit]

A group of dental researchers, Fatma Boke, Cagri Gazioglu, Selvi Akkaya, and Murat Akkaya, conducted a study titled "Relationship between orthodontic treatment and gingival health." The results indicated that some orthodontist treatments result in gingivitis, also known as gum disease. The researchers concluded that functional appliances used to harness natural forces (such as improving the alignment of bites) do not usually have major effects on the gum after treatment.[10] However, fixed appliances such as braces, which most people get, can result in visible plaque, visible inflammation, and gum recession in a majority of the patients. The formation of plaques around the teeth of patients with braces is almost inevitable regardless of plaque control and can result in mild gingivitis. But if someone with braces does not clean their teeth carefully, plaques will form, leading to more severe gingivitis and gum recession.

Experiencing some pain following fitting and activation of fixed orthodontic braces is very common and several methods have been suggested to tackle this.[11][12] Pain associated with orthodontic treatment increases in proportion to the amount of force that is applied to the teeth. When a force is applied to a tooth via a brace, there is a reduction in the blood supply to the fibres that attach the tooth to the surrounding bone. This reduction in blood supply results in inflammation and the release of several chemical factors, which stimulate the pain response. Orthodontic pain can be managed using pharmacological interventions, which involve the use of analgesics applied locally or systemically. These analgesics are divided into four main categories, including opioids, non-steroidal anti-inflammatory drugs (NSAIDs), paracetamol and local anesthesia. The first three of these analgesics are commonly taken systemically to reduce orthodontic pain.[13]

A Cochrane Review in 2017 evaluated the pharmacological interventions for pain relief during orthodontic treatment. The study concluded that there was moderate-quality evidence that analgesics reduce the pain associated with orthodontic treatment. However, due to a lack of evidence, it was unclear whether systemic NSAIDs were more effective than paracetamol, and whether topical NSAIDs were more effective than local anaesthesia in the reduction of pain associated with orthodontic treatment. More high-quality research is required to investigate these particular comparisons.[13]

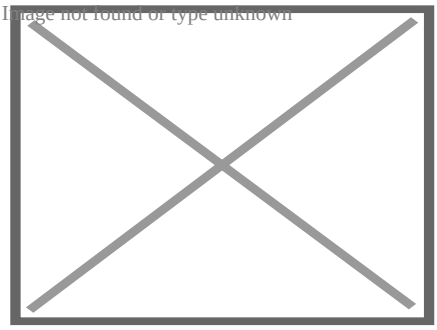
The dental displacement obtained with the orthodontic appliance determines in most cases some degree of root resorption. Only in a few cases is this side effect large enough to be considered real clinical damage to the tooth. In rare cases, the teeth may fall out or have to be extracted due to root resorption.[14][15]

History

[edit]

Ancient

[edit]



Old Braces at a museum in Jbeil, Lebanon

According to scholars and historians, braces date back to ancient times. Around 400–300 BC, Hippocrates and Aristotle contemplated ways to straighten teeth and fix various dental conditions. Archaeologists have discovered numerous mummified ancient individuals with what appear to be metal bands wrapped around their teeth. Catgut, a type of cord made from the natural fibres of an animal's intestines, performed a similar role to today's orthodontic wire in closing gaps in the teeth and mouth.[16]

The Etruscans buried their dead with dental appliances in place to maintain space and prevent the collapse of the teeth during the afterlife. A Roman tomb was found with a number of teeth bound with gold wire documented as a ligature wire, a small elastic wire that is used to affix the arch wire to the bracket. Even Cleopatra wore a pair. Roman philosopher and physician Aulus Cornelius Celsus first recorded the treatment of teeth by finger pressure. Unfortunately, due to a lack of evidence, poor preservation of bodies, and primitive technology, little research was carried out on dental braces until around the 17th century, although dentistry was making great advancements as a profession by then.[*citation neede*

18th century

[edit]

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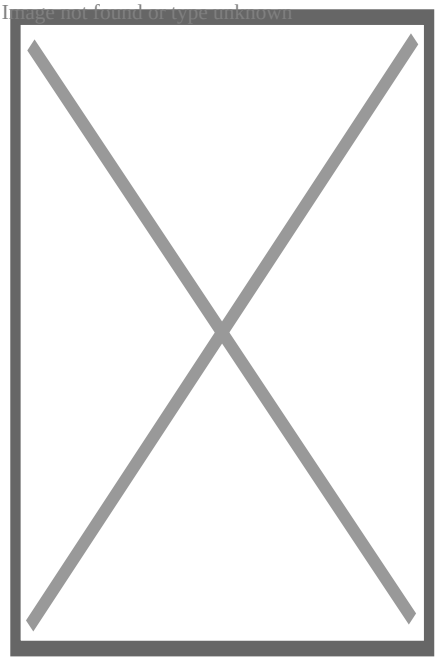

Portrait of Fauchard from his 1728 edition of *"The Surgical Dentist"*.

