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WINTER 2025/2026 ■ VOLUME 36 ■ NUMBER 4

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Editorial

Dr. Rob Pasch
Editor

Dear Members,

You will enjoy reading this issue of the IJO, as it is full of valuable items that you can use in your day-to-day orthodontic lives. These articles will help you with diagnosis and treatment decisions. Enjoy reading these pearls, for the authors have worked hard to present evidence-based results to make your lives easier.

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I remain
Respectfully,
Dr. Rob Pasch DDS MSc IBO General Practitioner.
Winter 2025/2026

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Who Is at Fault, the Doctor or the Patient?

by Laurance Jerrold, DDS, JD, ABO, FACD

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Abstract:

This report details specific clinical, patient, and practice management techniques and risk management principles relating to the duties and obligations owed under the doctor-patient relationship by both the patient to the doctor, and the doctor to the patient. The reader is asked to decide which party was primarily responsible for the injury the patient sustained.

Key Words: Doctor–Patient Relationship, Standard of Care, Referral Liability, Contributory Negligence, Comparative Negligence, Dental Risk Management

Conflict of Interest: None

The Clinical History

The patient was first seen by the pediatric dentist on 02/09/2018, 2 weeks shy of his 5th birthday. The intraoral exam was within normal limits (WNL) and noted that he was in the primary dentition, negative for caries, with good oral hygiene. A maxillary occlusal film was obtained, and the interpretation was WNL. Treatment at that time consisted of a prophy (P), fluoride varnish application (FV), oral hygiene instruction (OHI), and diet discussion (DD). He was scheduled for a 6 month recall appointment.

The patient next appeared on 09/24/2018, 7 months later. At this time, he was in the early mixed dentition, no caries, with good oral hygiene. The 2 lower central incisors were just starting to erupt. Two bitewing x-rays were acquired, the findings were negative, and the treatment rendered was the same as above. Another recall visit was scheduled for 6 months later.

The patient was next seen on 04/16/2019, approximately 7 months later. The 2 lower first permanent molars were beginning to erupt, a bilateral posterior crossbite was starting to develop, and the anterior teeth were edge to edge. No x-rays were acquired, and the treatment rendered was noted to be P, FV, OHI, and DD. Recall was scheduled for 6 months.

The patient was again seen 7 months later, on 11/19/2019. Two bitewing x-rays were acquired with negative findings. The clinical exam revealed the anterior teeth were still edge-to-edge, and the posterior dentition was now in bilateral lingual crossbite. The treatment rendered was the same as previously noted.

The patient missed his 06/19/20 recall appointment. He was not seen again until 05/24/21, 18 months since his last appointment. The patient was now 8 years old. At this visit, 2 bitewing x-rays and a panoramic film, Figure 1, were acquired. The interpretation of these films was that all was WNL. The clinical examination revealed that the 4 permanent first molars exhibited a mild Cl III relationship, the posterior crossbites were still present and the anterior teeth were now noted to be in crossbite. In addition, a 2-3 mm upper central diastema was noted. Once again, treatment consisted of P, FV, OHI, and DD.

Figure 1: Initial Panoramic Film 5/24/21

The patient was next seen 3 months later, 08/11/2021, at which time sealants (S) were placed on the 4 first permanent molars.

The patient missed his next recall appointment, scheduled for 12/06/2021, and was not seen again until 08/08/2022. He was now 9½ years old. Bitewing x-rays were acquired and noted to be WNL. Clinically, nothing had changed except that the central diastema was now noted to be 4mm. The following treatment was performed: P, FV, OHI, DD. The patient was referred for an orthodontic evaluation of the developing Cl III malocclusion, the anterior and posterior crossbites, and the diastema.

The patient did not appear at his next recall appointment scheduled on 02/20/2023. He also failed to make an appointment regarding the orthodontic referral. He was finally seen by the pediatric dentist 29 months later, 01/27/25. The patient, now one month short of his 12th birthday, stated that he noticed a slight bump on his right jaw, which elicited a pain response when pressure was applied. He noted that the swelling had been present for about 2 months. He also complained of a small mass on the left side of his neck.

The patient's mother indicated that they initially sought treatment from the patient's pediatrician who referred him to an ENT who ordered an ultrasound of both areas. The ultrasound report stated that there was a 1.7 cm complex cystic mass replacing the right parotid gland; a biopsy was recommended. The

mass on the left side was noted to be a level 2 lymph node. The extra oral exam revealed a right sided asymmetry that was firm to the touch and extended along the right body of the mandible posteriorly. The lymph node on the left side was easily palpable. Bitewing x-rays as well as a panoramic film (Figure 2) were acquired. The panoramic film revealed a multilocular radiolucent lesion in the right posterior mandible. The differential diagnosis was either odontogenic keratocyst (OKC), dentigerous cyst, or ameloblastoma. The patient was referred to an oral surgeon for evaluation and treatment.

Figure 2: Recall Panoramic Film 1/27/25

The patient saw the oral surgeon a week later, on 02/03/2025. An incisional biopsy was performed, and a medical grade Maxillofacial CT scan without contrast was obtained. The pathology report definitively revealed the lesion to be an "ameloblastoma with cystic and follicular growth patterns" and extended from the first molar area of the right mandibular body well up into the ramus. The surgical plan called for resection of the right mandible including the extraction of teeth #s 29, 30, 31, and 32; reconstruction of the mandible with a fibula graft; and rehabilitation of the right posterior dentition with temporary immediate implants followed by crowns when appropriate from a clinical and temporal perspective. The surgery was performed the following month, and a post operative radiograph, Figure 3, was obtained. The patient was seen by the oral surgeon for several visits postoperatively and is reported to be doing well. He was then referred back to both the pediatric dentist and the orthodontist.

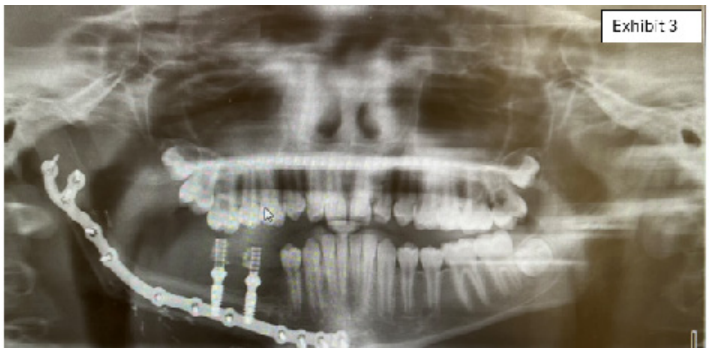

Figure 3: Post Operative Film

Discussion 1 - The Ameloblastoma

According to the Cleveland Clinic,[1] there are 5 types of ameloblastoma. The first is the conventional type representing approximately 85% of all ameloblastic lesions. These benign lesions grow rapidly and often present with a honeycomb or soap bubble type of appearance. The 2nd type, the unicystic form, is most often found in younger patients, although the patient noted in this report suffered from the first type. Unicystic types are less likely to metastasize beyond the jaw. Peripheral (extraosseous) ameloblastomas are very slow growing and are found in the extraosseous soft tissues before spreading to the hard tissues of the jaw. Types 4 and 5 are malignant in nature. The 4th type is the metastasizing ameloblastoma. It looks like a benign ameloblastoma but is actually a metastatic cancerous lesion from another part of the body. The last type is the ameloblastic carcinoma. It starts off being benign however, in time, it turns malignant.

As far as incidence and prevalence are concerned, ameloblastomas are more commonly found in those between the ages of 30 to 60; however, the unicystic type is more common in those patients in their 2nd and 3rd decades of life.[2] Although ameloblastomas are one of the more common benign tumors of the jaw, only about 1 in 1,000,000 people will develop one, and of this small percentage, only 2% are found to be malignant. These lesions are more commonly found in those of African and Asian descent. Etiologically, these tumors develop from enamel tissue that has not undergone morphodifferentiation during tooth development; the third molar area is a common site. Mutations of the BRAF V600E and SMC genes are commonly present in those who develop ameloblastoma.[1,3]

Suma[3] and colleagues noted the following. Clinically, an ameloblastoma is a slow-growing but aggressive tumor that, if undiagnosed, ultimately causes expansion of the buccal and lingual cortical plates, often perforating them and invading the adjacent soft tissues. They note the peak incidence to be during the 3rd and 4th decades of life with an equal gender distribution. They also state that ameloblastomas occur most often, between 80 and 99%, in the mandible. The most common site for development is in the molar area and ascending ramus. Treatments range between enucleation for lesions that are discovered early, to surgical excision if discovered later on. Recurrence is common, ranging from 17% for enbloc resections to 35% when treated conservatively. For this reason, it is important to follow patients post-surgically for a minimum of at least 10 years as 50% of all lesions surgically excised tend to reoccur during the first 5 years post surgically. The recurrence rate for the unicystic type is approximately 10%.

Because of its aggressive nature, its capacity to invade both bone and adjacent soft tissue, and the amount of time that expires before the ameloblastoma is diagnosed, an ameloblastoma can range in size between 1 and 16 cm. Larger ameloblastomas often result in facial asymmetry and disfigurement, the displacement of teeth, malocclusion, and because of cortical plate expansion, pathological factures are also known to occur.

