The Endless Enigma of Extractions and Expansions

The most divisive and persistent argument throughout the history of orthodontics has been whether to extract teeth.1,2 For patients that present with some degree of crowding or protrusion, the question is not whether to extract, but when and which teeth (even if only third molars). The instability of expansive treatments to avoid extraction has been repeatedly examined and reaffirmed,3,4 yet we continue to (re-)introduce “new” ways of squeezing all teeth into dental arches, encroaching upon the enveloping muscular and periodontal equilibrium and “filling” the face and smiles with teeth to o’erflowing. All this kvetching – in the hopes of avoiding the extraction of premolars – often ensures the removal of third molars and the utilization of “permanent” retention, permanently. So, what’s this Pecksniffian exchange actually worth?

The contemporary meme of expanding younger patients (with jackscrew appliances)5 or older ones (with “slippery” braces and wider wires)6 is not an insurance policy for better stability, function or aesthetics (e.g., smiles, buccal corridors or profiles). We seem easily enticed to buy into concepts featuring braces that are said to have unique profiles). We seem easily enticed to buy into concepts featuring “truly lighter forces”7 and wide-body arch wires, or ancient appliances resurrected with arcane claims of bone development8 (e.g., bony “adaptation” or “tissue engineering” expanders); all with the promise of better treatment results through the avoidance of extraction.9,10 The hype is usually novel, but the patient’s intrinsic biology hasn’t changed.11

The Extraction Decision

Appropriately applied extraction treatment does not produce routine adverse effects on profiles (lack of “fullness”) or smiles (narrow dental arches with dark buccal corridors).12,22 But what typically determines our decision to extract? When diagnosis is carried out by typical evaluation of patients’ photographs, radiographs and model analysis, it appears from statistical analysis that an orthodontist’s decision to extract has been primarily based on the following factors: 1) how “flared” are the upper incisors? (e.g., upper incisor to S-N a angle); 2) how “flared” are the lower incisors? (e.g., lower incisor to S-N b angle); 3) upper arch length discrepancy; 4) lower arch length discrepancy; 5) how “scrambled” are the lower incisors? (e.g., Irregularity Index); and 6) protrusiveness of the profile (e.g., “full” E-plane or Z-angle).23 There seems little mystery inherent to these factors influencing this “life-and-death” decision for teeth. Yet, there are modernists who believe that defending the extraction strategy is nothing more than oikophobic exercises from hoary academia and exodontia fanatics.

Full-face or Bald-face Orthodontics?

Some within our specialty profess there is a tacit understanding that “expansion” of some contrivance is required to correct nearly any angle classification of malocclusion. Some would have patients believe that the avoidance of extraction (nee, expansion) is the only treatment that will produce the preferred “full faces” and Hollywood smiles.6,13 Yet, if we take a moment to evaluate the desired “look” within the faces of those who populate the runways and red carpets, we find that they might occasionally reveal “full lips,” but they also manifest “flatter” profiles – without any contribution from extraction orthodontics (e.g., Angelina Jolie, Brad Pitt, Paris Hilton, Gisele Bündchen, Milla Jovovich, Katie Holmes, Jennifer Garner, Nick Lachey, Jessica Simpson, Salma Hayak, Prince William, Halle Berry, Anna Nicole Smith, Charlene Theron, Hilary Duff, Jackie Kennedy O’Nassis, Sarah Palin, Bollywood’s Aishwarya Rai (Miss World 1994), Princess Grace, Drew Barrymore and George Clooney).

Bimaxillary protrusions certainly seem to travel in the minority within the circles stalked by paparazzi (Hilary Swank, Rosanna Arquette, Chelsea Clinton, Olivia and Maryam d’Abo, Jason Biggs, Bill Clinton’s paramour Paula Jones). In fact, those with the most popular “wide, Hollywood” smiles (Cameron Diaz, Brad Pitt, Angelina Jolie, Farrah Fawcett, Michelle Pfeiffer, Prince William, Justin Timberlake, Ellen Degeneres, CNN anchorwoman Robin Meade, Gossip Girl’s Leighton Meester, Rachel McAdams, Mary Tyler Moore, President Barack Obama, Azra Akin (Miss World 2002), George Clooney, and above all, Julia Roberts) also display the largest “negative spaces.”13 It would then seem all the more questionable to promote non-extraction treatments, especially unstable expansive ones,2,3,4,21 with the intent of preventing “dark corridors.” This holds especially true when smile aesthetics for extraction and non-extraction treatments have been clearly shown to be equivalent2,13,17,22 and also when the common folk (the “end-users” of
orthodontic services) are not particularly discerning or afraid of the “dark.”