Orthodontics truly began developing in the 18th and 19th centuries. In 1669, French dentist Pierre Fauchard, who is often credited with inventing modern orthodontics, published a book entitled *"The Surgeon Dentist"* on methods of straightening teeth. Fauchard, in his practice, used a device called a "Bandeau", a horseshoe-shaped piece of iron that helped expand the palate. In 1754, another French dentist, Louis Bourdet, dentist to the King of France, followed Fauchard's book with *The Dentist's Art*, which also dedicated a chapter to tooth alignment and application. He perfected the "Bandeau" and was the first dentist on record to recommend extraction of the premolar teeth to alleviate crowding and improve jaw growth.

19th century

[edit]

Although teeth and palate straightening and/or pulling were used to improve the alignment of remaining teeth and had been practised since early times, orthodontics, as a science of its own, did not really exist until the mid-19th century. Several important dentists helped to advance dental braces with specific instruments and tools that allowed braces to be improved.

In 1819, Christophe François Delabarre introduced the wire crib, which marked the birth of contemporary orthodontics, and gum elastics were first employed by Maynard in 1843. Tucker was the first to cut rubber bands from rubber tubing in 1850. Dentist, writer, artist, and sculptor Norman William Kingsley in 1858 wrote the first article on orthodontics and in

1880, his book, *Treatise on Oral Deformities*, was published. A dentist named John Nutting Farrar is credited for writing two volumes entitled, *A Treatise on the Irregularities of the Teeth and Their Corrections* and was the first to suggest the use of mild force at timed intervals to move teeth.

20th century

[edit]

In the early 20th century, Edward Angle devised the first simple classification system for malocclusions, such as Class I, Class II, and so on. His classification system is still used today as a way for dentists to describe how crooked teeth are, what way teeth are pointing, and how teeth fit together. Angle contributed greatly to the design of orthodontic and dental appliances, making many simplifications. He founded the first school and college of orthodontics, organized the American Society of Orthodontia in 1901 which became the American Association of Orthodontists (AAO) in the 1930s, and founded the first orthodontic journal in 1907. Other innovations in orthodontics in the late 19th and early 20th centuries included the first textbook on orthodontics for children, published by J.J. Guilford in 1889, and the use of rubber elastics, pioneered by Calvin S. Case, along with Henry Albert Baker.

Today, space age wires (also known as dental arch wires) are used to tighten braces. In 1959, the Naval Ordnance Laboratory created an alloy of nickel and titanium called Nitinol. NASA further studied the material's physical properties.[17] In 1979, Dr. George Andreasen developed a new method of fixing braces with the use of the Nitinol wires based on their superelasticity. Andreasen used the wire on some patients and later found out that he could use it for the entire treatment. Andreasen then began using the nitinol wires for all his treatments and as a result, dental doctor visits were reduced, the cost of dental treatment was reduced, and patients reported less discomfort.

See also

[edit]

icon
Medicine portal

- Mandibular advancement splint
- Oral and maxillofacial surgery
- Orthognathic surgery
- Prosthodontics
- Trismus
- Dental implant

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[edit]

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External links

[edit]

- Useful Resources: FAQ and Downloadable eBooks at Orthodontics Australia
- Orthos Explain: Treatment Options at Orthodontics Australia
- Image not found or type unknown Media related to Dental braces at Wikimedia Commons
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Orthodontics

Diagnosis

- Bolton analysis
- Cephalometric analysis
- Cephalometry
- Dentition analysis
- Failure of eruption of teeth
- Little's Irregularity Index
- Malocclusion
- Scissor bite
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Appliances

- ACCO appliance
- Archwire
- Activator appliance
- Braces
- Damon system
- Elastics
- Frankel appliance
- Invisalign
- Lingual arch
- Lip bumper
- Herbst Appliance
- List of orthodontic functional appliances
- List of palatal expanders
- Lingual braces
- Headgear
- Orthodontic technology
- Orthodontic spacer
- Palatal lift prosthesis
- Palatal expander
- Quad helix
- Retainer
- SureSmile
- Self-ligating braces
- Splint activator
- Twin Block Appliance

Procedures	○ Anchorage (orthodontics) ○ Cantilever mechanics ○ Fiberotomy ○ Interproximal reduction ○ Intrusion (orthodontics) ○ Molar distalization ○ SARPE ○ Serial extraction
Materials	○ Beta-titanium ○ Nickel titanium ○ Stainless steel ○ TiMolium ○ Elgiloy ○ Ceramic ○ Composite ○ Dental elastics

