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Editorial

Evolution, revolution, or a symbiotic convergence?

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The dichotomy between steady evolution and drastic changes or revolution creates an engaging narrative in the dynamic field of orthodontics. From the progression of bracket systems to the remarkable rise of aligners and artificial intelligence (AI), orthodontists today navigate through the world full of technological opportunities. However, which path is the enroute to success? and What will evolution, revolution, or their symbiotic convergence bring forth the future of orthodontics?

The Solid Ladder: Evolution in Orthodontics

Precision and efficiency have always been essential to the daily tasks of orthodontics. Orthodontics has a long history of evolutionary advancements in this field. For an instance, considering the development of brackets, it has changed significantly. From the ribbon arch device which was first introduced by Dr. Edward Angle in the early 1900s to edgewise to contemporary self-ligating systems that provide axial control are of innovations that have upgraded precision and efficiency while reducing the chair-side time. Current materials, such heat-activated nickel-titanium wires, have further enhanced the treatment results by guaranteeing the best possible force delivery with the least amount of discomfort.

Likewise, there have been consistent improvements in cephalometric tracing. Digital technologies have transformed manual tracing, which was formerly time-consuming and prone to human error. In order to help orthodontists with accurate diagnosis and treatment planning, semi-automated and completely automated technologies now offer more accurate evaluations with less work.[1] These developmental stages provide the foundation of orthodontics. Every innovation, whether in workflow, materials, or design, demonstrates the field's dedication to ongoing development and improves patient outcomes and clinician productivity.

Revolution: Aligners and AI- Spreading the wings to soar

While evolution represents consistent development, revolution is about breaking the norm and rewriting the rules. One example of such is the classic case of aligners. Aligners have revolutionized the orthodontic practice since the introduction of Align Technology's Invisalign in the late 1990s.[2] What began as an option for small adjustments has developed into a flexible remedy that can handle complex malocclusions. Research and development in AI, attachment designs, and aligner material have greatly increased patient's satisfaction and treatment outcomes. Aligner treatment in certain places is currently used to treat up to 45% of orthodontic cases, which indicates to its

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groundbreaking results.[3]

Artificial intelligence (AI) has brought about yet another revolution in orthodontics. AI-driven systems currently provide cephalometric landmark detection, treatment simulation, and decision-making. AI can precisely classify skeletal patterns, predict growth, and identify when extractions are needed.[1,3] Convolutional neural networks (CNNs), one type of artificial intelligence (AI) technology, have significantly reduced the time and error associated with cephalometric analysis in diagnostic imaging. Automated landmark detection and precise craniofacial structure segmentation are now on par with human proficiency, with the promise of greater speed and consistency.[1]

Revolutions are difficult to comprehend. The ongoing problem of equality, ethical concerns regarding data privacy, and the opaqueness of AI decision-making processes are barriers to all the potential.[1] If only premium clinics have access to AI tools, might there be an even bigger discrepancy in care? These difficulties serve as a reminder that advancement depends not only on technology but also on our decision to use it.

The Interplay: Where Evolution Meets Revolution

AI's revolutionary potential in orthodontics may be too well captured by the simple contrast between evolution and revolution. Rather, it seems more likely that a synergistic approach, in which small improvements lead to big changes, will work. AI cannot work alone; human knowledge, strong data governance, and ethical principles are all necessary for it to be effective.[1,3] Consider individualized treatment planning, in which we, the orthodontists, make the final decisions after AI analyzes the data and offers insights. The goal is to use AI to supplement human interaction, not to replace it. For example, the development of bracket systems enhances the revolutionary potential of aligners by providing solutions for extractions or severe rotations, two situations in which aligners falls short.

AI helps us see patterns we might otherwise miss, but it's still our expertise that guides the patient journey in this hybrid approach. Rather than a handover, it's a partnership. Hasn't that always been the goal of orthodontics? To achieve the best results for our patients, we combine science, skill, and art.

Call to Embrace the Dynamic Duality

Instead of being driven to an all or nothing choice between evolution versus revolution, orthodontists are responsible for leading a discipline that thrives on the need to reconcile invention and tradition. Our advances are fuelled by the synthesis of the two,-A symbiotic Cinvergence- to the point that our patients benefit from the most innovative care possible thanks to the use of both dramatic innovations and subtle adaptations.

Whether it is the brackets evolution, the disruptive revolution of aligners, to the promise of artificial intelligence, orthodontics is a beautiful story of progression. It is essential to embrace this dynamic interaction while staying connected to established principles and open to ongoing innovation in the future. Specifically, for all of us to do, above all else, let us continue to center patients in all that we do, ask the uncomfortable questions and aspire towards fairness and transparency. Whether this route is one of evolution, revolution, or both, we must walk it together, cautiously, and purposefully.

Conflict of Interest

None.

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