Discussion 2 – The Patient Was to Blame

The doctor-patient relationship is pseudo-contractual in nature. One court[5] defined it quite succinctly by stating: "[The] doctor and patient enter into a simple contract, the patient hoping that he will be cured and the doctor optimistically assuming that he will be compensated." Because of the contractual nature of this relationship, there are rights, obligations and duties (RODs) that each party is required to assume. While the number of RODs owed by dentists to their patients is approximately 20, the number of RODs that patients owe their doctors is just over a handful, 6 to

be exact. They are, in no particular order:

1) the doctor's instructions will be followed;[6]
2) patients will not dictate inappropriate treatment;[7]
3) appointments will be kept;[8]
4) fees for professional services rendered will be paid;[8,9]
5) patients will be truthful regarding all valid clinical and administrative inquiries;[10] and
6) patients will conform to accepted modes of behavior.[11]

Alluding to a patient's RODs, 2 other courts have noted in their decisions:

> It is the patient's duty to use such care as a person of reasonable prudence would ordinarily use in circumstances like his own; and if he fails to do this, he cannot hold the physician answerable for the consequences of his own want of ordinary care.
>
> If an office patient fails to come to the office of the physician or surgeon whom he employs and from whom he has received careful and skillful treatment, and then fails to return to the office for further treatment, and in consequence thereof suffers injury, he is not entitled to maintain an action against the physician, because it is his own default and misfeasance.[12,13]

In the case described at the beginning of this article, the patient breached 2 of the RODs owed the pediatric dentist. First, the doctor's instructions were not followed regarding his referral to the orthodontist. Had the patient done so, the orthodontist's initial diagnostic records would have revealed the tumor at least 2 years earlier. Secondly, the patient did not keep several of his scheduled recall appointments; some temporal spans were longer than 2 years. Again, had the patient kept these appointments, there is no question that the tumor would have been discovered much earlier, thus providing the opportunity for a much better outcome.

From a risk-management perspective, whenever a patient breaches one or more of their RODs inherent in the doctor-patient relationship, the doctor should consider taking some type of action in order to mitigate against the development of any negative sequela that may result from the patient's action or inaction, either of which may lead to claims that the doctor erred in some manner. One such solution is to terminate the doctor-patient relationship by dismissing the patient from his or her practice. As was noted by another court,[14] "If a physician is ever justified in withdrawing … it can only be where the patient obstinately refuses to follow the treatment prescribed."

Does justification or excuse exist that would allow patients to shirk adhering to any of the RODs owed the treating doctor? In this case, the mother reported that even though the pediatric dentist's office did reach out to her to reschedule each missed recall appointment, she explained that she had recently been diagnosed with Stage 4 liver cancer and that the reason she did not bring the child in for treatment between 08/08/2022 and 01/27/2025 was because she was preoccupied with attending to all of her own medical needs. She decided to postpone the child's dental appointments as his mouth was always clean, he never had any cavities, and she believed the orthodontic referral could wait because of his age.

Can we say the patient was at fault? Yes. Regardless of the mother's own medical status, her own misfeasance in not keeping the recall appointments and not seeking the recommended referral, even though understandable under the circumstances, is a basis to apportion blame to the patient for the non-discovery of the tumor in a timely manner.

Discussion 3 – The Doctor Was to Blame

The standard of care requires dentists to first possess a requisite degree of skill, knowledge, education, experience, expertise, and technology (SKEEET). Next, they must exercise this degree of SKEEET in a reasonable manner. Third, doctors must use their best judgment in applying their SKEEET when treating their patients. In addition, doctors need to advise patients of their responsibilities and conduct during their treatment. Fifth, practitioners must keep up with advances in their field, including technology; for example, the use of Artificial Intelligence, CBCTs, TADs, etc. Finally, doctors are required to utilize the means and methods for treatment in a manner generally employed and accepted within their profession.[15,16]

Bal[17] notes that the 4 elements plaintiffs, or their representatives, need to prove in order to succeed in a medical malpractice action are:

1. A defined duty of care owed to the patient;
2. The doctor breached this duty in some fashion
3. The patient suffered some compensable type of injury or damage
4. The breach of the duty owed was the direct or proximate cause of the injury sustained.

Looking at it from another perspective, a healthcare practitioner is required to "exercise the skill, diligence, and knowledge and must apply the means and methods, which would reasonably be exercised and applied under similar circumstances by reasonably prudent members of his profession in good standing and in the same line of practice."[18]

It is without question that the pediatric dentist had the duty to discover the tumor. He breached that duty by not discovering its presence on the 5/24/21 panoramic film. The patient certainly suffered a compensable injury. His jaw had to be resected, reconstructed, and ultimately, the dentition rehabilitated. Finally, not discovering the tumor in its incipient stage allowed it to grow, ultimately causing the extensive injury that the patient sustained.

In addition, the pediatric dentist waited far too long to make the orthodontic referral. The first notation in the chart describing the bilateral posterior and anterior crossbite occurred on the 11/19/19 appointment. According to the American Association of Orthodontists,[19] a referral should have been made at that time. The duty to refer occurs when

1. The primary care practitioner discovers, should discover, or should know
2. The patient's ailment is beyond his knowledge, technical skill, ability, or capacity to treat resulting in a likelihood of reasonable success; and
3. The practitioner is required to either disclose this to the patient or, advise him of the necessity to seek other or different treatment.[20]

Had that been done, there is a strong probability that the tumor would have been discovered much earlier, resulting in far less extensive surgery.

Can we assert that the doctor was to blame? Yes. All the elements for finding the practitioner liable were met. There is no question that on the original panoramic film the tumor was

present, albeit in an early stage. Although the doctor did not cause the ameloblastoma, it was not discovered in a timely manner. There is also no question that the orthodontic referral should have been made at an earlier point in time. Had the tumor been discovered earlier on, the injuries would have significantly mitigated.

Discussion 4 – Reading a Panoramic Radiograph

This case report evidences the importance of thoroughly examining all aspects of a panoramic radiograph. According to Dr. Adam Alexander,[21] who is both an orthodontist and an oral and maxillofacial radiologist, a good procedure for reading panoramic films is first to look at the image from a global perspective, comparing the right against the left side for any asymmetry. Next is to count the teeth and evaluate them for caries, the presence of any needed or defective restorations, the presence of any gross periodontal defects or compromises, and the presence of any periapical or other pathology. The third step is to examine the maxilla. One should look at the character of the alveolar bone followed by examination of the sinus floor. Next is to examine the mandible by checking the inferior border, the cortical bone, and the inferior alveolar canal for any lesions or discontinuity. Fifth is to evaluate the TMJ by examining the condylar morphology, the joint spaces, and evidence of any degenerative changes. Sixth is to examine the sinuses and airspaces; one needs to look at the maxillary sinuses, the nasal cavity, and the nasopharyngeal airway. Next is to examine the cervical spine as well as all adjacent soft tissues for the presence of any calcifications. The final step is to recheck any areas of asymmetry or uncertainty and compare those findings against any prior radiographs that might be available. The order that these steps are performed is not critical, but by following a stepwise approach for evaluating panoramic radiographs, the chances of missing any subtle findings are reduced.

Accordingly, if one were to reexamine the original panoramic image, one can clearly see the developing pathology.

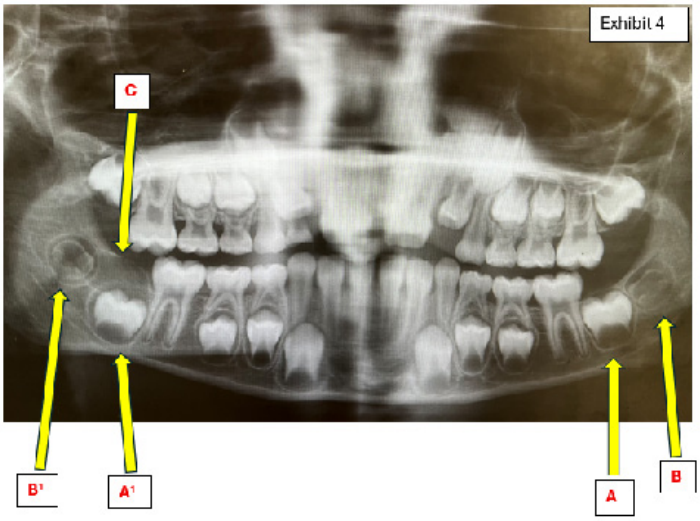

Figure 4: Letters show difference between normal and abnormal findings.

Arrow "A" shows the normal relationship of the 2nd molar to the first molar. However, arrow "A1" reveals that the 2nd molar on the affected side is inferiorly displaced relative to its relationship to the first molar and now approximates the mandibular border. Arrow "B" shows the relationship of the developing third molar to the second molar on the unaffected side. However, "B1" reveals that on the affected side, the third molar has been significantly displaced distally and superiorly in relationship to the second molar as compared to its contralateral mate. These two asymmetries are exemplars of the type of discrepancy that should indicate something abnormal is occurring. Arrow "C" reveals the developing presentation of a classic "soap bubble" appearance resulting in an expansion of the alveolar process superior to the second molar as compared to the left side.

Discussion 5 – Legal Considerations Relating to Fault

So, who was responsible for the injury, the doctor or the patient? The answer is that they both were. However, because of the legal doctrines of contributory and comparative negligence, liability may be attributed to just one, or to both parties. According to Barron's Law Dictionary, contributory negligence is defined as "…conduct on the part of the plaintiff [the patient] that falls below the standard to which he should conform for his own protection, and which is a legally contributing cause in addition to the negligence of the defendant in bringing about the plaintiff's harm."[22]

At common law, if the plaintiff was in any way responsible in bringing about his own injury, he was barred from seeking recovery. Over time, many courts found this approach to be too draconian and so, slowly, over decades, most courts replaced using the doctrine of contributory negligence with the doctrine of comparative negligence. There are only 4 states that still follow the doctrine of contributory negligence. They are Alabama, Maryland, North Carolina, and Virginia. In addition, the District of Columbia also follows it. The remainder of the country has now adopted the use of the doctrine of comparative negligence. Barron's[22] defines comparative negligence as "the allocation of responsibility for damages incurred between the plaintiff and the defendant [the patient and the doctor] based on the relative negligence of the two; the reduction of the damages [the monetary award] to be recovered by the negligent plaintiff in proportion to his fault."

For example, in a comparative negligence jurisdiction, if a jury awarded a plaintiff $100,000 in a case but found that the plaintiff was 20% responsible and the doctor 80% at fault, the award would be reduced by that percentage; hence, the plaintiff would receive $80,000. If the same case was adjudicated in a contributory negligence jurisdiction, the plaintiff would get nothing, as he or she was a contributing cause to the injury suffered.

How would this "case" fare if it ever goes to trial? Only the jury knows, as they will make the final determination based on their finding of comparative fault. The jury's determination will also take into consideration any justifications or explanations espoused by either party relative to the finding of fault.

