Dear Industry Partner,

At RMO we consider ourselves much more than a supplier of orthodontic products and services. We consider ourselves a partner to the orthodontic community. One example of this is that we’ve been providing CE seminars for more than 50 years; starting back in the ‘60s with our Provocative Discussions Seminars in Colorado. These seminars were an attempt to bring more to the orthodontic community than just products and services. They were an opportunity to share thoughts and ideas about other aspects of the world that could affect orthodontics. Many of the topics discussed were economic factors, health factors, political factors, and medical practices that indirectly affected dentistry and orthodontics. The Provocative Discussions were held in an open and fun environment with several social activities to accompany the daily lectures. We continue to host similar meetings in Vail, Colorado that mimic our Provocative Discussions seminars of the ‘60s.

RMO’s Clinical Review is published annually before the AAO session and gives us the opportunity to communicate with you clinical ideas and articles that are related to your profession. It has been very well received in the market place worldwide, therefore we have decided to expand the focus of this year’s edition from mostly clinical articles to articles concentrating on you “The Provider, the Orthodontist”. Several articles in this year’s Clinical Review are focused on your overall well-being, both mental and physical.

Keeping that in mind, we have contacted the best of the best in their respective fields and have asked them to contribute to this cause. You will learn how to stay physically fit and prevent the back pain or other related issues that affect your industry, how to relieve stress, how to optimize your website via search engine optimization, and what to look for when designing a new office.

We are humbled and proud to be able to partner with many of you and we look forward to continuing these relationships for many more years to come.

Tony Zakhem  
Chairman/CEO
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Helping create generations of smiles.

For more than 80 years, we’ve been helping orthodontists like you create smiles with products made right here in the USA.

That long history comes from our commitment to sustainability. Not just sustaining our environment, but also nurturing and protecting our communities, our customers, and our team so we can help you create the smiles for generations to come.
Keith Roberts

Keith Roberts has always been an unorthodox thinker. He started Zenman out of his living room in 1998 as a way to drive more business as a photographer. He graduated from the Brooks Institute of Photography in 1995 with a degree in Industrial Scientific Photography and a minor in Undersea Photography. Keith's approach to both photography and design directly reflect his personal “Zen” philosophy that mirrors the Golden Rule; treat your clients as you would want to be treated and success will follow. Since the living room days, Zenman has expanded dramatically, helping over 400 clients in 16 years. Keith's passion for the arts and his community is tantamount to his business, as is apparent from his work with local non-profit organizations. Keith's professionalism and his character, are responsible for much of Zenman's success, and one of the primary reasons the company continues to flourish and grow.

Joseph Miller, AIA, NCARB

Joseph Miller is a founding principal with JoeArchitect, Inc. located in Denver, Colorado, specializing in dental office design across North America. Together with his partners Joe Church and Kristi Volskis, they head a group of 5 design professionals whose focus is to work with dentists, orthodontists, and other dental specialists to design extraordinary office environments. Mr. Miller won his first dental commission in 1999. Since that time, he and his team have been involved in the design of over 250 offices. Mr. Miller regularly speaks with students and established practitioners about the process of designing and building a dental facility. In 2012 he was one of 6 industry professionals selected to co-author the current edition of The ADA Practical Guidelines to Dental Office Design.

Bruce Haskell, DMD, PhD

Dr. Bruce Haskell is a Professor of Orthodontics, (Part Time), at the University of Kentucky, Department of Orthodontics, where he joined the faculty in 2010. His prior experience includes orthodontic practice in the U.S. Air Force Dental Corps, at the Churchill Hospital in Oxford, England, and Clinical Professor at the University of Louisville, School of Dentistry, where he has taught since 1977. Currently, Dr. Haskell also works in his private practice in Louisville with his daughter, Jennifer. He is a Dental and Arts and Sciences graduate of the University of Pittsburgh, with a doctorate in Physical Anthropology, majoring in Cranio-facial Biology. Dr. Haskell obtained his orthodontic specialty training at the University of Rochester, Eastman Dental Center (The Eastman Institute for Oral Health). His publications include works on habit modification, bio-mechanics, cranio-facial computer modeling, and forensic anthropology.

John Steffens, DC

Dr. John Steffens received his Doctorate of Chiropractic from Logan College in St. Louis, MO. Following graduation he completed a two year associateship in Vail, CO working with outdoor athletes and enthusiasts of all levels. It was there he learned the importance of structural alignment of the body as it wholly relates to human performance. He furthered his specialty training in spinal correction as a member of Maximized Living in Denver, CO. Dr. Steffens served as team chiropractor for the Colorado Rapids Professional Soccer Team who won the 2010 Major League Soccer (MLS) Cup. He is in private practice in Denver, where he gets to share his passion for helping people reach their potential in health and in life.

Clint Gehde, NSCA, TPI, FMS, BS Kinesiology

Clint Gehde founded e3 with his two business partners in 2011. e3 has grown into one of the industry's leading training facilities for sustainable lifestyle driven workouts with a purpose to improve each individual's quality of life. e3's reach goes far beyond the workout. The amazing community that e3 has evolved into allows for huge impact in the surrounding community, which is perhaps Clint's biggest achievement thus far in his career. Before each session and start to the day, e3 recites their core value: "create fitness leaders who inspire positive healthy lifestyles."
WHY SEO STRATEGY IS IMPERATIVE TO STAYING COMPETITIVE

BY KEITH ROBERTS, ZENMAN

We find everything on the web. From buying books to researching healthcare providers, the Internet is our one-stop-shop for research at our fingertips. It’s a simple fact that your website is the first thing a potential patient sees when he or she starts researching treatment options and orthodontists. Everyone knows both doctor and friend referrals will always be the best lead generator, but even those prospective patients will still go to the web to research you and your practice before they pick up the phone. It’s the virtual first impression they get that decides whether or not they take the next step of scheduling a consultation.

This is where it starts to get interesting. In an age of constant connectivity we don’t know how individuals will be accessing your website. In 2013 mobile access surpassed desktop browsing and now more people are looking at your website on their phones or tablets than on a laptop/desktop. Information needs to be readily available on any device. The information a patient is looking for must be easy to find and quick to download. Having someone waiting for your phone number to load is no different than calling into the practice and having the phone ring endlessly and never get picked up. It’s the same as someone trying to contact your practice for possible treatment and before you speak with them, they give up. In a recent study, Amazon found that 1 extra second of load time cost them $1.6 billion in sales. What would it cost your practice in lost revenue if you had a potential patient leaving your website and going somewhere else because it was hard to load or navigate on their iPhones every week? What if that was happening every day? Responsive web development can help to combat this.
Responsive Web Design

What is a responsive website? A responsive website uses media queries to detect the screen size of the user's device and uses CSS to present the correct format and content served on a single HTML page. To put it simply, the page reacts to the device and you don't need multiple versions of your site (like a mobile, tablet and desktop version.) In fact, Google has started to negatively impact the organic search results on sites that do not handle mobile and tablet versions with responsive websites.