Challenges to orthodontic treatment approaches have left the arena of scientific discourse and landed squarely in the court of opinion. In other words, those who boast the loudest or are engendered with the most financial backing appear to prevail. The fact of the matter is that data and dollars are often at odds in our profession, especially since the range of treatment alternatives apparently offer no health-altering consequences. Besides, a few folks have apparently either benefitted from extractions or were at least not crippled by that dental decision: actors Meryl Streep, Richard Chamberlin, Catherine Zeta-Jones, Renée Zellweger, Jada Pinkett Smith, Heather Locklear, Shia LaBeouf, M eg Ryan, Kristin Davis, Angela Little, Chris Rock, Miss. U.K. Globe Hannah M C Cuág, Miss. Teen USA 2005 Chelsea Cooley, Miss. America 2002 Kate H Arman, Miss. Universe 2004 Jennifer Hawkins, TV personality Kelly Ripa, CNN reporter Richelle Carey, Meredith Vieira, John Edward's mistress Ralie H unter, quarterback Brett Favre, Olympic runner Sanya Richards, M etalica drummer Lars Ulrich, Guns ‘n Roses drummer Steven Adler, comedian Rita Rudner, French pop singer Julie Zenatti, Australian pop singer Kylie Minogue, a trio of 90210 TV stars: Shenae Grimes, Jessica Stroup and Jessica Lowndes, along with supermodels H édi Klum and Molly Sims... just to name a few. As might be assumed, it is an exceedingly difficult exercise to find photographs of celebs with wide-enough smiles and sharp-enough resolution to “count teeth.” It is also, perhaps, just simply ludicrous at this point to serve-up celeb anecdotes as proof in any scientific discourse.

Mini-screws Enter the Fray

Orthodontists have contemplated concerns for predictable anchorage control for more than a century. The recent introduction of skeletal anchorage, specifically with mini-screws, has provided relatively simple methods for creating innovative biomechanical constructs and, consequently, more predictable orthodontic results. Mini-screws are applicable when designing treatment solutions for a wide range of orthodontic malocclusions. The point of the present discussion is to determine if the advent of mini-screws offers any attributes that might, in fact, alter the extraction decision. Please note the caveat that “extraction” is not a diagnosis, but rather, merely a part of a specific treatment plan.

Maximum Retraction

Patients exhibiting severe crowding or protrusion would appear to be the most obvious beneficiaries for TAD-supported differential forces (in either or both arches) to improve the predictability of biomechanics (Figs. 1 & 2). These types of treatment plans most often require absolute anchorage and maximum retraction to resolve patients’ chief complaints. Occasionally, crowding is resolved with traditional orthodontic mechanics, but

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anchorage might be lost prior to any significant reduction in protrusion. For example, consider a half-step Class II, crowded patient (treated with extractions) where the dental discrepancy is resolved, but the upper molars remain uncorrected or inadvertently migrate into full-step Class II before overjet is even addressed. All manner of anchorage support has been attempted in these scenarios (e.g., headgear, tip back bends, “setting” anchorage, lingual and palatal arches, Nance holding arches, etc.), but suffer inclusively from limited predictability.

In contrast, molar positions can be maintained (or enhanced) by direct or indirect support from mini-screws (Figs. 2). In this manner, dental anchorage might not be stressed and maximum anterior retraction or complete utilization of extraction space for the resolution of severe crowding or protrusion is achievable.\(^\text{27-30}\) As an added benefit, the vertical dimension can be simultaneously controlled by “multi-tasking” with the same mini-screws.\(^\text{27,29}\)

**Maintaining Incisor/Lip Position**

Sometimes substantial space is required to resolve dental crowding, but no change in incisor angulation or anteroposterior position of the anterior teeth is desired. This situation has been historically problematic as a non-extraction approach could yield “flaring” of the incisors, unstable inter-canine expansion, and possibly untoward lip incompetence. As a more predictable alternative, mini-screws can provide anchorage to retract teeth “just enough” to eliminate the arch-length discrepancy.\(^\text{27,30-35}\) In extraction scenarios, screws can support subsequent protraction of the posterior teeth to close any residual spaces that remain after the resolution of crowding without disturbing lip support.\(^\text{27}\)

Unfortunately, many extraction detractors have conveniently forgotten that orthodontists can move teeth in both directions, especially with mini-screw anchorage (Figs. 3). Mini-screws can also be quite useful in situations where there are already missing teeth (e.g., mutilation or congenital absence) to assist with more predictable closure or opening of edentulous spaces.\(^\text{36}\) For instance, direct anchorage from mini-screws can facilitate molar protraction to close space where there was agenesis of a premolar.\(^\text{27}\) Elaborate mechanisms have been devised to avoid the unintended lingual movement of anterior teeth and associated adverse increase in overjet. Using mini-screws for direct or indirect anchorage support can effectively preclude those attendant side effects, while also enabling simplified and efficient biomechanics (Figs. 4).
When spaces are to be opened for the prosthetic replacement of congenitally missing maxillary lateral incisors, there has occasionally been an associated mesial drift of posterior teeth into a partial Class II relationship. Therefore, simply attempting to push "open" sufficient space for an implant might produce an increased overjet. Distal en masse retraction with mini-screws helps to control the space-opening procedure, reduce undesired incisor flaring, preclude extraction of premolar(s), and might also direct movement of posterior teeth into Class I (Figs. 5).27

Extract which Teeth?