Notable contributors	○ Edward Angle ○ Spencer Atkinson ○ Clifford Ballard ○ Raymond Begg ○ Hans Peter Bimler ○ Samir Bishara ○ Arne Björk ○ Charles B. Bolton ○ Holly Broadbent Sr. ○ Allan G. Brodie ○ Charles J. Burstone ○ Peter Buschang ○ Calvin Case ○ Harold Chapman (Orthodontist) ○ David Di Biase ○ Jean Delaire ○ Terry Dischinger ○ William B. Downs ○ John Nutting Farrar ○ Rolf Frankel ○ Sheldon Friel ○ Thomas M. Graber ○ Charles A. Hawley ○ Reed Holdaway ○ John Hooper (Orthodontist) ○ Joseph Jarabak ○ Harold Kesling ○ Albert Ketcham ○ Juri Kurol ○ Craven Kurz ○ Benno Lischer ○ James A. McNamara ○ Birte Melsen ○ Robert Moyers ○ Hayes Nance ○ Ravindra Nanda ○ George Northcroft ○ Dean Harold Noyes ○ Frederick Bogue Noyes ○ Albin Oppenheim ○ Herbert A. Pullen ○ Earl W. Renfroe ○ Robert M. Ricketts ○ Alfred Paul Rogers ○ Ronald Roth ○ Everett Shapiro ○ L. F. Andrews ○ Frederick Lester Stanton ○ Earl Emanuel Shepard ○ Cecil C. Steiner

Organizations	○ American Association of Orthodontists ○ American Board of Orthodontics ○ British Orthodontic Society ○ Canadian Association of Orthodontists ○ Indian Orthodontic Society ○ Italian Academy of Orthodontic Technology ○ Society for Orthodontic Dental Technology (Germany)
Journals	○ American Journal of Orthodontics and Dentofacial Orthopedics ○ The Angle Orthodontist ○ Journal of Orthodontics
Institution	○ Angle School of Orthodontia

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About malocclusion

"Deep bite" and "Buck teeth" redirect here. For the village, see Deep Bight, Newfoundland and Labrador.

Malocclusion

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Malocclusion in 10-year-old girl

Specialty Dentistry Image not found or type unknown Edit this on Wikidata

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Look up ***bucktooth*** in Wiktionary, the free dictionary.

In orthodontics, a **malocclusion** is a misalignment or incorrect relation between the teeth of the upper and lower dental arches when they approach each other as the jaws close. The English-language term dates from 1864;[1] Edward Angle (1855–1930), the "father of modern orthodontics",[2][3][*need quotation to verify*] popularised it. The word derives from *mal-* 'incorrect' and *occlusion* 'the manner in which opposing teeth meet'.

The malocclusion classification is based on the relationship of the mesiobuccal cusp of the maxillary first molar and the buccal groove of the mandibular first molar. If this molar relationship exists, then the teeth can align into normal occlusion. According to Angle, malocclusion is any deviation of the occlusion from the ideal.[4] However, assessment for malocclusion should also take into account aesthetics and the impact on functionality. If these aspects are acceptable to the patient despite meeting the formal definition of malocclusion, then treatment may not be necessary. It is estimated that nearly 30% of the population have malocclusions that are categorised as severe and definitely benefit from orthodontic treatment.[5]

Causes

[edit]

The aetiology of malocclusion is somewhat contentious, however, simply put it is multifactorial, with influences being both genetic[6][*unreliable source?*] and environmental.[7] Malocclusion is already present in one of the Skhul and Qafzeh hominin fossils and other prehistoric human skulls.[8][9] There are three generally accepted causative factors of malocclusion:

- Skeletal factors – the size, shape and relative positions of the upper and lower jaws. Variations can be caused by environmental or behavioral factors such as muscles of mastication, nocturnal mouth breathing, and cleft lip and cleft palate.
- Muscle factors – the form and function of the muscles that surround the teeth. This could be impacted by habits such as finger sucking, nail biting, pacifier and tongue thrusting[10]
- Dental factors – size of the teeth in relation to the jaw, early loss of teeth could result in spacing or mesial migration causing crowding, abnormal eruption path or timings, extra teeth (supernumeraries), or too few teeth (hypodontia)

There is not one single cause of malocclusion, and when planning orthodontic treatment it is often helpful to consider the above factors and the impact they have played on malocclusion. These can also be influenced by oral habits and pressure resulting in malocclusion.[11][12]

Behavioral and dental factors

[edit]

In the active skeletal growth,[13] mouthbreathing, finger sucking, thumb sucking, pacifier sucking, onychophagia (nail biting), dermatophagia, pen biting, pencil biting, abnormal posture, deglutition disorders and other habits greatly influence the development of the face and dental arches.[14][15][16][17][18] Pacifier sucking habits are also correlated with otitis media.[19][20] Dental caries, periapical inflammation and tooth loss in the deciduous teeth can alter the correct permanent teeth eruptions.

Primary vs. secondary dentition

[edit]

Malocclusion can occur in primary and secondary dentition.

In primary dentition malocclusion is caused by:

- Underdevelopment of the dentoalvelor tissue.
- Over development of bones around the mouth.
- Cleft lip and palate.
- Overcrowding of teeth.
- Abnormal development and growth of teeth.