Your responsive website should also embrace a 'mobile first' mentality. We recommend starting with the mobile version of the site first and working up to the desktop version in the design/user experience phase. There are a couple core reasons for this mindset. First, more than 50% of the users accessing the site will be coming from a mobile device. We want to embrace that and create the most rich, user-friendly experience for them based around the content they are looking for. It also helps us to focus on the users’ needs so we can present it to them intuitively. For example, the number one thing someone is looking for when they access an orthodontic practice’s website from their mobile device is the phone number. Statistically, it’s the same on a larger screen. By starting design with the mobile version first, that critical information is also organized at the top of website in the desktop version.

Responsive websites that are developed to be fluid will also adapt to future screen sizes in between the standard mobile (320 pixels wide) and tablet (800 pixels wide). This means you don’t have to modify your site when larger phones or smaller/larger tablets come on the market. A fluid responsive website is based on percentages and will adapt to any size device or browser size. Ease of cross-platform browser navigation isn’t the only reason to go responsive; it also benefits organic search results.

"More than 50% of the users accessing the site will be coming from a mobile device"
SEO (SEARCH ENGINE OPTIMIZATION)

Why does SEO matter to your practice? Statistically 68% of the web traffic will go to the top 3 organic search results (top placement receives 48% of clicks, second placement gets 13% and third placement getting a meager 7% of the traffic). It’s staggering how quickly you drop off people’s radar if you’re not at the top of the search results. Showing up at the top of the search results is the top performing lead generator to drive new patients behind direct referrals. Web searches are more effective than traditional marketing like direct mail, printed advertisements in local publications, and outdoor advertising. The people searching for “orthodontist” or “braces” are actively seeking your professional services and if you’re not at the top of the page you might as well not exist.

Don’t be fooled by unethical, hack or grey hat, SEO shops that go after key phrases that get zero searches. We have run reports for doctors that think they are at the top of Google’s results only to find they are being manipulated by poor keywords targeted like “Old town Scottsdale Orthodontist.” If you look at the number of searches for that phrase (usually zero) vs. the term “Orthodontist” (average 60,000 per month in large metro areas) you can clearly see it has no benefit to be at the top of a search that nobody performs. Google already knows you’re in Scottsdale based on your IP address and is presenting results based on your location.

Work with a real SEO agency and do your homework. Most bad shops flood doctors with a lot of unreadable reports and give bogus statistics. Make sure that the company you choose works with you to identify the most effective keywords that will drive prospective patients to your site, and have the analytics to back up their claims. Insist on reports that are easily understood and are focused on how the campaign is performing against the measurable results put in place at the project start. Improving your organic search rankings will drastically increase the number of visitors to your site. As the old saying goes, there is more than one way to skin a cat, so when organic search isn’t enough, consider a more direct tactic.
It can potentially take 6-9 months to start ranking organically on Google as well as any other search engines. For faster results, I would still recommend PPC and Retargeted Advertising campaigns. By implementing a PPC campaign, your site's listing can show up at both the top of the organic and sponsored results. By showing up in both places it illustrates dominance in your market and conveys confidence to your would-be patients. You will also be rest assured that 70% of web browsers are going to click on your organic listing if you show up in both places.

Retargeted ads are even more effective than PPC. Retargeting ads on the Google Display Network allows us to surgically target people who have visited your site in the past and present them with calls to action that are focused on the treatment option or content that they browsed on your site. We have all experienced this; say while looking at the weather on MSN and an ad for the exact jeans you view at Nordstrom’s pops up. The Google Display Network lets you place ads on a variety of news sites, blogs and other niche sites across the Internet to reach more customers. This extends your visibility to potential customers that have already spent time on your site and are therefore more likely to engage if they do click on your ad.
NEED SPACE?
THREE NEW RAPID PALATAL EXPANDERS AVAILABLE NOW FROM RMO FOR SOME MUCH NEEDED EXPANSION...

- Micro Expander
- Rapid Palatal Expander
- Rapid Expander with Orthogonal Arms
Once you have traffic on your site, it’s time to convert the casual web browser into a possible patient. Statistics show that 1% of people that visit your site will contact your practice to schedule a consultation, while 20% actually are actively seeking orthodontic services. How do we go after the 19% that aren’t calling? By creating a nurturing funnel that continues to educate your potential patients with content and calls to action about the type of care they have expressed interest in.

Since 2006 Inbound Marketing has been the most effective tool for website conversion. Inbound marketing is exactly what it sounds like. Inbound Marketing invites interested users into your site with great content. Once these users are engaged with your content, it becomes your job to hook them through high-end products and innovative service offers. Inbound Marketing strategies involve the creation of amazing web content, then the nurturing of leads said content garners with relevant information. Next you slowly convert those leads into consults/patients over time. Think of Inbound Marketing as a platform that invites interested people to visit your website in a way that is timely with the users needs and presents them with only the information they are seeking. Once that piece of the puzzle is secure, properly measuring your success is crucial.
You should always continue to learn based on your site’s analytics. By leveraging the insights provided by Google Analytics, we can continue to improve conversion and present the content that users find valuable. Analytics provide clarity into how long people spend on your site, the path they take through the site when browsing, and finally when and where they leave your site. This information is priceless when evolving a website to increase conversion, and allows you to create landing pages based around other marketing efforts to track effectiveness of traditional campaigns. By tracking the ROI (return on investment) for all marketing efforts, you can focus your marketing dollars where they are the most effective.

To stay competitive in today’s constantly changing marketplace, your website is the critical component to the ongoing success of an orthodontic practice. As new practices come online in your city, it is imperative that your website and SEO dominate your geographic location. Choose an agency that has proven results and that you enjoy working with. Developing a new website and SEO strategy is a collaborative effort that requires your input, just like designing a new office space or treatment plan. Expect a 3-4 month engagement to develop your new site and a 6-9 month runway to start seeing traction on your organic SEO. Remember, the longer you wait the more ground you will have to make up down the road, so start today!
"WHEN AN ORTHODONTIST RETAINS US TO DESIGN THEIR OFFICE, WE GO THROUGH A DETAILED INTERVIEW PROCESS TO UNDERSTAND THEIR GOALS FOR THE PRACTICE."
ORTHODONTIC OFFICE DESIGN IN THE RETAIL ENVIRONMENT:
ROLL UP YOUR SHADES AND SHOW THE WORLD WHAT YOU’RE ALL ABOUT

JOE MILLER, JOEARCHITECT

As an architect whose focus is the design of dental, orthodontic, and dental specialty offices, I have enjoyed the benefit of visiting hundreds of practices, both new and old, from Southern California to Newfoundland... and beyond. One common thread I have found in thriving practices is a consistency of the brand message in all of its manifestations. Simply put, this means that everywhere that your patient base comes in contact with your brand, they experience a consistent visual representation and a consistent message of who you are and what you believe in. Whether that point of contact is your business card, mailer, website or the design of your office, all of these elements are most effective when they work together in concert. Office design is often overlooked but it is as much a part of your brand as your logo or your website.