Conclusion – The Mitigation of Risk

Develop a protocol for reading radiographic images be they periapical, panoramic, cephalometric, or CBCT. You are not responsible to know what every finding is, but you are responsible for recognizing any abnormalities discovered and then managing the situation appropriately. One adage, recently adopted to combat crime and terrorism, is "if you see something – say something." It applies in dentistry as well. If you see something suspicious or you don't know what it is, say something … to someone. You now have the obligation, by way of referral, to consult with someone who can find the answer for you.

One good risk management tip regarding handling missed appointments notes, "depending on the patient's diagnosis and/or reason for the appointment, the treating provider may instruct an assigned staff member to follow up missed appointments either verbally or by way of a 'missed appointment letter.' Generally, the efforts required to contact the patient are commensurate with the patient's medical condition and potential consequences of missed treatment."[23]

When a patient misses an appointment, it is critical to know what type of appointment was missed relative to the patient's clinical condition or status. Another court noted in its decision regarding a doctor's duty to follow up that "a dentist … is under the duty not only to use the requisite care and skill in a particular operation, but also to give such follow up care to the patient as is necessary …."[24] For example, if an orthodontic patient is in the middle of 4 first premolar extraction therapy and the canines are being retracted with a stretched NiTi coil spring, that tooth will continue to move until there is no force remaining in the activation. This situation requires the patient to return at prescribed intervals to ensure that over-retraction or other unwanted tooth movement does not occur. When this type of appointment is missed, it is relatively important for the patient to be recalled in a timely manner. On the other hand, if the patient has already been in retention for a significant number of months, and now misses a few retainer check appointments, it is probably not necessary for them to return at all. It is the doctor's absolute responsibility to review the charts of all no shows or cancellations at the end of each day in order to instruct his administrative staff regarding the importance, or not, of recalling the patient in a timely manner.

According to Loomis,[23] patients who have missed their appointments fall into 1of 3 risk categories. The first is where the patient is at minimal risk if not seen. The patient in this situation merely needs to be reminded that they missed their appointment; and, if appropriate, the negative consequence that he or she may befall if they continue to miss future appointments.

The second category relates to patient who might be at moderate risk. In this situation, continued treatment is still necessary but the patient is not a critical stage of treatment. In this type of situation, missing a specific, or multiple appointments during the midst of ongoing professional ministrations raises the risks of a negative happenstance occurring. As the risk for negative sequelae increases due to continually missing regularly scheduled appointments, the need to increase the number of efforts made to reschedule the patient also needs to increase.

The final category is the high-risk patient who has a good chance of suffering any number of negative consequence if they are not seen in a timely manner. These patients need the doctor's office to engage in repeated efforts to recall the patient, as allowing their continued absence to persist without professional monitorization not only jeopardizes their health but places the practitioner in potential jeopardy as the doctor-patient relationship is still in existence and the duty to adhere to a defined standard of care still remains. It is for this reason that terminating the doctor-patient relationship regarding a recalcitrant patient may often be in the doctor's best interest.

Two final words of caution remain. First, all instances of patient non-compliance regarding the RODs owed the doctor; all efforts made in the attempt to reschedule the patient; and all chart entries made describing any serious negative consequences that can arise unless treatment is properly supervised and rendered in a timely fashion, must be fastidiously documented. From a risk management perspective, if you didn't record it , you either didn't do it, you didn't say it, or it didn't happen.

Secondly, relying on specific communication technologies that provide automated phone calls after a missed appointment informing the patient they need to reschedule doesn't quite make the grade, as these technological practice aids don't differentiate between those patients who can afford to miss the appointment and those who can't. Only the treating practitioner can make that distinction. This rationale serves as the basis for admonishing practitioners to establish an in-office missed appointment protocol that deals with any no-show and cancellation visits at the end of each day.

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Interceptive Orthodontic Management of a Child with Severe Hypomineralization in Primary Molars and Canines

by Luciana Duarte Caldas, DDS, MSD, PhD and Luísa Schubach da Costa Barreto, DDS, MSD, PhD

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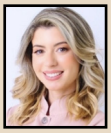

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Abstract

Hypomineralized second primary molars (HSPM) are characterized by a qualitative defect in enamel development occurring during the mineralization and maturation phases of amelogenesis. HSPM is prevalent but often underdiagnosed, particularly by orthodontists, and a multidisciplinary approach is essential to establish an appropriate treatment plan, especially when malocclusions are already present at an early age. Numerous risk factors (environmental and systemic) may be associated with hypomineralization, as well as with malocclusions (extrinsic and intrinsic factors and deleterious oral habits), in addition to genetic/hereditary influences. This case report describes an 8-year-old female patient in the mixed dentition stage presenting with severe HSPM and canines, molar-incisor hypomineralization (MIH), maxillary constriction, anterior open bite, and Class II malocclusion associated with mandibular retrognathism. Clinical and radiographic examinations revealed extensive enamel deterioration of the affected primary molars and canines, occlusal disharmony, and vertical growth tendency. A family history suggestive of hereditary involvement was also identified. After interceptive orthodontic treatment, the patient exhibited preserved clinical crown integrity of teeth affected by MIH, satisfactory occlusion, improved facial profile, and a harmonious smile. This case highlights the importance of early diagnosis of DDEs and the role of a multidisciplinary interceptive approach in preventing functional deterioration, minimizing structural damage, and improving long-term occlusal and esthetic outcomes.

Keywords: Molar Hypomineralization; Malocclusion, Angle Class II; Open Bite; Palatal Expansion Technique; Orthodontics.

Conflict of Interest: None

Introduction

The diagnosis of developmental defects of enamel (DDEs) during childhood has gained increasing attention in recent years.[1,2] Hypomineralized second primary molars (HSPM) and molar-incisor hypomineralization (MIH) are among the most prevalent DDEs worldwide,[3-6] with complex and multifactorial etiologies involving environmental, systemic, genetic, and epigenetic factors occurring during pre-, peri-, or postnatal development.[7-9]

The presence of hypomineralization in the primary dentition significantly increases the likelihood of permanent dentition involvement, particularly when multiple primary teeth are affected.[10,11] Genetic influence plays an important role, as both dentitions tend to be affected when hereditary factors are involved.[10,12,13] Clinically, HSPM and MIH conditions present as qualitative enamel defects with demarcated opacities and altered translucency, often asymmetrically distributed.[2,3]

When associated with malocclusions such as Class II relationships and maxillary constriction, hypomineralized enamel (already structurally fragile) may be further compromised, reinforcing the need for a multidisciplinary approach.[14,15] Accordingly, this case report demonstrates the integrated management of a pediatric patient with severe HSPM and MIH associated with maxillary constriction, anterior open bite (AOB), and Class II malocclusion through coordinated Pediatric Dentistry and Orthodontic care.

CASE REPORT

Patient information

An 8-year-old female patient was referred for orthodontic evaluation accompanied by her legal guardian and older brother, with the chief complaint of misaligned teeth. Facial clinical examination revealed a convex profile, protrusive lips, absence of passive lip seal, increased lower facial third, and a slightly deficient malar region (Fig 1).

Written informed consent was obtained from the child's legal guardians for both the treatment and the publication of clinical data and images. In accordance with local regulations and institutional guidelines, approval from an ethics committee was

not required for the reporting of a single clinical case.

Clinical Findings

During the intraoral clinical examination, extensive coronal structural deterioration was observed in all second primary molars, presenting a yellowish-brown discoloration characteristic of HSPM. In addition, all primary canines also exhibited developmental defects of enamel. A demarcated opacity was noted on the buccal surface of tooth 16, indicating that the patient also presented MIH. To investigate a possible hereditary epigenetic involvement, the patient's legal guardian and older brother were clinically evaluated, and both were found to present MIH as well (Fig 2).

Further intraoral assessment revealed a previous restorative treatment on tooth 75, a model discrepancy of -4 mm in the maxillary arch and -1.5 mm in the mandibular arch, a slightly deviated maxillary dental midline to the left, an overjet of 3 mm, a negative overbite, and an Angle Class II malocclusion, division 1, right subdivision. Functional analysis also showed the presence of tongue interposition at rest, as well as a lower lip interposition habit, characterizing an AOB with negative overbite (Fig 1). The patient also reported a history of thumb-sucking until the age of five.

Diagnostic assessment

The panoramic radiograph (Fig 3a) was carefully evaluated as part of the initial diagnostic records. This examination allowed the assessment of dental development, eruption pattern, presence of third molar tooth germs, and overall osseous structures and dental conditions. Special attention was given to the mandibular second primary molars, which exhibited extensive coronal structural deterioration consistent with hypomineralization. No additional pathological findings were observed, and all the remaining dental and osseous structures were considered within normal limits.

The maxillary occlusal radiograph (Fig 3b) showed a clearly visible midpalatal suture line, indicating that the maxillary halves had not yet fused, which is consistent with the patient's chronological age.

Figure 1: Pretreatment extraoral photographs: (a) profile; (b) frontal rest; (c) frontal smile; and intraoral photographs: (d) right lateral; (e) frontal; (f) left lateral; (g) maxillary occlusal; and (h) mandibular occlusal views.