In secondary dentition malocclusion is caused by:

- Periodontal disease.
- Overeruption of teeth.[21]
- Premature and congenital loss of missing teeth.

Signs and symptoms

[edit]

Malocclusion is a common finding,[22][23] although it is not usually serious enough to require treatment. Those who have more severe malocclusions, which present as a part of craniofacial anomalies, may require orthodontic and sometimes surgical treatment (orthognathic surgery) to correct the problem.

The ultimate goal of orthodontic treatment is to achieve a stable, functional and aesthetic alignment of teeth which serves to better the patient's dental and total health.[24] The

symptoms which arise as a result of malocclusion derive from a deficiency in one or more of these categories.[25]

The symptoms are as follows:

- Tooth decay (caries): misaligned teeth will make it more difficult to maintain oral hygiene. Children with poor oral hygiene and diet will be at an increased risk.
- Periodontal disease: irregular teeth would hinder the ability to clean teeth meaning poor plaque control. Additionally, if teeth are crowded, some may be more buccally or lingually placed, there will be reduced bone and periodontal support. Furthermore, in Class III malocclusions, mandibular anterior teeth are pushed labially which contributes to gingival recession and weakens periodontal support.
- Trauma to anterior teeth: Those with an increased overjet are at an increased risk of trauma. A systematic review found that an overjet of greater than 3mm will double the risk of trauma.
- Masticatory function: people with anterior open bites, large increased & reverse overjet and hypodontia will find it more difficult to chew food.
- Speech impairment: a lisp is when the incisors cannot make contact, orthodontics can treat this. However, other forms of misaligned teeth will have little impact on speech and orthodontic treatment has little effect on fixing any problems.
- Tooth impaction: these can cause resorption of adjacent teeth and other pathologies for example a dentigerous cyst formation.
- Psychosocial wellbeing: malocclusions of teeth with poor aesthetics can have a significant effect on self-esteem.

Malocclusions may be coupled with skeletal disharmony of the face, where the relations between the upper and lower jaws are not appropriate. Such skeletal disharmonies often distort sufferer's face shape, severely affect aesthetics of the face, and may be coupled with mastication or speech problems. Most skeletal malocclusions can only be treated by orthognathic surgery.[*citation needed*]

Classification

[edit]

Depending on the sagittal relations of teeth and jaws, malocclusions can be divided mainly into three types according to Angle's classification system published 1899. However, there are also other conditions, e.g. *crowding of teeth*, not directly fitting into this classification.

Many authors have tried to modify or replace Angle's classification. This has resulted in many subtypes and new systems (see section below: *Review of Angle's system of classes*).

A deep bite (also known as a Type II Malocclusion) is a condition in which the upper teeth overlap the lower teeth, which can result in hard and soft tissue trauma, in addition to an effect on appearance.[26] It has been found to occur in 15–20% of the US population.[27]

An open bite is a condition characterised by a complete lack of overlap and occlusion between the upper and lower incisors.[28] In children, open bite can be caused by prolonged thumb sucking.[29] Patients often present with impaired speech and mastication.[30]

Overbites

[edit]

This is a vertical measurement of the degree of overlap between the maxillary incisors and the mandibular incisors. There are three features that are analysed in the classification of an overbite:

- Degree of overlap: edge to edge, reduced, average, increased
- Complete or incomplete: whether there is contact between the lower teeth and the opposing teeth/tissue (hard palate or gingivae) or not.
- Whether contact is traumatic or atraumatic

An average overbite is when the upper anterior teeth cover a third of the lower teeth. Covering less than this is described as ‘reduced’ and more than this is an ‘increased’ overbite. No overlap or contact is considered an ‘anterior open bite’.[25][31][32]

Angle's classification method

[edit]

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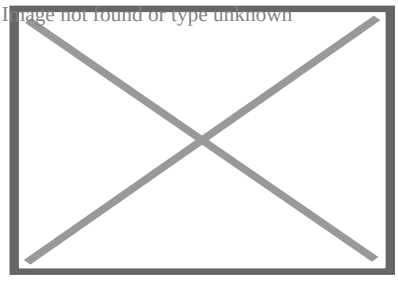

Class I with severe crowding and labially erupted canines

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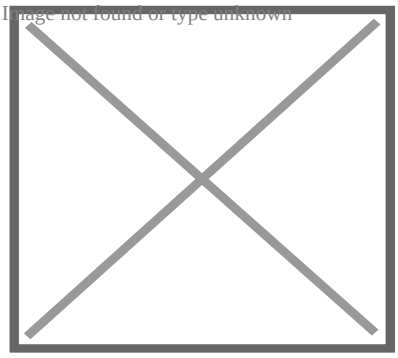


Class II molar relationship

Edward Angle, who is considered the father of modern orthodontics, was the first to classify malocclusion. He based his classifications on the relative position of the maxillary first molar.[33] According to Angle, the mesiobuccal cusp of the upper first molar should align with the buccal groove of the mandibular first molar. The teeth should all fit on a line of occlusion which, in the upper arch, is a smooth curve through the central fossae of the posterior teeth and cingulum of the canines and incisors, and in the lower arch, is a smooth curve through the buccal cusps of the posterior teeth and incisal edges of the anterior teeth. Any variations from this resulted in malocclusion types. It is also possible to have different classes of malocclusion on left and right sides.