At JoeArchitect we work with new-start and established practices in equal measure. When an orthodontist retains us to design their office, we go through a detailed interview process to understand their goals for the practice. This starts with the doctor’s programmatic space requirements and extends to the look and feel of the office. The discussion goes well beyond the functional layout of an orthodontic office and often touches on the doctor’s practice philosophy and passions outside of the office environment. Like your website, or any other media where your brand is on display, your patients often meet your office before they meet you. This is especially true with the trend towards retail office locations. Currently, we are seeing nearly half of our orthodontic clients (and over one third of all our dental clients) choosing to locate their office in a first floor commercial strip center setting where their practice is on display via illuminated building signage, and visible through large storefront windows, for all the world to see. While the public nature of a retail environment is certainly not for everyone, it does provide a level of exposure that is hard to beat when compared to a traditional office building. Of course, you always have the option to roll down your shades and hide... or you can embrace your retail location in all its “strip center” glory.
Fig. 1: Willow Creek Dental – Lone Tree, CO
Exposed Structure/Ductwork in Retail Location
There was a time when a medical professional would never consider locating his/her practice in a retail shopping center. The thought of mingling with the pizza parlors and delicatessens of the world was unheard of. Today, a shrewd dentist or orthodontist recognizes the sheer numbers that drive by/pass through these centers on any given day. In addition to the tremendous exposure, there are a number of other advantages to a single story retail location:

- **Increased Parking**: In general, the parking requirements for a retail development are greater than the requirement for a medical or general office building (meaning more parking spaces). This makes life easier for your staff and patients.

- **Increased Ceiling Height**: These structures are typically constructed in a way to maximize the distance between the floor and the roof structure, allowing plenty of room to run mechanical ducts and other systems. From a design standpoint, this opens up the opportunity for much higher ceilings than you would normally find in a multi-story building. It is not uncommon to see 10 to 12 foot high ceiling or greater, if an exposed roof structure is a look that you favor (Fig. 1).

- **Separate Staff Parking/Access**: The classic shopping center plan has customer parking in the front and additional staff parking in the rear with a back door for private entry. This allows the doctor and his/her team to park and access the office without crossing paths with patients.

- **Single Story**: Because most strip centers are single story, it simplifies construction as it relates to the mechanical systems. Since there are no floors above you, air exhaust and venting required for bathrooms, sinks, labs, medical gas and mechanical rooms can be easily routed through the roof. Large mechanical units can be located on the roof saving valuable floor space.

- **Useable vs. Rentable Area**: It’s important to understand the difference between ‘useable’ and ‘rentable’ area as it relates to your lease. In general, ‘useable’ square footage is the amount of space that you actually inhabit. Traditional multi-story office buildings have a considerable amount of common space located outside the individual tenant suites that is shared amongst the tenants. This can include the lobby, corridors, restroom, stairs, elevators and other building services. In addition to the ‘useable’ area you occupy within your suite, you are also charged for your pro-rata share of the common space. The actual percentage attributable to common space (or common area factor) is different for every building, but generally ranges anywhere from 12 to 20 percent depending on the configuration of the building. Simply put, multiplying the ‘useable’ area times the common area factor results in the ‘rentable’ area. Your rent equals the ‘rentable’ square footage times the lease rate per square foot. One advantage to the retail center is that it typically has little or no common space, therefore, your ‘useable’ and ‘rentable’ square footage are often identical.

- **Ease of Construction**: Construction on the upper floor of a multi-story building has many challenges. Every subcontractor and laborer that enters the building to perform work in your suite has to pass through hundreds of feet of finished lobby, elevator and hallway before reaching your door. This requires that the general contractor protect every inch of that journey from potential damage and debris. Even the most careful, considerate construction superintendent will, at some point run into issues. Construction noise is unavoidable and will inevitably disturb someone, somewhere in the building. Landlords will often require that work take place after-hours. This can slow down the construction process and add cost. It is difficult, if not impossible, to keep your future neighbors happy when they are on 4 sides of you. In addition, you occasionally have to access their suites to run plumbing and other utilities. By comparison, demolition or construction in a single story retail strip is remarkably straightforward. It rarely requires access into adjacent spaces or after-hours work. It requires only that you keep a clean construction site, limit the noisiest work to before 8 am or after 8 pm and buy a couple of really nice gift baskets for your neighbors.
Of course, you do pay a premium for a premium location. Colin Carr is the president of Carr Healthcare Realty, a commercial tenant representative specializing in dental and medical lease negotiations, office relocations and lease renewals along the Colorado Front Range.

Colin notes that “when evaluating lease possibilities, many orthodontists first will weigh the pros and cons of a traditional medical office building versus a retail store front location. There is no right or wrong choice, and is a most often a philosophical question about the practice’s goals and expectations of patient sources. Retail centers offer convenient locations with easy parking and prominent signage and visibility. Medical office buildings on the other hand provide a more professional environment and synergetic neighboring tenants, usually have janitorial service and utilities included, and typically have a lower lease cost than retail.

Both have proven to be ideal homes for successful practices”. Colin points out that in the end, it usually comes down to the doctor’s personal preference.

In 2009 we worked with Dr. David Thurman on the design of Dental Elements, a general dental office located in Denver’s Lower Downtown (or LoDo). At the time it was one of only a few downtown practices and, in my opinion, the first to truly take advantage of its “street level” presence. The office is located on 15th Street, a major vehicular thoroughfare that bifurcates downtown and has enjoyed a significant increase in pedestrian traffic. While it is a multi-story building, it was specifically designed to accommodate retail on the main level. Dr. Thurman took advantage of the 14 foot high arched windows to showcase his practice. In the evening, as local professionals head home, they cannot miss the glowing interior (Fig. 2). The doctor recognized

Fig. 2: Dental Elements – Denver, CO
Interior Architecture as Signage
that the architecture of his office IS signage, and took the opportunity to reinforce his brand through its distinctive modern design. This design aesthetic extends clearly through all the expressions of Dental Elements unique brand.

Most retail tenant spaces in the 1,200 to 2,500 square foot range are long and narrow in shape and are proportioned like a shoe box or bowling alley. JoeArchitect has successfully designed many dental and orthodontic offices over the years in spaces that closely match this description. A good example of this is Seacoast Orthodontics, a 2,000 square foot practice located in North Hampton, New Hampshire (Fig. 3). It is approximately 25 feet wide by 80 feet deep. On Seacoast, we integrated curves into the floor and ceiling elements to mitigate the “shotgun” effect inherent in narrow spaces. It is important to note that there are limits to what can be done in a space of this kind.

Bring on your architect as you are considering various real estate options so that he/she can help you fully understand the character of a space before you sign a lease.