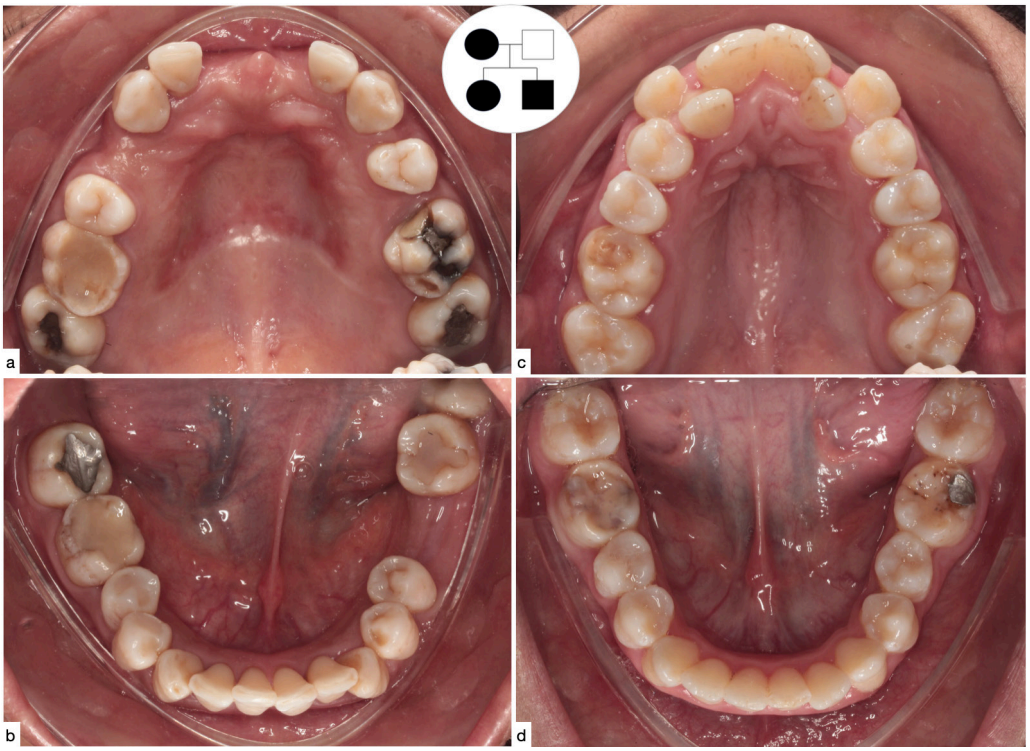

Figure 2: Intraoral photographs of the patient's family members presenting molar-incisor hypomineralization (MIH): (a, b) mother; (c, d) brother. The schematic representation highlights the suspected hereditary epigenetic contribution to the condition observed within the family.

All patient photos used with signed consent

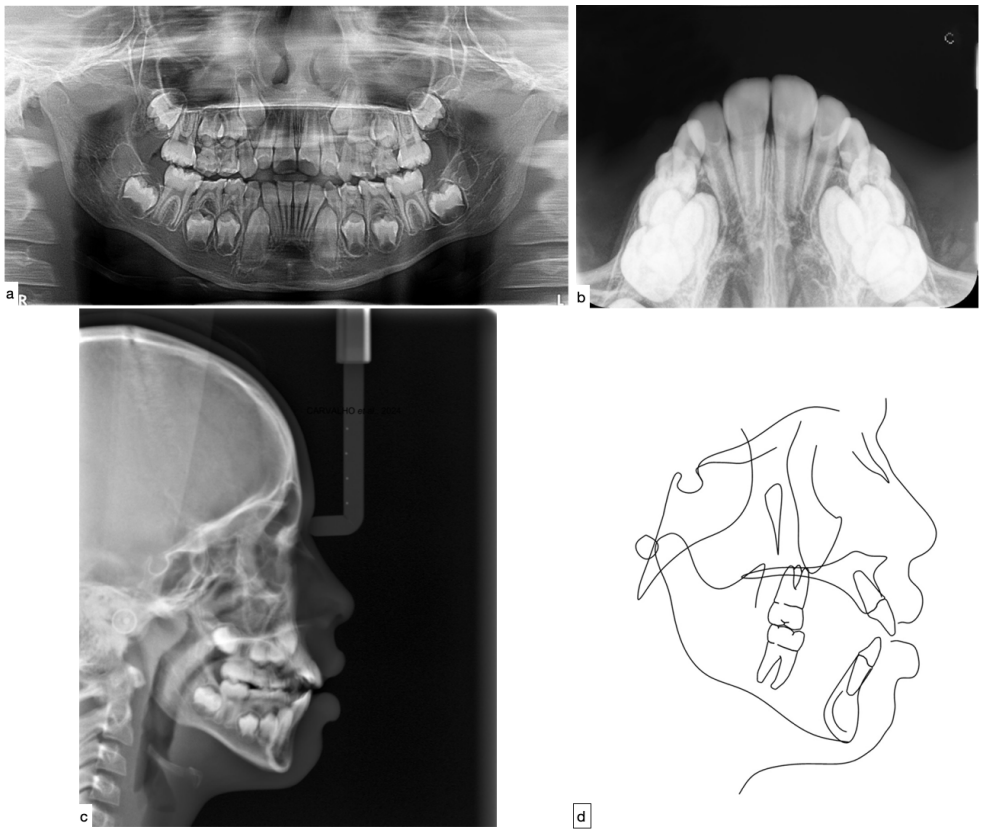

Figure 3: Pretreatment radiographic records: (a) panoramic; (b) maxillary occlusal; (c) lateral cephalometric; and (d) cephalometric schematic diagram.

Table 1: Cephalometric Measurements Pretreatment

Category	Measurement	Norm (Mean ± SD)	Pretreatment
	SNA (°)	82.0 ± 2.0	80°
	SNB (°)	80.0 ± 2.0	74°
	ANB (°)	2.0 ± 2.0	6°
Skeletal pattern	SND (°)	80.0 ± 3.0	71°
	SN-GoGn (°)	32.0 ± 5.0	44°
	FMA (°)	25.0 ± 4.5	37°
	NAPog (°)	0.0 ± 5.0	11°
	1-NA (°)	22.0 ± 5.0	23°
Dental pattern	1-NB (°)	25.0 ± 5.0	29°
	Interincisal angle (°)	130.0 ± 6.0	121°

Note. Values are presented as mean ± standard deviation (SD).

Figure 4: Haas-type rapid maxillary expander with crib before activation (a) and after rapid maxillary expansion (RME) (b). The post-expansion occlusal radiograph demonstrates satisfactory opening of the midpalatal suture (c).

Cervical vertebral maturation assessment indicated that the patient was in the prepubertal growth phase (between CS1 and CS2) (Fig 3c).[16] An orthodontist evaluated cephalometric radiographic (Fig. d), in which revealed facial convexity on the lateral cephalogram (NAPog = 11°), a retropositioned mandible (SNB = 74°, SND = 71°), a vertical growth tendency (FMA = 37°, SNGoGn = 44°), skeletal Class II pattern (ANB = 6°), and protruded mandibular incisors (1.1 = 121°; 1.NA = 23°; 1.NB = 29°) (Table 1).

Therapeutic intervention

Clinically, the patient underwent periodic follow-up of the primary teeth affected by hypomineralization under the care of a pediatric dentist. Oral hygiene instructions and dietary counseling were provided, along with reinforcement of the use of fluoridated toothpaste and professional topical fluoride application. The patient did not report dentin hypersensitivity or esthetic discomfort throughout the treatment period; therefore, no additional restorative or rehabilitative procedures were required.

As part of the interceptive orthodontic treatment plan, the patient initially underwent rapid maxillary expansion (RME). A modified Haas-type maxillary expander associated with a palatal crib was installed (Fig 4a), and four quarter-turn activations were performed on the day of placement. The patient's legal guardian was instructed to perform two quarter-turn activations per day for 15 days (Fig 4b). A new maxillary occlusal radiograph was obtained after expansion to confirm effective opening of the midpalatal suture (Fig 4c).

To minimize the collateral effect of clockwise mandibular rotation resulting from the buccolingual tipping of the permanent first molars, as well as to prevent worsening of the negative overbite, a vertical splint/chin cup was used for 10 weeks with a force ranging from 200 to 250 N17, considering the patient's vertical facial growth pattern (Fig 5, Table 1). In the mandibular arch, a Nance lingual arch and a removable active lip bumper were installed to prevent the deleterious habit of lower lip interposition (Fig 6).

Follow-up and outcomes

After 18 months of interceptive

Figure 5: Chin cup with vertical splint used as an adjunctive appliance to minimize the collateral effect of clockwise mandibular rotation induced by rapid maxillary expansion (RME): (a) lateral; and (b) frontal view.

Figure 6: Active lip bumper used to eliminate the lower lip interposition habit and Nance lingual arch used to address the negative discrepancy identified in the mixed dentition analysis. **I**ntraoral photographs: (a) right lateral; (b) frontal; (c) left lateral; (d) mandibular occlusal; (e) frontal rest views.

Figure 7: Post treatment extraoral photographs after 18 months: (a) profile; and (b) smile view.

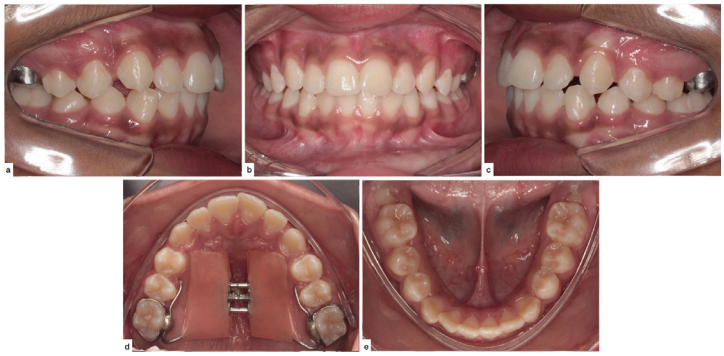

Figure 8: Post treatment intraoral photographs: (a) right lateral; (b) frotal; (c) left lateral; (d) maxillary occlusal; and (e) mandibular occlusal views.**photographs: (a) right lateral; (b) frontal; (c) left lateral; (d) mandibular occlusal; (e) frontal rest views.**

orthodontic treatment, the patient moved to another city with her family and, unfortunately, was unable to undergo the final radiographic examinations that had been requested for follow-up.

The most recent extraoral photographs demonstrated a significant improvement in the facial profile, with reduced convexity and achievement of passive lip seal at rest, as well as a more esthetic and harmonious smile (Fig 7). Intraoral images revealed favorable occlusal outcomes, including satisfactory intercuspation, Class I molar relationship, and adequate overjet and overbite, indicating readiness for the corrective phase of orthodontic treatment (Fig 8).