- **Class I** (Neutrocclusion): Here the molar relationship of the occlusion is normal but the incorrect line of occlusion or as described for the maxillary first molar, but the other teeth have problems like spacing, crowding, over or under eruption, etc.
- **Class II** (Distocclusion (retrognathism, overjet, overbite)): In this situation, the mesiobuccal cusp of the upper first molar is not aligned with the mesiobuccal groove of the lower first molar. Instead it is anterior to it. Usually the mesiobuccal cusp rests in between the first mandibular molars and second premolars. There are two subtypes:
  - Class II Division 1: The molar relationships are like that of Class II and the anterior teeth are protruded.
  - Class II Division 2: The molar relationships are Class II but the central are retroclined and the lateral teeth are seen overlapping the centrals.
- **Class III**: (Mesiocclusion (prognathism, anterior crossbite, negative overjet, underbite)) In this case the upper molars are placed not in the mesiobuccal groove but posteriorly to it. The mesiobuccal cusp of the maxillary first molar lies posteriorly to the mesiobuccal groove of the mandibular first molar. Usually seen as when the lower front teeth are more prominent than the upper front teeth. In this case the patient very often has a large mandible or a short maxillary bone.

Review of Angle's system of classes and alternative systems

[edit]

A major disadvantage of Angle's system of classifying malocclusions is that it only considers two dimensions along a spatial axis in the sagittal plane in the terminal occlusion, but occlusion problems can be three-dimensional. It does not recognise deviations in other spatial axes, asymmetric deviations, functional faults and other therapy-related features.

Angle's classification system also lacks a theoretical basis; it is purely descriptive. Its much-discussed weaknesses include that it only considers static occlusion, it does not account for the development and causes (aetiology) of occlusion problems, and it disregards the proportions (or relationships in general) of teeth and face.[34] Thus, many attempts have been made to modify the Angle system or to replace it completely with a more efficient one,[35] but Angle's classification continues be popular mainly because of its simplicity and clarity.[*citation needed*]

Well-known modifications to Angle's classification date back to Martin Dewey (1915) and Benno Lischer (1912, 1933). Alternative systems have been suggested by, among others, Simon (1930, the first three-dimensional classification system), Jacob A. Salzmann (1950, with a classification system based on skeletal structures) and James L. Ackerman and William R. Proffit (1969).[36]

Incisor classification

[edit]

Besides the molar relationship, the British Standards Institute Classification also classifies malocclusion into incisor relationship and canine relationship.

- Class I: The lower incisor edges occlude with or lie immediately below the cingulum plateau of the upper central incisors
- Class II: The lower incisor edges lie posterior to the cingulum plateau of the upper incisors
  - Division 1 – the upper central incisors are proclined or of average inclination and there is an increase in overjet
  - Division 2 – The upper central incisors are retroclined. The overjet is usually minimal or may be increased.
- Class III: The lower incisor edges lie anterior to the cingulum plateau of the upper incisors. The overjet is reduced or reversed.

Canine relationship by Ricketts

[edit]

- Class I: Mesial slope of upper canine coincides with distal slope of lower canine
- Class II: Mesial slope of upper canine is ahead of distal slope of lower canine
- Class III: Mesial slope of upper canine is behind to distal slope of lower canine

Crowding of teeth

[edit]

Dental crowding is defined by the amount of space that would be required for the teeth to be in correct alignment. It is obtained in two ways: 1) by measuring the amount of space required and reducing this from calculating the space available via the width of the teeth, or 2) by measuring the degree of overlap of the teeth.

The following criterion is used:[25]

- 0-4mm = Mild crowding
- 4-8mm = Moderate crowding
- >8mm = Severe crowding

Causes

[edit]

Genetic (inheritance) factors, extra teeth, lost teeth, impacted teeth, or abnormally shaped teeth have been cited as causes of crowding. Ill-fitting dental fillings, crowns, appliances, retainers, or braces as well as misalignment of jaw fractures after a severe injury are also known to cause crowding.[26] Tumors of the mouth and jaw, thumb sucking, tongue thrusting, pacifier use beyond age three, and prolonged use of a bottle have also been identified.[26]

Lack of masticatory stress during development can cause tooth overcrowding.[37][38] Children who chewed a hard resinous gum for two hours a day showed increased facial growth.[37] Experiments in animals have shown similar results. In an experiment on two groups of rock hyraxes fed hardened or softened versions of the same foods, the animals fed softer food had significantly narrower and shorter faces and thinner and shorter mandibles than animals fed hard food.[37][39][*failed verification*]