Dr. David Walt engaged JoeArchitect in 2010 to assist him with the design of his first orthodontic office in suburban Toronto, Walt Orthodontics. Vaughan, Ontario is located north of Toronto and is one of the fastest growing municipalities in Canada. Dr. Walt leased 1,800 square feet in a small retail development in Vaughan to accommodate his new 5-chair practice. The space the doctor selected is roughly 37 feet wide by 50 feet deep. While it is an interior space with windows on one side only, its square-ish shape afforded the design team quite a bit of flexibility regarding plan layout and available daylight.
The doctor chose to locate the clinical open bay directly adjacent to a large 15 foot wide section of glass storefront (Fig. 4). This allows for a light filled clinical area with views to the outside. Conversely, this permits the public to see into the heart of the practice. Privacy is available on-demand through the use of full-height roller shades. Otherwise, the practice is on full display to motorists (via building signage) and window shoppers alike (Fig. 5 & 6). Dr. Walt’s progressive practice philosophy includes minimizing the environmental footprint wherever possible. This message was delivered by the doctor to JoeArchitect at the start of the design process. Materials such as reclaimed barn wood and polished concrete were selected not only for their sustainability but also for their unique, almost industrial, appearance. These finishes set the tone for the visual representation of the brand. JoeArchitect was able to share the material palette with the doctor’s graphic/digital design firm, Qcreative, to help inform the logo, print and website design (Fig. 7). The overall result is a strong, consistent brand that presents itself boldly to the community through its retail presence.

Whether planning your first office or next office, remember that your office design is an extension of your brand and a physical representation of your practice. If a retail location is right for you, be sure to involve your architect early in the process to help you assess your options and build your brand. Take full advantage of these opportunities to make a great first impression and set yourself apart from the masses.

Fig. 4: Walt Orthodontics – Vaughn, ON
“Square-ish” Shape Allows for Open Bay Clinic on Windows

Fig. 5: Walt Orthodontics – Vaughn, ON
Clinical Open Bay
"...YOUR OFFICE DESIGN IS AN EXTENSION OF YOUR BRAND AND A PHYSICAL REPRESENTATION OF YOUR PRACTICE."
THE RELATIONSHIP OF VERTICAL SKELETOFACIAL MORPHOLOGY TO OROPHARYNGEAL AIRWAY SHAPE USING CONE BEAM COMPUTED TOMOGRAPHY: POSSIBLE IMPLICATIONS FOR AIRWAY RESTRICTION

JENNIFER A. HASKELL; BRUCE S. HASKELL; MICHAEL E. SPOON; CHANGYONG FENG

ABSTRACT

OBJECTIVE: To determine if the shape of the oropharyngeal airway is related to the vertical morphology of the skeletofacial complex, including the hyoid bone.

MATERIALS AND METHODS: Cone beam computed tomography scans from 50 pretreatment adult orthodontic records were used to obtain skeletal and airway measurements. Linear regression statistics were used to compare soft tissue variables to hard tissue predictor variables.

RESULTS: Transverse airway widening was significantly increased when the distance between the hyoid and vertebrae was reduced; when the three-dimensional (3D) facial axis angle decreased (became more vertical); when the 3D mandibular plane angle increased; when the width of the hyoid increased, or when the calculated length of the geniohyoid decreased.

CONCLUSIONS: A laterally elliptical airway—found when the face is more vertical and when the hyoid is closer to the cervical vertebrae - is hypothetically more resistant to collapse. Patients with a retrognathic, skeletal deep bite and a rounded oropharynx should be identified and corrected early to prevent potential airway problems.

KEY WORDS: Oropharynx shape, CBCT, Facial skeleton, Hyoid, OSA
INTRODUCTION
Upper airway dimension is a contributing factor to airway collapsibility in oxygen-limiting disorders such as obstructive sleep apnea (OSA). However, the findings related to patients with OSA are ambiguous. There is a lack of correlation between pharyngeal size and the apneic index of OSA patients.

Pharyngeal resistance to airway collapse on inspiration is decreased in OSA patients, but the overlap with normal individuals confuses the use of this parameter. Waking measurements of airway resistance in OSA individuals often display normal values.

The suprahyoid muscle group lifts the hyoid to improve airway patency. Electromyography (EMG) of these muscles may be elevated in both sleeping and awake OSA and non-OSA individuals. It is believed that OSA individuals activate airway musculature to compensate for increased airway loads while sleeping. EMG activity might well be activated fully while awake but is unable to meet the required level of activation necessary for patency when the airway is loaded during sleep.

The etiology of OSA is thus unclear: EMG activity, pharyngeal size, and pharyngeal resistance may be normal in OSA sufferers. Leiter’s model introduced the physics of airway shape in OSA etiology. An airway that has a cross section that is longer anterior-posteriorly (A–P) than laterally is considered more at risk for collapse during sleep. The muscles associated with the anterior border of the pharynx influence the shape and volume of the airway. A laterally elliptical hypopharynx displays increased volume when pulled anteriorly by muscle action, compared to an airway that is originally rounded or elongated in the A–P direction (Figure 1). The lack of muscles on the lateral walls of the pharynx requires the internal pressure of the airway to maintain patency. It is the posterior and lateral walls that collapse in apneic individuals. Turbulence in the pharynx causes an increase in the velocity of air, with a lowering of surrounding pressure (the Bernoulli effect), which elevates the soft tissue structure into the narrowed space and closes the airway. It is the inspiratory activation of the muscles in the A–P plane, including the genioglossus, that stabilizes and dilates the airway anteriorly. The shape of the upper airway can also be constrained laterally by fat pads. It follows that the OSA patients with the smallest airway lumens, oriented in the A–P direction, require the greatest amount of EMG activity to maintain airway patency. Thus, there is a balance between airway lumen, EMG activity, and shape. Biomechanical efficiency factors such as the position of the hyoid impact the relative muscle activity displayed and may determine whether or not a threshold effect is reached, resulting in OSA. Additionally, the physics of a transverse elliptical pharynx allow for less pharyngeal resistance, with less airway turbulence.

Figure 1. Cross section of the oropharynx. Based on shape, the left image is more at risk for collapse. The right image is a more desirable, less collapsible shape.
A two-dimensional cephalometric study by Otsuka et al. compared variables between responders and nonresponders with regard to a titratable oral appliance. Surprisingly, middle and inferior airway space and oropharyngeal airway cross-sectional area were significantly larger in the group that did not respond to a titratable mandibular advancing appliance. However, only the sagittal component can be seen in cephalometric radiographs. Ogawa et al. demonstrated the utility of three-dimensional (3D) airway diagnosis with cone beam computed tomography (CBCT) imaging. Two-dimensional images are not capable of measuring cross-sectional areas of the oropharynx.