Discussion

HSPM and MIH are currently understood as conditions with a complex and multifactorial etiology, resulting from the interaction of systemic, genetic, and epigenetic risk factors.[3] In the present case, both perinatal hypoxia and postnatal conditions, such as allergic rhinitis, were present, findings that are consistently associated with MIH in the literature.[7,8,18] In addition, clinical examination of close relatives supported a possible hereditary component (Fig 2), reinforcing previous evidence of familial aggregation of enamel hypomineralization.[10,12,13]

Environmental factors may also contribute to hypomineralization. Prolonged pacifier use was reported in this case, raising concern regarding exposure to bisphenol A (BPA), a compound still permitted in pacifier manufacturing in Brazil and previously associated with MIH.[19] Clinically, lesion color remains a relevant indicator for treatment planning, as darker opacities are associated with lower mineral content and increased fracture risk.[20] In this patient, brownish discoloration combined with Class II malocclusion and maxillary constriction likely contributed to extensive enamel breakdown, highlighting the importance of early orthodontic assessment in severe HSPM cases.

Rapid maxillary expansion (RME) was indicated despite anchorage on permanent teeth due to extensive coronal destruction of the primary molars. Although anchorage on primary teeth is preferable to preserve buccal bone thickness of permanent molars,[21] the clinical condition justified this decision. RME also resulted in spontaneous improvement of the Class II malocclusion, consistent with previous findings in patients with mandibular retrognathism and increased gonial angle.[22] Vertical control was further addressed using a chin cup, following established biomechanical recommendations,[17] contributing to improved facial balance.

Regarding dental management, conservative preventive measures were adopted due to the absence of hypersensitivity or esthetic complaints, in accordance with current MIH management guidelines.[23] HSPM and MIH are qualitative enamel defects caused by disturbances in amelogenesis, clinically presenting as demarcated opacities with altered translucency and colors ranging from white and cream to yellowish and brownish hues, with an asymmetric distribution among affected teeth.[2] Given the increased risk of caries, bonding failure, hypersensitivity, and functional impairment associated with enamel hypomineralization,[3,14,24,25] glass ionomer cement was selected for orthodontic bonding, providing remineralizing and antibacterial benefits.[26]

Despite the lack of final radiographic records due to patient relocation, clinical outcomes demonstrated improvement in

facial profile, occlusion, and elimination of deleterious habits. Overall, this case reinforces the importance of early recognition of hypomineralization severity. When appropriately planned, interceptive orthodontic treatment and coordinated pediatric dentistry-orthodontics management can achieve favorable functional, occlusal, and esthetic outcomes, even in the presence of severe enamel defects.

Conclusion

This case highlights the importance of early and accurate diagnosis of DDEs, combined with family history assessment and timely orthodontic evaluation. Even in the presence of severe HSPM and MIH, individualized biomechanics and coordinated multidisciplinary management between Pediatric Dentistry and Orthodontics allowed successful functional, occlusal, and esthetic outcomes.

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Referrals Are Relationships Made Visible

By Scott J. Manning, MBA,
Founder of Dental Success Today

Referrals are not a marketing gimmick. Referrals are not a punch card or a sign at the front desk. Referrals are not something you "get" by squeezing in one more awkward ask on the way out the door.

Referrals are a relationship outcome.

Every referral is a patient taking the trust they feel with you and handing it to someone they care about. They are saying, "Go here. Trust these people. They will take care of you." They are putting their own name and reputation on the line with a spouse, a child, a friend, a coworker, a neighbor.

Referred patients arrive differently. They walk in with belief already built in. They already heard a story about you. Someone they trust has told them, "This place is different." So from the very first phone call there is momentum, because trust shows up before they do.

This is why referrals are far too important to hope for and far too personal to treat like a transaction. Both truths are real at the same time. We must be personal and we must be intentional. We must build relationships that make referrals natural and we must build habits that make referrals consistent.

So, the first question is not "How do we ask for more referrals?" The first question is "What kind of experience are we delivering that makes patients want to talk about us at all?"

The moment a patient says, "I have never had a dentist like this," that is a referral moment.

The moment a patient says, "That was easier than I expected," that is a referral moment.

The moment you finish treatment and their confidence shifts, that is a referral moment.

Now, you do have to ask. We are not going to avoid it but you can do it correctly.

While you must be deliberate, you cannot be desperate. Asking for referrals should not feel like begging or a sales close. It should feel like what it really is… leadership and service.

The language is simple and confident. "We are grateful you trust us. If you have someone you care about who deserves this kind of experience as well, we would be honored to help them the way we helped you."

We choose the moments where value is fresh. When the patient is relieved. When they are expressing appreciation. When they just experienced something far better than they expected. That is when the feeling is strong enough to ask.

However, don't get confused. Referrals do not come from asking more; referrals come from caring better, from transforming lives, from showing up on purpose.

All of this sits inside one ecosystem. Retention keeps relationships connected. Re-engagement restores momentum when life interrupts it. Referrals expand the mission through people who already believe in you. It is all relationships.

That means referrals are not the job of one person. Referrals are the result of the entire team's culture. Every touch point contributes… The greeting. The handoff. The visit. The outcome. The follow-up. It all matters.

Furthermore, patients are not only watching how we treat them. They are watching how we treat each other. They are deciding quietly, "Would I bring someone I love into this environment?"

Here is the standard: We will be a practice that earns referrals by being the kind of place people are proud to recommend. Deliberate without being odd. Personal without being disorganized. Systematic without being robotic.

We will build relationships strong enough that referrals become inevitable, because patients do not just like us… they trust us.

Now, let's turn this into action for today.

Look at today's schedule as a team. Each person should pick one patient you would be proud to have refer someone they love here. Say their name out loud.

For that patient, answer: What will you do today to make them feel more proud of choosing this practice. Share your answers. Borrow ideas from each other. Then go live it out, chair by chair, phone call by phone call, handoff by handoff.

Lead, serve, and create stories worth repeating. Because referrals are relationships made visible.

Standard of Care Versus State of the Art

by Milton E. Pedrazzi, DDS

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Abstract:

A comparative analysis of orthodontic standard of care versus orthodontic state of the art.

Orthodontically straight teeth compared to orthodontically straight teeth when considering dental function and the TMJ. As the level of orthodontic treatment progresses from standard of care to state of the art, the health of the TMJ and the dental occlusion come into closer focus. Standard of care provides the patient with orthodontically straight teeth that function and a full smile. The state of the art provides the patient with orthodontically straight teeth, a functional dentition that works in a particular way, a full smile, and particular attention to the TMJ's condyle-disc position and its function.

Keywords: TMJ, Sagittal appliance

Conflict of Interest: None

A Treated Case

Note carefully the beginning models of the following orthodontic case, which display insufficient space for upper cuspid eruption and the end-to-end position of the upper incisors. Also, note the adjusted Sagittal appliances used (worn after completing their usefulness) which began the treatment of this Class III case.

In the models of the completed case, note the following:

1. Upper first molar position as it relates to the lower first molar and lower second molar
2. Upper central incisor and lower central incisor midline agreement
3. Upper cuspid position and its overlap between the lower cuspid and lower first bicuspid in centric occlusion
4. Upper second bicuspid position as it relates to the upper first molar
5. Incisors overbite and overjet:

Compare the tooth positions in the finished models to the tooth positions in the beginning models. The beginning models displayed an anterior edge-to-edge bite and lacked space for future upper cuspid eruption. Note the molar and bicuspid positions as well as the anterior overbite and overjet in the finished case. Also note the apparent bony development in the anterior aspect of the maxilla.

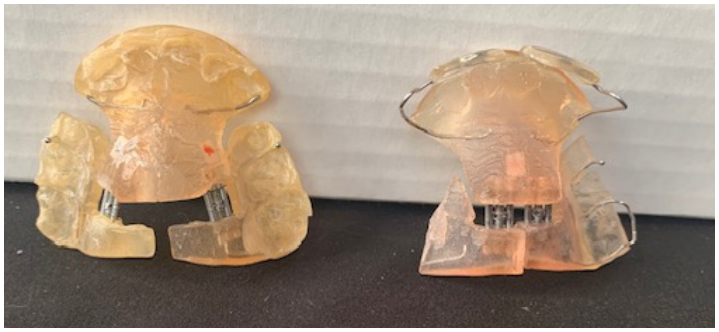


Fig. 1: The Sagittal appliances

Fig. 2: Comparison of starting tooth posistions and finished models.

*This article has been peer reviewed

The Sagittal appliances, shown in Fig. 1, used to begin the treatment of this case to initiate the correction of the anterior edge-to-edge bite are displayed after their final adjustments and their usefulness had been completed. The first Sagittal appliance was used to advance the premaxilla. The second Sagittal appliance with the methyl methacrylate labial lip bumpers was used to further advance the premaxilla as well as to encourage appositional bone growth in the maxilla's frontal aspect. Additionally, the second Sagittal appliance held the lip forward reducing the lip force exerted on the maxilla's anterior region. This design helped to promote bony development of the frontal maxillary area and the premaxilla bringing the anterior teeth along with the gained bony development.

Elements and Criteria of Completed Treatment in Orthodontic State of the Art

Class I Molar and Class I Cuspid, Upper and Lower dental roots properly oriented with adjacent teeth. Teeth upright as identified in a periapical x-ray film or other x-ray imaging technique. Upper and Lower Central Incisor midlines in agreement, orthodontically straight teeth without rotations, marginal ridge heights aligned from tooth to tooth with a pleasing smile.

Shallow, immediate cuspid rise on the dental working side, with no interferences on the balancing side, with immediate posterior and anterior dental disclusion in all lateral movements. Temporomandibular joint functioning normally. Final anterior overbite and overjet measurements as well as the interincisal angle are dependent upon the mandibular growth pattern of the patient. No cuspal or incisal interference as the patient bites into centric occlusion. Solid centric occlusion without cuspal or incisal interference on closure. No posterior cuspal or incisal interferences in mandibular excursive movements.

The next question is how to accomplish these State of the Art criteria?

The Beginning

Orthodontic cases begin by gathering the facts (records) at one point in time in order to develop a diagnosis. The diagnosis then leads to a treatment plan and ultimately to the treatment of the case.

The following facts need to be gathered before a case can be diagnosed.