A 2016 review found that breastfeeding lowers the incidence of malocclusions developing later on in developing infants.[40]

During the transition to agriculture, the shape of the human mandible went through a series of changes. The mandible underwent a complex shape changes not matched by the teeth, leading to incongruity between the dental and mandibular form. These changes in human skulls may have been "driven by the decreasing bite forces required to chew the processed foods eaten once humans switched to growing different types of cereals, milking and

herding animals about 10,000 years ago."[38][41]

Treatment

[edit]

Orthodontic management of the condition includes dental braces, lingual braces, clear aligners or palatal expanders.[42] Other treatments include the removal of one or more teeth and the repair of injured teeth. In some cases, surgery may be necessary.[43]

Treatment

[edit]

Malocclusion is often treated with orthodontics,[42] such as tooth extraction, clear aligners, or dental braces,[44] followed by growth modification in children or jaw surgery (orthognathic surgery) in adults. Surgical intervention is used only in rare occasions. This may include surgical reshaping to lengthen or shorten the jaw. Wires, plates, or screws may be used to secure the jaw bone, in a manner like the surgical stabilization of jaw fractures. Very few people have "perfect" alignment of their teeth with most problems being minor that do not require treatment.[37]

Crowding

[edit]

Crowding of the teeth is treated with orthodontics, often with tooth extraction, clear aligners, or dental braces, followed by growth modification in children or jaw surgery (orthognathic surgery) in adults. Surgery may be required on rare occasions. This may include surgical reshaping to lengthen or shorten the jaw (orthognathic surgery). Wires, plates, or screws may be used to secure the jaw bone, in a manner similar to the surgical stabilization of jaw fractures. Very few people have "perfect" alignment of their teeth. However, most problems are very minor and do not require treatment.[39]

Class I

[edit]

While treatment is not crucial in class I malocclusions, in severe cases of crowding can be an indication for intervention. Studies indicate that tooth extraction can have benefits to correcting malocclusion in individuals.[45][46] Further research is needed as reoccurring crowding has been examined in other clinical trials.[45][47]

Class II

[edit]

A few treatment options for class II malocclusions include:

1. Functional appliance which maintains the mandible in a postured position to influence both the orofacial musculature and dentoalveolar development prior to fixed appliance therapy. This is ideally done through pubertal growth in pre-adolescent children and the fixed appliance during permanent dentition .[48] Different types of removable appliances include Activator, Bionatar, Medium opening activator, Herbst, Frankel and twin block appliance with the twin block being the most widely used one.[49]
2. Growth modification through headgear to redirect maxillary growth
3. Orthodontic camouflage so that jaw discrepancy no longer apparent
4. Orthognathic surgery – sagittal split osteotomy mandibular advancement carried out when growth is complete where skeletal discrepancy is severe in anterior-posterior relationship or in vertical direction. Fixed appliance is required before, during and after surgery.
5. Upper Removable Appliance – limited role in contemporary treatment of increased overjets. Mostly used for very mild Class II, overjet due to incisor proclination, favourable overbite.

Class II Division 1

[edit]

Low- to moderate- quality evidence suggests that providing early orthodontic treatment for children with prominent upper front teeth (class II division 1) is more effective for reducing the incidence of incisal trauma than providing one course of orthodontic treatment in adolescence.[50] There do not appear to be any other advantages of providing early treatment when compared to late treatment.[50] Low-quality evidence suggests that, compared to no treatment, late treatment in adolescence with functional appliances is effective for reducing the prominence of upper front teeth.[50]

Class II Division 2

[edit]

Treatment can be undertaken using orthodontic treatments using dental braces.[51] While treatment is carried out, there is no evidence from clinical trials to recommend or discourage any type of orthodontic treatment in children.[51] A 2018 Cochrane systematic review anticipated that the evidence base supporting treatment approaches is not likely to improve occlusion due to the low prevalence of the condition and the ethical difficulties in recruiting people to participate in a randomized controlled trials for treating this condition.[51]

Class III

[edit]

The British Standard Institute (BSI) classify class III incisor relationship as the lower incisor edge lies anterior to the cingulum plateau of the upper incisors, with reduced or reversed over jet.[52] The skeletal facial deformity is characterized by mandibular prognathism, maxillary retrognathism or a combination of the two. This effects 3-8% of UK population with a higher incidence seen in Asia.[53]

One of the main reasons for correcting Class III malocclusion is aesthetics and function. This can have a psychological impact on the person with malocclusion resulting in speech and mastication problems as well. In mild class III cases, the patient is quite accepting of the aesthetics and the situation is monitored to observe the progression of skeletal growth.[54]

Maxillary and mandibular skeletal changes during prepubertal, pubertal and post pubertal stages show that class III malocclusion is established before the prepubertal stage.[55] One treatment option is the use of growth modification appliances such as the Chin Cap which has greatly improved the skeletal framework in the initial stages. However, majority of cases are shown to relapse into inherited class III malocclusion during the pubertal growth stage and when the appliance is removed after treatment.[55]