A CBCT evaluation by Schendel et al. showed that as the airway grows, the total volume, length, area, and volume-to-length index all increase until age 20, then remain relatively stable until age 50, when they begin to decrease profoundly. They found that 45-year-olds had only slightly larger airways than did 15-year-olds. Other anatomical factors exist that have an influence upon airway patency, but they are not fully understood.

The present study was designed to clarify the relationship between airway shape, craniofacial morphology, and the hyoid using i-CATH (Imaging Sciences International, Hatfield, Pa) CBCT images of adults that presented for orthodontic treatment. The specific aims were to (1) determine if the airway is laterally elliptical when the hyoid is lower, further back, angled, or smaller in width and (2) determine the correlation with vertical and horizontal facial morphology. Understanding the anatomical factors in the development of airway patency issues may improve diagnosis for risk factors of airway obstructions and possibly contribute to averting them with various treatment modalities.
MATERIALS AND METHODS

This retrospective study was approved by the local Research Subjects Review Board. Fifty pretreatment CBCT records were collected from a private orthodontics practice. Inclusion criteria included the following: patient age of 18 years or older (nongrowing individuals); the hyoid had to be visible in its entirety; the subject must not have undergone previous orthognathic surgery; and the subject had to be dentate.

DICOM files were imported into Dolphin V.11 and oriented with the axial plane equal to the occlusal plane—defined by the mesiobuccal cusp tips of both maxillary first molars and the incisal embrasure between the maxillary central incisors. The occlusal plane is parallel to the planes of interest—the cross sections of the oropharynx (Figure 2). The midsagittal plane was subjectively determined.

Measurements of the hyoid, the craniofacial complex, and the oropharyngeal airway were made by digitizing 48 landmarks (see Table 1) using Dolphin 3D Imaging 11 software.

The software was created to calculate specified measurements from the XYZ coordinates of the landmarks. It was necessary to modify conventional cephalometric measurements for 3D analysis. The angle of interest for all craniofacial measurements (two angles are always created at the intersection of two planes) was parallel to the sagittal plane. The following lists (Tables 2–4) show each measurement made and the definition of each according to the landmarks listed in Table 1.

The SAS statistical software package (SAS Institute Inc, Cary, NC) was used to calculate linear regression using the hard tissue hyoid and craniofacial measurements (H1–H11 and C1–C7) as the independent variables and the airway measurements (A1–A10) as the dependent variables. Descriptive statistics were performed for each variable, including mean, standard deviation, and range. Pearson correlations compared each of the airway variables to each other. The normality of the outcome variables was tested with a Shapiro-Wilks test, which found that six of the 10 airway variables needed to be transformed via Box-Cox to obtain normality. A4 was squared, and the log of A6 through A10 was taken. Only the significant variables (p ≤ .05) were included in the linear regression equation.
### Table 1. Landmark Definitions

<table>
<thead>
<tr>
<th>Landmark (L)</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>Greater cornu tip, hyoid left</td>
</tr>
<tr>
<td>L2</td>
<td>Greater cornu tip, hyoid right</td>
</tr>
<tr>
<td>L3</td>
<td>Lesser cornu tip, hyoid left</td>
</tr>
<tr>
<td>L4</td>
<td>Lesser cornu tip, hyoid right</td>
</tr>
<tr>
<td>L5</td>
<td>Most anterior-superior portion of hyoid body</td>
</tr>
<tr>
<td>L6</td>
<td>Most posterior-superior aspect of hyoid body</td>
</tr>
<tr>
<td>L7</td>
<td>(Not used in analysis)</td>
</tr>
<tr>
<td>L8</td>
<td>Posterior border of pharynx along plane of hyoid</td>
</tr>
<tr>
<td>L9</td>
<td>Genial tubercle</td>
</tr>
<tr>
<td>L10</td>
<td>Right lingula tip</td>
</tr>
<tr>
<td>L11</td>
<td>Left lingula tip</td>
</tr>
<tr>
<td>L12</td>
<td>Right mesioibuccal maxillary first molar cusp tip</td>
</tr>
<tr>
<td>L13</td>
<td>Left mesioibuccal maxillary first molar cusp tip</td>
</tr>
<tr>
<td>L14</td>
<td>Midpoint between incisal embrasure of upper centrals</td>
</tr>
<tr>
<td>L15</td>
<td>Right orbitale</td>
</tr>
<tr>
<td>L16</td>
<td>Left orbitale</td>
</tr>
<tr>
<td>L17</td>
<td>Right temporal fossa point (TFP)21</td>
</tr>
<tr>
<td>L18</td>
<td>Left (TFP)21</td>
</tr>
<tr>
<td>L19</td>
<td>Anterior nasal spine</td>
</tr>
<tr>
<td>L20</td>
<td>Right lateral condyle pole</td>
</tr>
<tr>
<td>L21</td>
<td>Left lateral condyle pole</td>
</tr>
<tr>
<td>L22</td>
<td>Right medial condyle pole</td>
</tr>
<tr>
<td>L23</td>
<td>Left medial condyle pole</td>
</tr>
<tr>
<td>L24</td>
<td>Right foramen rotundum</td>
</tr>
<tr>
<td>L25</td>
<td>Left foramen rotundum</td>
</tr>
<tr>
<td>L26</td>
<td>Nasion</td>
</tr>
<tr>
<td>L27</td>
<td>Basion</td>
</tr>
<tr>
<td>L28</td>
<td>Most anterior vertebral point along plane of hyoid</td>
</tr>
<tr>
<td>L29, 30</td>
<td>Points defining the line at the largest transverse width of airway at the cross section (LAT) of the superioranterior (Sup) aspect of the second cervical vertebra body (C2)</td>
</tr>
<tr>
<td>L31, 32</td>
<td>Points defining the line at the largest anterior-posterior depth of airway at the cross section (AP) of Sup C2</td>
</tr>
<tr>
<td>L33, 34</td>
<td>LAT of the middle aspect (Mid) of C2</td>
</tr>
<tr>
<td>L35, 36</td>
<td>AP of Mid C2</td>
</tr>
<tr>
<td>L37, 38</td>
<td>LAT of the most inferior-posterior aspect (Inf) of C2</td>
</tr>
<tr>
<td>L39, 40</td>
<td>AP of Inf C2</td>
</tr>
<tr>
<td>L41, 42</td>
<td>LAT of Sup C3</td>
</tr>
<tr>
<td>L43, 44</td>
<td>AP of Sup C3</td>
</tr>
<tr>
<td>L45, 46</td>
<td>LAT of Mid C3</td>
</tr>
<tr>
<td>L47, 48</td>
<td>AP of Mid C3</td>
</tr>
</tbody>
</table>