1. Diagnostic Orthodontic Study Models
2. Diagnostic X-ray films (Panorex, Lateral Head film and Periapical x-ray films)
3. Diagnostic Photographs
4. Patient History
5. Patient and/or Parent consultation

Diagnostic orthodontic study models identify the patient's orthodontic dental classification as Class I, Class II or Class III molar and cuspid relationships.

Tooth size discrepancies, rotations, missing teeth anterior tooth relationships ,as well as the palatal shape and arch form are also revealed by the models.

Diagnostic Panorex x-ray film and Periapical x-ray films identify the number of teeth, their development and their positions plus any bony abnormalities that might be present.

Diagnostic Photographs reveal the patient's profile, full on view and lip position as well as orthodontic dental classification (molar and cuspid relationship). Additionally, the photographs identify facial characteristics and aid in identifying a mouth breathing patient.

Diagnostic Lateral Head Film shows the patient's soft tissue profile, upper and lower jaw relationship, the bony symphysis, several bony landmarks, several soft tissue landmarks, the interincisal angle, the lower border of the mandible and a clue as to a possible airway obstruction and breathing pattern.

Mandibular growth direction is determined by linear and angular measurements taken from the Lateral Head Film.

The initial examination plus the patient/parent consultation reveals the patient's breathing pattern, the facial pattern of the parents and/or patient and provides pertinent medical and dental history.

Interpreting the information gained from the above facts (records) leads to a diagnosis.

After the case has been diagnosed, the next step is to have a consultation with the patient and/or the parents. Patient history is discussed plus observation of the parents facial patterns and characteristics are mentally noted and financial arrangements are made at this appointment. This appointment is followed with a letter to the responsible party explaining the treatment, the appliances to be used, the cost and the financial arrangements agreed upon.

The progression from start to finish of the orthodontic case is as follows:

Orthodontic Records —>Diagnosis—>
Treatment Plan—>Treatment—>Retention

Essential to the diagnosis and treatment planning in a growing patient is the assumption that the patient's past facial growth direction (pattern) is prologue to the patient's future facial growth direction. The treatment plan relies on the assumption that a growing patient's growth direction will continue into the future (until growth is completed) as it has grown in the past. In particular, the growth direction of the face and particularly the mandible is of prime interest in orthodontics. The prediction of the future mandibular growth direction is determined by evaluating elements within the Lateral Head Film.

Knowing the mandibular growth direction (clockwise, counterclockwise, neutral, or a combination thereof) is necessary as it affects orthodontic-orthopedic appliance design, bracket positions (locations) on the upper anterior teeth and lower molar band positions. Knowing the direction of growth of the mandible cannot be overemphasized as it relates to orthodontic treatment.

Of note is that the only record from which mandibular growth direction can be determined is the Lateral Head Film. Tabulated linear and angular measurements from the Lateral Head Film are interpreted to identify the growth direction of the mandible.

The mandibular growth direction is germane to the development of a treatment plan as it influences the type and fabrication of removable and/or fixed orthopedic/orthodontic appliances, if they are needed, and the adjustments made to these appliances during treatment. Once any required orthopedic/orthodontic appliance therapy is completed detailed banding and bracketing can take place.

Knowing the growth direction of the mandible is essential in order to determine the lower molar band positions and the

bracket heights from the incisal edges on the upper anterior teeth. Mandibular growth direction also influences the overbite and overjet position and interincisal angle of the anterior teeth as well as cuspid guidance and function of the posterior teeth in the finished case. It can also be helpful in designing the post-orthodontic retention appliances.

In a patient with a mandibular counterclockwise growth pattern, a deep anterior overbite in the finished case is contraindicated. Close attention must also be paid to the finished interincisal angle as the incisor teeth must not interfere with the freedom of mandibular movements. Interference with mandibular movements in the completed case may drive the condyle posteriorly in the glenoid fossa inviting clinical TMJ pathology during treatment or in the future.

Several measurements from the Lateral Head Film are necessary in order to make a determination of the growth direction of the mandible. One measurement is insufficient to produce a reliable diagnosis. A preponderance of evidence(facts) must be gathered from the Lateral Head Film and interpreted before arriving at a diagnosis for the case. Linear and angular measurements from the Lateral Head Film are tabulated and interpreted to arrive at a diagnosis before designing a treatment plan and embarking upon treatment. In diagnosis, it is the parts that compose the whole. A treatment plan cannot be crafted (designed) until the facts influencing growth direction are known.

The Finish

Orthodontic cases that present a neutral mandibular growth pattern finish with a 1.75 to 2 mm anterior overbite and a 2 mm anterior overjet. Cases with a strong mandibular clockwise growth pattern finish with a 2.0 mm overbite and 2 mm overjet. Cases with a strong counterclockwise growth pattern finish with a 1.5 mm overbite and 2 mm overjet These finished measurements along with the interincisal angle (not over 130° in the counterclockwise case) of the case should be considered in the original treatment plan before beginning treatment as it influences anterior bracket placement and lower molar band placement, which helps to determine the dental function in the completed case. The rationale for finishing the overbite/overjet and interincisal angle in the anterior segment as indicated is to account for post-treatment settling which will occur. At the same time, attention to these finishing conditions help protect the TMJ condyle-disc relationship.

The final occlusion should exhibit the following elements. The posterior teeth are finished with a solid centric bite. The anterior teeth are finished with positive but light occlusion with the proper interincisal angle. The cuspid rise is immediate and shallow (not deep). There are no posterior cuspal nor anterior incisal interferences in mandibular closure or in lateral movements.

It is well understood that orthodontic cases will settle after the bands and brackets have been removed. In strong mandibular counterclockwise growth patients, the anterior overbite will tend to deepen with time. In strong mandibular clockwise growth patients the anterior overbite will not deepen with time. In neutral mandibular growth pattern patients, the anterior overbite and overjet will remain fairly constant and may deepen slightly as time progresses.

Anterior teeth settling post orthodontic treatment is largely dependent upon the patient's muscles of closure. These same muscles, mainly the masseter and temporalis, their strength and angle of origin and insertion determine the force and power of a patient's bite. The force and power of a patient's bite along with the influence of the buccinator muscles as they compress the cheeks against the teeth strongly affects post-orthodontic dental settling.

Retentive device design must take these muscular forces into consideration. Form follows function therefore form and function considerations while fabricating the retentive device for the completed case is important.

Dental post treatment settling becomes important when considering its long term effect on the TMJ. Attention to the details of anterior overbite, overjet, centric occlusion, interincisal angle, along with a shallow cuspid rise and immediate posterior teeth disclusion in lateral mandibular movements in the completed case reduces the likelihood of a patient developing clinical TMJ pathology in the future.

Once the diagnosis has been made and future concerns are noted, a treatment plan is developed. The treatment plan must be developed in order to complete the case from start to finish in an efficient manner while at the same time considering the function of the TMJ. Using light forces and managing the direction and duration of those forces will help to move teeth efficiently and help to protect the TMJ from developing clinical pathology during or post orthodontic treatment.

Order of Treatment

Treating orthodontic malocclusions should follow a certain order from beginning treatment to the end of treatment to finish the case in a timely manner without round tripping.

Treatment Sequence:

1. Crossbite correction
2. Tongue and Swallowing Habit correction
3. Molar and Cuspid correction to Class I and begin midline correction
4. Level and align teeth
5. Refine Class I Molar and Class I Cuspid and midline correction
6. Refine Cuspid rise and posterior teeth disclusion in function
7. Cuspid rise should be immediate in excursive movement yet shallow (not deep) to guard against distalization of the condyle in the glenoid fossa.
8. Retention

State-of-the-Art orthodontics ends its treatment with a positive centric bite without cuspal or incisal interferences during closure. In lateral movements, there is immediate lift off of the anterior and posterior dentition using a shallow cuspid rise on the dentition's working side. The finished case must provide smooth dental excursive movements without cuspal interference. It must coordinate the finished dental occlusion with condyle-disc movements as the joint and dentition work harmoniously. Emphasis must be placed on a solid centric occlusion on closure along with a shallow yet immediate cuspid rise in excursive movements. This dental arrangement results in no cuspal interference on closure and immediate posterior and anterior dental disclusion during working movements in the finished case.

A shallow but immediate cuspid rise as the dentition functions in working lateral movement quickly discluding the anterior and posterior teeth is important to protect the condyle-disc

relationship as it moves along or in close proximity to the posterior slope of the temporal bone. This functional arrangement reduces the chance of developing TMJ pathology during orthodontic treatment or long after orthodontic treatment has been completed.

The biconcave cartilaginous disc is attached only weakly by ligaments to the mandibular condyle. Additionally, the disc is slippery. The condyle-disc relationship must be protected as much as possible. Keeping the condyle-disc arrangement intact helps keep the condyle from moving too far posteriorly in the glenoid fossa and the disc from sliding mesially and sagittally beyond the tubercle located at the inferior aspect of the temporal bone's posterior slope. Posterior displacement of the condyle plus anterior and sagittal displacement of the disc is oftentimes the cause of TMJ related clinical pain.

Anatomically speaking the posterior slope of the temporal bone is at a different angle in different people and the angle may even differ from the right to the left side on a single patient. Orthodontic treatment and the final dental occlusion is designed to accommodate as much as possible to the function of the condyle-disc movements.

In order to allow for the different angular slopes encountered in different patients without knowing the slope angle, the steepness of the cuspid rise must be considered in the dental working occlusion. A shallow but immediate cuspid rise in working dental lateral movement allows for most if not all different angles of that slope. It is therefore best to have a shallow cuspid rise with immediate lift off of the anterior and posterior teeth in working dental function in the finished orthodontic case.

A shallow cuspid rise will interfere with the condyle and disc relationship less than will a deep cuspid rise. A deep cuspid rise tends to move the condyle distally as the dentition functions, which may lead to clinical TMJ symptoms. If the condyle is driven distally and the disc moves mesially and sagittally, it is not uncommon for the patient to have pain. Pain from this derangement in the TMJ is often felt in the muscles of the face, head or neck region. Muscles exhibit the pain but are not the genesis of it.