Another approach is to carry out orthognathic surgery, such as a bilateral sagittal split osteotomy (BSSO) which is indicated by horizontal mandibular excess. This involves surgically cutting through the mandible and moving the fragment forward or backwards for desired function and is supplemented with pre and post surgical orthodontics to ensure correct tooth relationship. Although the most common surgery of the mandible, it comes with several complications including: bleeding from inferior alveolar artery, unfavorable splits, condylar resorption, avascular necrosis and worsening of temporomandibular joint.[56]

Orthodontic camouflage can also be used in patients with mild skeletal discrepancies. This is a less invasive approach that uses orthodontic brackets to correct malocclusion and try to hide the skeletal discrepancy. Due to limitations of orthodontics, this option is more viable

for patients who are not as concerned about the aesthetics of their facial appearance and are happy to address the malocclusion only, as well as avoiding the risks which come with orthognathic surgery. Cephalometric data can aid in the differentiation between the cases that benefit from ortho-surgical or orthodontic treatment only (camouflage); for instance, examining a large group of orthognathic patient with Class III malocclusions they had average ANB angle of -3.57° (95% CI, -3.92° to -3.21°). [57]

Deep bite

[edit]

The most common corrective treatments available are fixed or removal appliances (such as dental braces), which may or may not require surgical intervention. At this time there is no robust evidence that treatment will be successful.[51]

Open bite

[edit]

An open bite malocclusion is when the upper teeth don't overlap the lower teeth. When this malocclusion occurs at the front teeth it is known as anterior open bite. An open bite is difficult to treat due to multifactorial causes, with relapse being a major concern. This is particularly so for an anterior open bite.[58] Therefore, it is important to carry out a thorough initial assessment in order to obtain a diagnosis to tailor a suitable treatment plan.[58] It is important to take into consideration any habitual risk factors, as this is crucial for a successful outcome without relapse. Treatment approach includes behavior changes, appliances and surgery. Treatment for adults include a combination of extractions, fixed appliances, intermaxillary elastics and orthognathic surgery.[30] For children, orthodontics is usually used to compensate for continued growth. With children with mixed dentition, the malocclusion may resolve on its own as the permanent teeth erupt. Furthermore, should the malocclusion be caused by childhood habits such as digit, thumb or pacifier sucking, it may result in resolution as the habit is stopped. Habit deterrent appliances may be used to help in breaking digit and thumb sucking habits. Other treatment options for patients who are still growing include functional appliances and headgear appliances.

Tooth size discrepancy

[edit]

Identifying the presence of tooth size discrepancies between the maxillary and mandibular arches is an important component of correct orthodontic diagnosis and treatment planning.

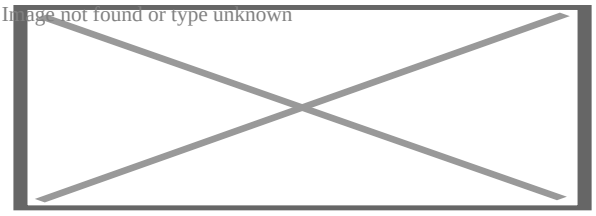
To establish appropriate alignment and occlusion, the size of upper and lower front teeth, or upper and lower teeth in general, needs to be proportional. Inter-arch tooth size discrepancy (ITSD) is defined as a disproportion in the mesio-distal dimensions of teeth of opposing dental arches. The prevalence is clinically significant among orthodontic patients and has been reported to range from 17% to 30%.[59]

Identifying inter-arch tooth size discrepancy (ITSD) before treatment begins allows the practitioner to develop the treatment plan in a way that will take ITSD into account. ITSD corrective treatment may entail demanding reduction (interproximal wear), increase (crowns and resins), or elimination (extractions) of dental mass prior to treatment finalization.[60]

Several methods have been used to determine ITSD. Of these methods the one most commonly used is the Bolton analysis. Bolton developed a method to calculate the ratio between the mesiodistal width of maxillary and mandibular teeth and stated that a correct and harmonious occlusion is possible only with adequate proportionality of tooth sizes.[60] Bolton's formula concludes that if in the anterior portion the ratio is less than 77.2% the lower teeth are too narrow, the upper teeth are too wide or there is a combination of both. If the ratio is higher than 77.2% either the lower teeth are too wide, the upper teeth are too narrow or there is a combination of both.[59]

Other conditions

[edit]
Further information: Open bite malocclusion



Open bite treatment after eight months of braces.

Other kinds of malocclusions can be due to or horizontal, vertical, or transverse skeletal discrepancies, including skeletal asymmetries.