Can the advent of TAD-based mechanics make a difference in the actual choice of specific teeth for extraction? Occasionally, compromises are required when teeth are selected for extraction. For instance, viable, "virgin" first premolars have often been sacrificed in deference to "root canaled/cored/crowned" second premolars, especially in situations requiring maximum anchorage like those with severe arch length constraints. In addition, "bombed-out" first molars have been maintained while freshly erupted premolars were removed (Figs. 6). Also, second premolars have been occasionally extracted with the intent to limit anterior retraction (the average effect is said to be about 1mm less incisor retraction than that produced by first premolar extraction)19,20 or to facilitate protraction of molars. Although the lip response to retraction in any extraction strategy is not especially predictable,21,37 all of these decisions might need to be re-thought in a world with mini-screw anchorage and efficiently applied directional forces.27,28

There should be no fear to extract premolars if properly designed biomechanics are employed. If, however, retraction
mechanics are initiated with no real objective or goal in mind, the consequences of efficient TAD-based mechanics might produce unintended results. It would seem that the use of the visual treatment object (VTO) or something similar should enjoy a renaissance in the age of the mini-screw as predictions of tooth movement might now be reasonably accurate. The bottom line: The advent of mini-screw anchorage should finally eliminate the age-old (real or conjured) concerns of adverse facial changes from extraction, as spaces can be closed predictably, while maintaining or even enhancing specific incisor and lip position: moving them either anteriorly or posteriorly as the situation warrants.

**Borderline Extraction**

Proof has been nugatory for any “better” alternatives for producing the amount of space that the extraction of premolars provides for patients with clear-cut situations that demand them: those with crowding or protrusion. But, what of the “borderline” extraction case? Can the extraction decision for these patients be altered with mini-screws? Mini-screw-supported molar distalization (e.g., Horseshoe Jet, AOA Orthodontic Laboratory, Sturtevant, Wisconsin) has been demonstrated to be an alternate to maxillary premolar extractions for the resolution of overjet and mild to moderate crowding (Figs. 7). Some degree of distal en masse movement (i.e., bodily retraction) of both the maxillary and mandibular dentition has also been reported (Figs. 8). Taken one step beyond, could minor crowding (3-4mm) be resolved by simple TAD-based retraction without questionable two-phase bimaxillary expansion, drastic interproximal reduction or extractions of premolars? At a minimum, perhaps the extraction of a mandibular incisor could be avoided in some instances with this type of mass retraction. Certainly, the limitations of available posterior arch length (e.g., third molar space), the efficiency/predictability of this type of retraction, and the long-term stability of these “backward-pulling mechanics” are yet to be explored (Figs. 9 & 10). As a result, TAD-based “bimaxillary retraction” as a non-extraction alternative should be approached with cautious optimism.

Some distal tipping of the entire dentition might be anticipated when pulling back all teeth in a dental arch (as might also
**Figs. 9:** A 13-year old male transferred after Phase I treatment. Bimaxillary en masse “retraction” with miniscrews was initiated to reduce the protrusion and lip incompetency. Progress after 1 year of comprehensive treatment demonstrated significant improvement in profile. Miniscrews maintained the position of the dentition as normal facial growth progressed, resulting in favorable change in Ricketts’ E-plan and lip posture.

**Figs. 10:** Mild bimaxillary protrusion treated with en masse “retraction” using direct anchorage from miniscrews and improvement in protrusion and profile was achieved.
be expected to accompany bimaxillary retraction with dual J-hook headgear); therefore, full-size arch wires and torque control would be required to limit this effect. Only long-term evaluation of finished results will determine if encroachment on third molar space and this type of posterior “uprighting” is as stable as traditional extraction treatments; however, it certainly appears this might be a more appealing alternative for some patients compared to aggressive, early expansion schemes or relying upon pious hopes for stability of “bone-growing” appliances.14 Although we continue to consistently revisit or resurrect many of these “expansive” dead zones in the evolution of our specialty; proof of efficacy still eludes us.14,36,40 This is especially disconcerting as there is the potential for enormous sample pools of patients that should seemingly be easy to tap from practices of those who tout such unique extraction alternatives.

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REFERENCES


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