Since the angle of the posterior slope of the temporal bone is not known, yet that slope must be considered in regard to TMJ function, the following question arises.

Joint Dentition Relationship

How to finalize the orthodontic dental occlusal scheme, so it functions physiologically with the condyle-disc, as it goes through its many movements?

The answer lies in the function of the dentition. The final occlusion must have a solid centric occlusion with no cuspal or incisal interferences on closure.

Cuspid guidance on the working side of the dentition must be shallow but immediate as it lifts all the posterior teeth out of centric occlusion.

In order to provide mandibular movements which allow TMJ proper function in a finished occlusion, a shallow dental cuspid rise, which immediately discludes the posterior teeth, is necessary. A shallow but immediate cuspid rise allows the function of the dentition while maintaining the ability of the condyle-disc complex to remain in contact with (or as near as possible) to the posterior slope of the temporal bone as that slope acts as a possible guide and anterior limit for many movements of the condyle and disc.

Orthodontic treatment should be designed to treat to a normal condyle-disc relationship as it moves along or near the posterior slope anatomical limit of the temporal bone and midmost in the glenoid fossa when the case is in its final dental centric occlusion. Additionally, there should be no dental cuspal or dental incisal interferences as the bite closes to acquire its solid centric occlusal position.

A deep and long cuspid rise risks driving the condyle distally and may result in clinical TMJ pathology during treatment or in the future as the condyle is driven posteriorly in the glenoid fossa. If the condyle is driven posteriorly in the fossa, the disc may be separated from the condyle resulting in the disc being displaced mesially and sagittally anterior to the confines of the glenoid fossa. This displacement of the condyle and disc may result in muscular pain in the facial, neck, or temporal areas.

In addition to pain, signs or symptoms of clinical TMJ pathology are frequently expressed as popping or clicking emanating from the temporomandibular joint area. Palpating the joint area for pain or discomfort is useful in diagnosing TMJ dysfunction. In TMJ dysfunction when the disc is first dislocated from the condyle usually no sound is heard. When the disc recaptures its position back onto the condyle is when the pop or click is noticeable by noise and/or palpation.

Considering the function of the TMJ in the treatment plan and producing precautions in the final occlusion by providing the patient a solid centric bite without dental interferences on closure or in lateral movements is important and reduces the chance of patients developing clinical TMJ pathology in the future as well as providing the patient an efficient and comfortable chewing dentition.

State-of-the-art orthodontic treatment must consider the dynamic dental occlusion as well as the static dental occlusion in the finished case. Correct occlusion and disclusion in orthodontically finished cases may help to prevent TMJ pathology in the future as patients age and become less supple.

Patients who present with existing clinical TMJ pathology on their first visit are best first treated with conservative therapy for that pathology. Orthodontic treatment should be delayed until the clinical TMJ pathology has been remedied. Since the clinical pain of TMJ pathology is displayed in the musculature, the musculature must be addressed prior to beginning orthodontic treatment in these patients. This treatment is best done by building a clutch (hard splint) for the upper arch and meticulously adjusting it until the patient is pain free with a repetitive centric mandibular closure position. This process of attaining a musculature with a repetitive centric closure position may take several office visits. This line of treatment works well and can eliminate a patient's TMJ pain and most or all joint noise.

Orthodontic treatment for the TMJ patient then begins and ends by holding the gained repetitive muscular closure centric position during the entire orthodontic treatment process.

Retention

Just prior to debracketing the case, an appointment is made with the parents (if the patient is a minor) and the patient to explain retention and its purpose. Straightening the teeth orthodontically is for the short and long term benefit of the patient. Therefore, the retention appliance and its purpose must

be explained to both the parents and the patient.

Many cases begin with some lower anterior teeth crowding. This crowding oftentimes is displayed in a counterclockwise or neutral mandibular growth patient and therefore retention is most important in these cases as the lower anterior teeth will tend to move post active orthodontic treatment. In these cases. retention must be made with this future movement possibility in mind. An excellent method for retention in these patients is an upper removable Hawley appliance. The lower retention appliance is best accomplished with a well-fitting lower 19x25 fixed wire (a well adapted braided wire works well) that extends from the lower first bicuspid mesial pit on the patient's right side to the lower first bicuspid mesial pit on the patient's left side. Additionally, a well fitting .030 fixed stainless steel wire from the labial of lower right cuspid to lower left cuspid is beneficial. This lower cuspid to cuspid labial wire is removed after 6 months of wear. This configuration on the lower arch reduces the amount of post-orthodontic crowding that may creep into the case as time progresses. For added lower anterior stability in the future after the lower labial wire is removed, a pull down clear retainer can be made for the patient to wear at night time. Explanation of the reason for the cuspid to cuspid labial wire and its removal to the patient and/or parents will help gain patient acceptance of the labial wire placement.

In the mandibular clockwise growing patient the upper anterior teeth must be held in place by a well fitting Hawley appliance. The lower retention in these cases oftentimes does not require a labial wire from cuspid to cuspid on the lower arch. The lingual retention on the lower arch with an additional pull down clear retainer for nighttime wear is still necessary.

The upper Hawley appliance may need a slight adjustment from time to time. Be aware that adjustments to the upper Hawley wire are critical and usually slight. Since the labial wire on the Hawley is continuous, an adjustment on one side may (will) affect the wire position on the opposite side.

Conclusion

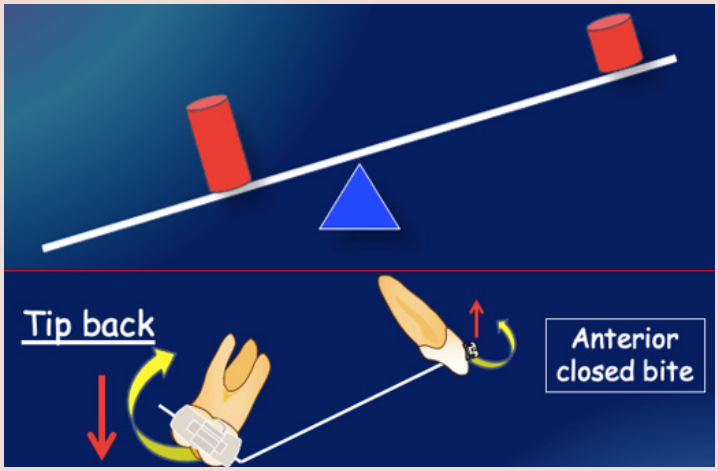
In conclusion, orthodontics must move beyond the static occlusion demonstrated by currently acceptable final orthodontic models and photos. The function of the dentition and the condyle-disc relationship must also be considered in the final result. A thorough diagnosis, plus a detailed treatment plan, sequentially and meticulously carried out results in the original goal of unobstructed centric occlusion, a shallow cuspid rise, freedom in dental excursive movements and a clinically sound TMJ.

Mulligan Mechanics III: Mulligan Intrusion Arch

By Dr. Adrian J. Palencar, MUDr, MAGD, IBO, FADI, FPFA, FICD

The Mulligan Intrusion arch is a two-couple intrusion arch wire used for control of anterior deep overbite. It is commonly made with round wire (a .020 or a .018 SS), attached to the teeth only at the molars and the incisors and is activated for incisor intrusion by a molar tip-back (off-center, gable) bend. Dr. Mulligan used a .020 ss arch wire; however, the author prefers a .018 SS arch wire – as there is less friction and biding.

The Intrusion arch is activated by one squeeze of the Tweed loop forming pliers – "V" pointing occlusally, just in front of the molar tubes. This one squeeze creates approximately 45° tip back (off-center bend). If less is desired, squeeze less. In author's opinion, it is paramount to apply these bends extra-orally.



Analyzing the result of the tip-back, there is a long arm mesially – pointing in the direction of the force (intrusion of incisors) and creating labial moment (flaring of incisors). Distally of the tip-back, there is a short arm distally pointing opposite of the direction of the force (extrusion of the molars) and creating distal moment (distal tipping of the molars).

Remember, the long arm points in the direction of the force. The short arm points opposite to the direction of the force.

Is not there an analogy between the teeter-totter and the intrusion arch?

The Mulligan intrusion arch renders the dental arch longer, improves the mild dental Class II by tipping the molars distally. If the extrusion of molars is undesirable, place a TP arch in the maxilla and Lingual arch in the mandible.

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Accelerated Orthodontics: Can We Move Teeth Faster in Adults?

by Monika Tyszkowski, DDS, MSc

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Abstract

This review compares two minimally invasive approaches for accelerating orthodontic tooth movement in adults — micro-osteoperforations (MOPs) and platelet concentrates (PRP/PRF) — with emphasis on the rate of canine retraction/tooth movement, patient-reported comfort and pain, and treatment-related adverse effects.

Overall, MOPs demonstrated greater acceleration, whereas PRP/PRF was generally associated with less pain and discomfort. Protocols and outcome measures varied across studies, limiting direct comparison and highlighting the need for additional head-to-head trials.

Keywords: accelerated tooth movement, micro-osteoperforation, PRP/PRF in orthodontics, pain perception in OMT, side effects in OMT

Conflict of Interest: None

Introduction

One of orthodontics' last frontiers is accelerating tooth movement — particularly in adults, where bone remodeling is slower due to a reduced osteoblastic response.

The reviewed studies focus on inducing or modulating the regional acceleratory phenomenon (RAP), a response to bone or soft-tissue injury first described by Harold Frost in 1983 (Feizbakhsh et al 2018). RAP is associated with transient osteopenia and increased bone remodeling for approximately four months (Joy et al 2021). (Figure 1.)

The first method was MOP (micro-osteoperforation), being a more mechanical (surgical) approach where inflammatory mediators are being released in response to mechanical insult.

The second was PRF / PRP rich Plasma or fibrinogen (the only difference is the use of the preservative like citric acid dextrose) being a more biological option where inflammatory mediators are added to the extraction site from a person's own blood.