Increased vertical growth causes a long facial profile and commonly leads to an open bite malocclusion, while decreased vertical facial growth causes a short facial profile and is commonly associated with a deep bite malocclusion. However, there are many other more common causes for open bites (such as tongue thrusting and thumb sucking) and likewise for deep bites.[61][62][63]

The upper or lower jaw can be overgrown (macrognathia) or undergrown (micrognathia).[62][61][63] It has been reported that patients with micrognathia are also affected by

retrognathia (abnormal posterior positioning of the mandible or maxilla relative to the facial structure).[62] These patients are majorly predisposed to a class II malocclusion. Mandibular macrognathia results in prognathism and predisposes patients to a class III malocclusion.[64]

Most malocclusion studies to date have focused on Class III malocclusions. Genetic studies for Class II and Class I malocclusion are more rare. An example of hereditary mandibular prognathism can be seen amongst the Hapsburg Royal family where one third of the affected individuals with severe class III malocclusion had one parent with a similar phenotype [65]

The frequent presentation of dental malocclusions in patients with craniofacial birth defects also supports a strong genetic aetiology. About 150 genes are associated with craniofacial conditions presenting with malocclusions.[66] Micrognathia is a commonly recurring craniofacial birth defect appearing among multiple syndromes.

For patients with severe malocclusions, corrective jaw surgery or orthognathic surgery may be carried out as a part of overall treatment, which can be seen in about 5% of the general population.[62][61][63]

See also

[edit]

- Crossbite
- Elastics
- Facemask (orthodontics)
- Maximum intercuspation
- Mouth breathing
- Occlusion (dentistry)

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Further reading

[edit]

- Peter S. Ungar, "The Trouble with Teeth: Our teeth are crowded, crooked and riddled with cavities. It hasn't always been this way", *Scientific American*, vol. 322, no. 4 (April 2020), pp. 44–49. "Our teeth [...] evolved over hundreds of millions of years to be incredibly strong and to align precisely for efficient chewing. [...] Our dental disorders largely stem from a shift in the oral environment caused by the introduction of softer, more sugary foods than the ones our ancestors typically ate."

External links

[edit]

Classification	○ **ICD-10**: K07.3, K07.4, K07.5, D K07.6 ○ **ICD-9-CM**: 524.4 ○ **MeSH**: D008310

Image not found or type unknown

Wikimedia Commons has media related to ***Malocclusion***.

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Orthodontics

Diagnosis	○ Bolton analysis ○ Cephalometric analysis ○ Cephalometry ○ Dentition analysis ○ Failure of eruption of teeth ○ Little's Irregularity Index ○ Malocclusion ○ Scissor bite ○ Standard anatomical position ○ Tooth ankylosis ○ Tongue thrust
Conditions	○ Overbite ○ Overjet ○ Open bite ○ Crossbite ○ Dental crowding ○ Dental spacing ○ Bimaxillary Protrusion ○ Prognathism ○ Retrognathism ○ Maxillary hypoplasia ○ Condylar hyperplasia ○ Overeruption ○ Mouth breathing ○ Temperomandibular dysfunction

Appliances	○ ACCO appliance ○ Archwire ○ Activator appliance ○ Braces ○ Damon system ○ Elastics ○ Frankel appliance ○ Invisalign ○ Lingual arch ○ Lip bumper ○ Herbst Appliance ○ List of orthodontic functional appliances ○ List of palatal expanders ○ Lingual braces ○ Headgear ○ Orthodontic technology ○ Orthodontic spacer ○ Palatal lift prosthesis ○ Palatal expander ○ Quad helix ○ Retainer ○ SureSmile ○ Self-ligating braces ○ Splint activator ○ Twin Block Appliance
Procedures	○ Anchorage (orthodontics) ○ Cantilever mechanics ○ Fiberotomy ○ Interproximal reduction ○ Intrusion (orthodontics) ○ Molar distalization ○ SARPE ○ Serial extraction
Materials	○ Beta-titanium ○ Nickel titanium ○ Stainless steel ○ TiMolium ○ Elgiloy ○ Ceramic ○ Composite ○ Dental elastics

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Organizations	○ American Association of Orthodontists ○ American Board of Orthodontics ○ British Orthodontic Society ○ Canadian Association of Orthodontists ○ Indian Orthodontic Society ○ Italian Academy of Orthodontic Technology ○ Society for Orthodontic Dental Technology (Germany)
Journals	○ American Journal of Orthodontics and Dentofacial Orthopedics ○ The Angle Orthodontist ○ Journal of Orthodontics
Institution	○ Angle School of Orthodontia

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Dental disease involving the jaw

General	○ Jaw abnormality ○ malocclusion ○ Orthodontics
Size	○ Gnathitis ○ Micrognathism ○ Maxillary hypoplasia
Maxilla and Mandible	○ Cherubism ○ Congenital epulis ○ Torus mandibularis ○ Torus palatinus

Other	○ Jaw and base of cranium
	  ○ Prognathism
	  ○ Retrognathism
	○ Dental arch
	  ○ Crossbite
	  ○ Overbite
	○ Temporomandibular joint disorder

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