### Table 2. Hyoid Measurements

<table>
<thead>
<tr>
<th>Hyoid Measurements</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>Greater cornua distance (mm): L1–L2</td>
</tr>
<tr>
<td>H2</td>
<td>Lesser cornua distance: L3–L4</td>
</tr>
<tr>
<td>H3</td>
<td>Hyoid plane (HP) (L1, L2, L5) to occlusal plane (OP) (L12, L13, L14) angle</td>
</tr>
<tr>
<td>H4</td>
<td>HP to mandibular plane (MP; L9, L10, L11) angle</td>
</tr>
<tr>
<td>H5</td>
<td>HP to Frankfort horizontal plane (FH; midpoint of L15, L16 to L17 to L18) angle</td>
</tr>
<tr>
<td>H6</td>
<td>Distance from the posterior of the body of hyoid to the posterior of the pharynx: L6–L8</td>
</tr>
<tr>
<td>H7</td>
<td>Distance from the posterior of the body of hyoid to the anterior of the vertebral column: L6–L28</td>
</tr>
<tr>
<td>H8</td>
<td>Distance of hyoid to MP: perpendicular intersect of L5 with the MP</td>
</tr>
<tr>
<td>H9</td>
<td>Hyoid to lingula distance, right: L5–L10</td>
</tr>
<tr>
<td>H10</td>
<td>Hyoid to lingula distance, left: L5–L11</td>
</tr>
<tr>
<td>H11</td>
<td>Geniohyoid length: L6–L9</td>
</tr>
</tbody>
</table>

### Table 3. Craniofacial Measurements

<table>
<thead>
<tr>
<th>Craniofacial Measurements</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Modified facial axis: posterior, inferior angle between the (midpoint of L24, L25) to L9 and L26–L27</td>
</tr>
<tr>
<td>C2</td>
<td>Mandibular plane angle: mandibular plane to Frankfort horizontal</td>
</tr>
<tr>
<td>C3</td>
<td>Lower facial angle, right: L19 to L10 to L9</td>
</tr>
<tr>
<td>C4</td>
<td>Lower facial angle, left: L19 to L11 to L9</td>
</tr>
<tr>
<td>C5</td>
<td>Mandibular angle, right: L9 to L10 to (midpoint between L20, L22)</td>
</tr>
<tr>
<td>C6</td>
<td>Mandibular angle, left: L9 to L11 to (midpoint between L21, L23)</td>
</tr>
<tr>
<td>C7</td>
<td>Inter-lingula distance: L10–L11</td>
</tr>
</tbody>
</table>

### Table 4. Airway Measurements

<table>
<thead>
<tr>
<th>Airway Measurements</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Largest transverse length of cross section of airway at Sup C2: L29–L30</td>
</tr>
<tr>
<td>A2</td>
<td>Largest transverse length at Mid C2: L33–L34</td>
</tr>
<tr>
<td>A3</td>
<td>Largest transverse length at Inf C2: L37–L38</td>
</tr>
<tr>
<td>A4</td>
<td>Largest transverse length at Sup C3: L41–L42</td>
</tr>
<tr>
<td>A5</td>
<td>Largest transverse length at Mid C3: L45–L46</td>
</tr>
<tr>
<td>A6</td>
<td>Cross-sectional shape at Sup C2: LAT (L29–L30)/AP (L31–L32)</td>
</tr>
<tr>
<td>A7</td>
<td>Cross-sectional shape at Mid C2: LAT (L33–L34)/AP</td>
</tr>
<tr>
<td>A8</td>
<td>Cross-sectional shape at Inf C2: LAT (L37–L38)/AP</td>
</tr>
<tr>
<td>A9</td>
<td>Cross-sectional shape at Sup C3: LAT (L41–L42)/AP</td>
</tr>
<tr>
<td>A10</td>
<td>Cross-sectional shape at Mid C3: LAT (L45–L46)/AP</td>
</tr>
</tbody>
</table>
Foundation for Modern Bioprogressive Orthodontics

Symposium - April 25, 2014 | 8:00 am - 5:00 pm
New Orleans, LA | New Orleans Marriott
555 Canal Street, New Orleans, LA 70130

www.bioprogressive.org

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RESULTS

Linear regression analysis showed that there are significant predictor hard tissue variables for all of the outcome airway variables. The significant hyoid predictor variables were the width between the greater cornua (H1); the width between the lesser cornua (H2); the distance of the anterior body of the hyoid from the nearest vertebra along the hyoid plane (H7); the angle of the hyoid plane to the occlusal plane (H3); the angle of the hyoid plane to Frankfort horizontal (H5); and the calculated length of geniohyoid muscle (H11). The most significant craniofacial predictor variables were modified facial axis (C1) and modified mandibular plane angle (C2).

"LINEAR REGRESSION ANALYSIS SHOWED THAT THERE ARE SIGNIFICANT PREDICTOR HARD TISSUE VARIABLES FOR ALL OF THE OUTCOME AIRWAY VARIABLES."

Table 5 shows the significant predictor variables for the lateral width of each level of the airway. It also shows the coefficient and p-value for each significant predictor variable. A negative coefficient represents an inverse relationship between the predictor and outcome variables. For example, the first two lines of the table can be interpreted in the following ways: the width between the lesser cornua of the hyoid increases by 0.65 mm or the distance between the hyoid body and the anterior surface of the vertebral column along the plane of the hyoid decreases by 2.65 mm; the width of the airway at the superior aspect of C2 increases by 1 mm.

<table>
<thead>
<tr>
<th>Outcome Variable: Lateral Width</th>
<th>Predictor Variables</th>
<th>Coefficient</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2 superior (A1)</td>
<td>Lesser cornu width</td>
<td>0.65</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>Distance of hyoid from nearest vertebra along the hyoid plane</td>
<td>-2.65</td>
<td>0.01</td>
</tr>
<tr>
<td>C2 middle (A2)</td>
<td>Modified mandibular plane angle</td>
<td>0.27</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>Lesser cornu width</td>
<td>0.82</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td>Distance of hyoid from nearest vertebra</td>
<td>-2.16</td>
<td>0.02</td>
</tr>
<tr>
<td>C2 inferior (A3)</td>
<td>Modified facial axis</td>
<td>-0.52</td>
<td>0.01</td>
</tr>
<tr>
<td>C3 superior (squared)</td>
<td>Modified facial axis</td>
<td>-19.66</td>
<td>0.04</td>
</tr>
<tr>
<td>C3 middle (A5)</td>
<td>Greater cornu width</td>
<td>0.39</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>Angle of hyoid plane to occlusal plane</td>
<td>-15.82</td>
<td>0.009</td>
</tr>
<tr>
<td></td>
<td>Angle of hyoid plane to occlusal plane</td>
<td>-0.29</td>
<td>0.003</td>
</tr>
</tbody>
</table>
Table 6 shows the shape data as the outcome variables, in which each is represented as the log of the ratio of lateral to AP width of the airway at each of the five levels. Because each outcome variable in Table 6 has had its log taken, the coefficients of the predictor variables appear very small, but all are highly significant.