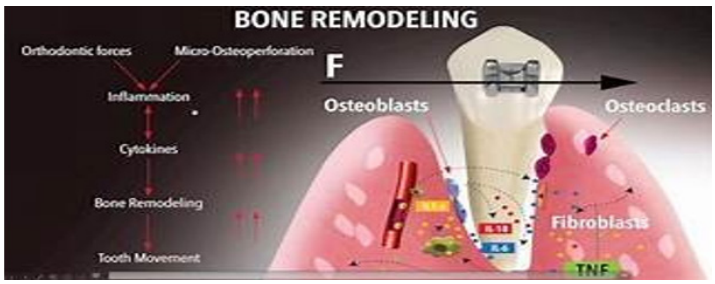

Fig. 1: Bone remodeling diagram in OTM

MOPs

Micro-osteoperforation is based on mechanical trauma to the bone done through mucosa, which signals beginning of series of biological processes including the secretion of the inflammatory factors like cytokines and growth factors to stimulate the activity of the osteoclasts (Alikhani et al 2013). Perforations were done with an instrument called Propel Excellerator driver (see Figure 2) or TAD in a specific pattern: average of 3 punctures 3-4 mm deep in the cancellous bone distal to the maxillary canine or between the molars or premolars for distalization (Gulduren et al 2020) or between the roots in incisors for unraveling (Sharin et al 2021). (See Figures 3 and 4.) MOPs were administered after complete healing of the site was achieved to avoid active RAP phenomenon. The number of MOPs in the experiments varied from 3-14. Movement speed was measured on superimposed 3D models using motion calculation software or on the plaster models with calipers (Figure 5).

Fig. 2: Typical MOPs locations – live patient

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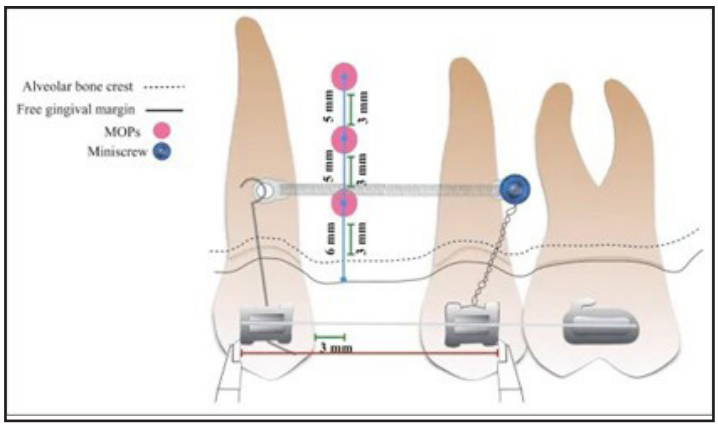

Fig. 3: Typical administration diagram for MOPs with height guidance

Fig. 4: Excellerator Propel instrument

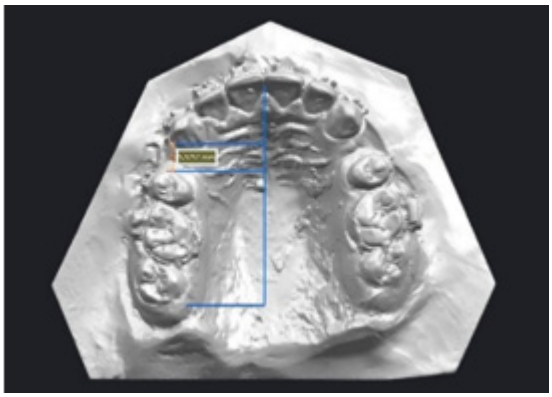

Fig. 5: On the plaster model measurement points for OTM

PRP/PRF

Platelet-rich plasma (PRP) and platelet-rich fibrin (PRF) are centrifuged blood fractions containing growth factors such as platelet-derived growth factor (PDGF), transforming growth factor-β (TGF-β), and vascular endothelial growth factor (VEGF), which may promote bone remodeling and healing (Ahmad et al 2019). PRP/PRF may induce the regional acceleratory phenomenon (RAP) through transmucosal injections and the local fibrin matrix, thereby accelerating bone remodeling (Zeitounian et al 2021; Abrar et al 2022). A single injection has been reported to persist for several months, with the greatest clinical acceleration observed during the second and fourth months (Liou et al 2016).

PRP/PRF was administered via submucosal and intraligamentary injections; alternatively, a membrane/plug was placed directly into the extraction site (Tehranchi et al 2018; Pacheco et al 2020).

The number of injections varied between 1–3 per side, and the volume ranged from 0.3–5 mL. Most studies initiated injections immediately after extraction. Each study used its own method for measuring tooth movement (Figures 6 and 7).

Fig. 6: Palatal location for PRP/PRF injection

Fig. 7: Typical buccal location for PRP/PRF injection

Materials And Methods:

To address the question of how to expedite orthodontic tooth movement in adults, we reviewed 21 peer-reviewed English-language clinical studies published between 2015 and 2022 that investigated either MOPs or PRP/PRF.

Included studies were randomized split-mouth trials or parallel two-arm studies in adult patients. Animal studies and case reports were excluded. Outcomes extracted for comparison included the rate of tooth movement, patient comfort/pain, reported adverse effects, and overall clinical effectiveness.

The following tables summarize key protocol differences and clinical outcomes across the included studies.

Summary of the Findings

What was the effectiveness of the newest accelerating methods when compared to each other?

The only clinical study comparing MOPs with PRP/ PRF was done by Abrar et al 2022.

This trial proved PRP/PRF method was the most efficient in the first 4 weeks of treatment when inflammatory markers were high. The opposite was true with MOP technique where acceleration occurred between baseline and 8 weeks, and inflammatory markers remained elevated throughout tooth movement. Repeated PRP /PFR injections would maintain RAP momentum for a longer period of time.

MOPs being a surgical procedure caused trauma stimulating the bone to be remodeled by creating transient osteopenia. The best results were achieved by using multiple MOPs less often, every 12 weeks. Using too many MOPs slowed the process of bone conversion.

PRP/PRF was more of the biological approach when the inflammatory markers and the stem cells derived from a patient's blood caused leverage of all pro-inflammatory markers in the injection site and in the gingival crevicular fluid (GCF). Adding a L-PRF membrane/ plug into an extraction site caused delayed tooth movement process due to an increased healing, regeneration and reducing of the inflammation.

The overall speed of the tooth movement was 2.3-fold faster with MOP than 1.7- fold with the PRP/PRF technique. The RAP effect lasted even longer in MOPs. Pain was slightly higher in the MOPs group than in the PRP/PRF group. Slightly more side effects including root resorption were seen in the MOPs group.

The MOPs procedures were easier for practitioners and patients, requiring only a simple instrument like the Propel and no referral to an oral surgeon. The surgery was performed in practice without a flap. PRP/PRF required drawing blood from a patient's vein with a needle, additional equipment such as a centrifuge to separate platelets from whole blood .and multiple injections into the patient's mouth.

Limitations

One major limitation is that to date only one study has been performed comparing the MOPs method to the PRF/PRP.
All studies included were performed in younger population (ages range 18-45) in

Table 1: Study Characteristics – Main Differences

MOPs	PRF/PRP
• 3 MOPs 3-4mm in cancellous bone • Punctures without creating a flap • Extraction site completely healed	• 1-3 injections per side 0.5-5 ml volume • Injection through the mucosa • Time of the injections right after the extraction

Table 2: Which Method Moved Teeth Faster – Summary

MOPs	PRP/PRF
• Statistically significant acceleration 2.3-fold • P<0.05 • Best results with longer intervals • Faster movement in the maxilla by 0.94 mm • Most efficient after 8 weeks	• Statistically significant acceleration 1.7fold • P<0.05 • Dependent on amount and concentration of platelets • Best results with repeated injections • Plug/membrane slows down the movement • Movement range 0.68-1.90mm • Most efficient in first 4 weeks

Table 3: Examples of Side Effects

	MOPs		PRP/PRF	
	CG	EG	CG	EG
Root resorption	0.71mm	0.67mm	None reported	
Anchorage loss	0.39mm Alkebsi et al 2018 0.66 mm Kundi et al 2020	0.35mm 0.48 mm	0.25° 1.41 mm Zeitoulonian et al 2020	0.06 ° TAD 1.64 mm TPA
Canine tipping	0.01m Alkebsi et al 2018	0.001mm	8.5° Pacheco et al 2020 15.46° El-Timamy et al 2020	5.8° 14.45°

Table 4: Comfort levels and pain related to the methods summary

MOPs	PRP/PRF
Minimal discomfort the day of the procedure 1-3 VAS scale average 15 % severe pain	Minimal pain the day of the procedure both groups 0.15-1.6 VAS scale average 15 % severe pain

Table 5: Other Research Findings Summary

	MOPs	PRP/PRF
Level of inflammatory markers in GCF (gingival crevicular fluid)	Elevated β -1 IL CG EG 0.25 0.80 pg/µL Alikhani et al 2013 P<0.05	Elevated inflammatory markers: B-1 IL MMP-8 RANKL Decreased OPG Erdur et al 2021 P< 0.001
Gingival and plaque index	CG EG 1.38 1.44 Alkebsi et al 2018 P=0.81	Not measured in the selected studies

the MOPs and PRP/PRF groups. The duration of observation ranged from 28 days to 6 months in MOP group and 4 weeks to 18 months in PRP/PRF group. All studies were performed for a specific type of malocclusion (Class II with extraction of first premolar).
Longer follow-up periods and broader population diversification with different treatment scenarios are needed to make results more general. Further studies on human population are needed, particularly on the use of PRP/PRF in OMT.

Conclusions

Both procedures have the potential to significantly accelerate orthodontic treatment clinically and make the overall patient and practitioner experience more efficient. The MOPs procedure is somewhat simpler and faster than PRP/PRF but according to current knowledge it is also slightly more painful.

Further studies on both methods, especially on PRP/PRF, are needed to explore the potential possibilities for facilitating tooth movement and other possible benefits.

List of Abbreviations:

MOP micro-osteoperforation
PRP platelet rich plasma
PRP platelet rich fibrin
OMT orthodontic tooth movement
CG control group
EC experimental group
RAP regional acceleratory phenomenon
GFC gingival crevicular fluid
TAD temporary anchorage device
VAS visual analogue scale

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