The relationship of hard tissue anatomy to the shape of the airway can be summarized as follows:

- The more vertical the craniofacial morphology, according to the modified facial axis and modified mandibular plane angle, the more laterally wide and transversely elliptical the airway.
- The closer the hyoid body and the vertebrae, the more laterally wide and transversely elliptical the airway.
- The closer the hyoid is to the chin, the more transversely elliptical the airway. (For example, in a retrognathic, vertically developed individual, the hyoid is closer to the chin and the vertebrae.)
- The wider the hyoid in the greater cornu or lesser cornu areas, the more laterally wide and transversely elliptical the airway.
- The steeper the pitch of the hyoid relative to the Frankfort horizontal, the more elliptical the airway.

**DISCUSSION**

The position of the hyoid descends over time in vertical patients with a steep facial axis, apparently worsening the biomechanics necessary for a proper EMG level of the genioglossus and the suprahypoid muscles in the modality explained by Leiter. An increased need for excessive nighttime EMG activity and tonus is required for patency, which may not be achieved in this milieu. Collapsibility is a function of lumen size, not only lumen shape. Grauer et al. indicated a qualitatively narrower and smaller airway in vertical, as compared with normal, facial types. It is suggested that vertical facial types might well have a higher rate of OSA were it not for a compensated elliptical airway shape creating a transverse resistance to compression in the elliptical pharynxes.

Iwasaki et al. showed that while the size of the upper airway did not differ statistically among facial types, the simulated maximal pressure and velocity of the dolichocephalic type were significantly higher than those of the brachyfacial type. The higher velocities and lower pressures found in the vertical skeletal types indicate a constriction of flow consistent with a narrowing of the airway.

A simple analogy is drawn in obtaining a photographic exposure. A combination of factors, with the potential for compensatory balances, yields a proper exposure. For example, a longer exposure can make up for a sensor with low light sensitivity. A similar interaction of anatomic (oropharyngeal shape and size) and physiologic factors (muscle activation) is necessary to avoid OSA.

Confounding factors in this study are that the images were captured in upright, alert patients with no attempt to control respiration or
swallowing (ie, to mimic a nongrowing, orthodontic patient population). The head is tipped up during CBCT capture, until the occlusal plane is horizontal, so postural change of the airway is inevitable. The sample of 50 random patients offers a wide distribution of possible attributes. Dental classifications and sexual dimorphism were avoided at the current level of investigation because the sample was intended to be statistically random for morphologic traits and OSA status.

OSA is a multifactorial problem, of which shape is a major component that has been addressed in biophysical and physiologic research. Investigating 3D shape as it relates to skeletal morphology is proposed using a simple measurement made possible by CBCT imaging. This study was not intended to prove that a positive relationship exists between certain airway shapes and OSA subjects. It was designed to serve as a descriptive population study of how horizontal and vertical craniofacial measurements relate to 3D airway shape and as a precursor to additional research. Previous studies describing the cross-sectional relationship to the vertebrae and the hyoid involved two dimensions only.

CONCLUSIONS

Vertical aspects of skeletal morphology in relationship to the hyoid bone are linked to the shape of the airway, as the subjects in this study were not known to have an airway obstruction. No study has yet fully integrated the interplay among airway morphology, the physiology of airway dynamics (including suprahyoid muscle activity), and biomechanics and the size and shape of the pharyngeal airway.

OSA has a multifactorial etiology, and shape seems to be an important factor for airway patency. It is not known whether persons with a vertical facial pattern are more “resistant” to airway collapse because of the correlation with a transverse elliptical airway. It also does not mean that they are “immune” from airway obstructive disease. Other factors, such as obesity, decreased volume, inadequate muscle activity, aging, etc, may have an overarching effect.

Indeed, it may be more important than previously realized to take the vertical dimension into consideration in comprehensive treatment planning for airway patency. Brachyfacial patients with a flat mandibular plane angle that are retrognathic or bimaxillary skeletally retrusive and with a low hyoid may be at greater risk for sleep apnea or other obstructive sleep disorders later in life if an associated airway morphology is determined to be more “rounded” in configuration. This remains to be proven with confirmed OSA patients, instead of through inference through biophysical and morphologic data. Treatment plans that decrease the vertical and A–P skeletal dimensions in patients who are retrognathic and brachyfacial should be avoided.

By inference, this study proposes that it may be prudent to have a CBCT scan to assess airway shape in selected orthodontic patients with planned procedures that might compromise or negatively influence the airway.
REFERENCES


11. Pae EK, Quas C, Quas J, Garret N. Can facial type be used to predict changes in hyoid bone position with age? A perspective based on longitudinal data.


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HEALTHY PRACTICE,
HEALTHY LIVING,
HEALTHY LIFE...
“I am healthy, see look…I am healthy.” Really, are you?

Most people do not look at how health can directly impact their business, personal life, and overall quality of life. Your health arguably has the greatest impact on your practice, and your work longevity, which directly correlates to your lifetime earning potential. If not to that extreme, it will certainly impact the quality in which you practice and carry out your regular day to day activities. Here’s a testimonial from Dr. Brett Levin on how changing his lifestyle positively impacted his practice and overall career.

Incorporating e3 into part of my lifestyle has been a transforming process. It has brought me to a level of fitness that I never could have comprehended a few years ago. But it has done so much more than that. The stress and energy release I get from each workout really offsets the daily rigors of running a dental practice. As I have become more fit, my body, more specifically, my posture has improved and I don’t feel those “aches and pains” from working on patients all day. It has improved my diet. I am more aware of what I am feeding my body and the lasting impact it can have not only on my waistline, but my future workouts. Lastly, there is a wonderful sense of community at e3. I have fostered some great friendships with some of the people I work out with, and they always support me during my workouts.

~ Dr. Brett Levin

We work with all kinds of people in a variety of industries. We have more than our share of dental and medical professionals that utilize our knowledge of fitness and health to apply it to their daily routine.

When we observe health in the fitness industry we aren’t just looking at the body as a shell. Life can get away from us very quickly and we tend to forget about the one most important thing, taking care of our physical health so we can set ourselves up to succeed in our professional and personal lives.
I’ve been working in the health industry for 15 years and I’ve personally witnessed a swing in how we view working out, diets, and eating habits. There is a direct correlation of how the shift in our outlook has affected our personal and professional lives. At our training center, Element 3 (e3), we have a global view of fitness and health. At e3 we provide a lifestyle-focused approach to fitness programming, nutrition, and health. Our programming is designed to fit to your lifestyle rather than try and have you adapt to our lifestyle. The e3 approach requires change; however it’s important that healthy change occurs with a minimal amount of resistance from your existing lifestyle. That’s where our coaching comes in.

Our intention is to give our members the lifestyle that takes the element of fitness from a chore to a quality-adding component of your daily existence. If your goals are tangible the product we provide addresses that. Along the way we identify and analyze the intangibles. As we move toward the goal, we learn of its origin, we find clues, and we make real change. Fitness is multi-dimensional.

**HOW DID I GET TO THIS PLACE?**

We like to take a very broad view when examining our busy professional colleagues. At e3 we have built a formula that we’ve implemented over the past 10 years: W → L → H&B

The chart moves from left to right. We find that many of our colleagues get caught up in the daily chaos of **work** and **life** which can lead to poor **health** and **balance** practices. How many times has work or life stood in the way of addressing your fitness and nutrition habits?

At e3 we ask ourselves the reverse question. Does your health and wellness ever negatively impact your **work** or personal **life**? Rarely does this situation occur. In fact, typically a good approach to health and wellness only enhance **work** and **life** practices. Incorporating health into your daily life is what we identify as your e3L or ‘e3 Lifestyle’. This is the ability to perform any task that you want to accomplish without having to additionally prepare for it. You’re always at that ready stage with a baseline sustainable fitness level. This is relative and attainable for all! The intent is to take your healthy lifestyle and parlay that into your professional life and personal life. Once we can switch the scale you will find that your lifestyle is much more positive with less resistance in all important areas of life. We know we’re fighting an uphill battle so let’s start identifying some issues specifically for the dental professions and provide some solutions.

Let’s dive into this by identifying the 101 Doctor checklist for physical health, directly impacting your profession and practice:
At e3 we see many cases of dental professionals that show early signs of at least two of the top five issues listed above. What we have learned is that this is a very prevalent problem amongst your peers, and by taking a proactive approach to treat these issues, we’re able to sideline the pain and prevent any further injury. Here’s a very applicable testimonial and one example of the impact changing your approach to fitness can have on your professional life.

“In my profession, good posture and ergonomic stability is the difference between a long successful career and a short "painful" one. Before training at e3 and adopting a healthier lifestyle, I suffered with back, neck and shoulder pain on an almost daily basis. Sitting for a two hour procedure was difficult and I was only 5 years into my career.

e3’s methods, advanced education in biomechanics, and years of experience, has made my day to day practice life remarkably better. I can now easily sit for a three or four hour procedure without fear of discomfort afterwards.

Having a healthy lifestyle has taught me the importance of one’s core strength, being ahead of pain bug, and has revolutionized the way I go about my daily practice routine. It’s made a huge difference outside of the office as well as my skiing and volleyball game have been taken to a whole new level! In addition, my stress management in day to day life has improved dramatically since committing to a training routine.

I can confidently say that my approach to having a proactive healthy lifestyle has guaranteed the longevity of my career.”

~Dr. Maureen Roach
SO...WHAT DO I DO?

Let’s meet some of the top threats to your professional longevity. Learning more about some of these threats can really help in mitigating them in your future. Let’s first identify them and then we can provide proper steps for prevention.

1. **Shoulder Impingement** is caused by too much internal rotation of the rotator and not enough **paction**. Why is this happening? The answer is overuse. The way you’re set up in your chair leads to an unprotected movement pattern for your shoulder. You’re unable to keep your shoulder completely packed. Even if you have an awareness that this is occurring it’s sometimes impossible to correct. A very common chronic injury associated with this set up is **scapulocostal syndrome** or snapping scapula. This is the excessive rubbing, grinding, and bursitis issues that occurs when there’s muscle breakdown, range of motion issues, or atrophy.

2. **Spinal or Rotary** issues are caused by a sedentary lifestyle, excessive weight, and low mobility. All these are limiting factors for optimal efficiency in your spine. The spine is extremely important and all movements we engage in affect the spine. The easy way to think about this is how you ‘hinge’ in order to bend down, around, and sometimes over to either pick something up or reach. Have you ever been taught the proper patterns?

3. **Absence of Lower Core Activation** creates compensation and acute unawareness to all other areas. How many core exercises do we practice? Which ones are best for you? Well, you may be surprised. Crunches aren’t going to get the job done for you, nor are they even in the top 10 list for core exercises that provide good stability and strength to the region. Simple quadruped movements along with plank variations will get you much further. We have some great examples for you.

4. **Hip Impingement and Tightness** is caused by your daily “seated posture”, excessive weight, and low mobility. Because of the up/down requirements and variable seat heights; your hip flexors, psoas, and low back erectors are in a constant state of tug of war! This one is more about stretching and counter corrective movement pattern to protect your mobility then it is about strengthening exercises. We will provide you with some simple exercises that will really help with this. One of which is always going to be good amounts of fascia release or “rolling”.

5. **Heart Health** stems from stress, demand on you, poor diet, lack of sleep, lack of time. I am sure we could keep going with this category. If nothing else, getting out and exercising on a consistent basis can really help with the stress demands.
Here’s a great motivator from someone in your field who was forced to make this change, and now wouldn’t know how to practice without incorporating healthy decision making into his lifestyle.

“In 2011 I read an article in Forbes that interviewed some of the most successful CEO’s across the country. One of the questions that they asked was what time they woke up, and I was shocked to see how early they would rise in the morning. The next question was what they did when they woke up, and over 90% of them would engage in some sort of physical activity, whether it be going to the gym or yoga. I then decided to make fitness in the morning a priority in my life. I now go to the gym 3-4 times per week at 5:15 am, and I will do something outside another 2-3 days per week. My energy level is higher than ever and I am able to work harder and longer days. Harder and longer days will directly result in increased production and efficiency. There is no doubting this.

We have been blessed with a profession that enables us to practice for many years. We have also been cursed by a lifestyle that lends itself to eating 5+ meals out per week to go with a sedentary 8-5 daytime job. It is now my mission to spread this new found awareness and change the culture of our industry. However, first we must lead by example.”

~Dr. Anil Idiculla

**SUMMARY: CAUSE & EFFECT**

**SHOULDER PAIN/IMPINGEMENT**

**CAUSE:** Excessive internal rotation of the rotator

**EFFECT:** Excessive rubbing/grinding of joint, bursitis, restricted range of motion

**SPINAL ISSUES**

**CAUSE:** A sedentary lifestyle, excessive weight, and low mobility

**EFFECT:** Limited mobility/pain

**ABSENCE OF LOW CORE ACTIVATION**

**CAUSE:** General unawareness of core activation techniques

**EFFECT:** Lower back pain, general discomfort in core region

**HIP IMPINGEMENT AND TIGHTNESS**

**CAUSE:** Seated posture, excessive weight, low mobility

**EFFECT:** Tightness in hip region leading to low mobility

**POOR HEART HEALTH**

**CAUSE:** Stress, poor diet, lack of exercise

**EFFECT:** At risk for heart attack and other heart related diseases

At e3 we are not fans of presenting a bunch of problems without solutions. For each one of these top 5 issues, we would like to give some corrective exercises in order to help get you started. This is a great addition to a routine you may already have or simply a great starting point to help spark interest and tip that scale in the right direction.
Are your patients keeping a low profile?

In the last 81 years that RMO® has been in the Orthodontic industry, technology and innovations have improved considerably. Patient comfort and product reliability are two of the most important characteristics of a successful and sustainable bracket.

This is how the FLI® Twin bracket was invented. Keeping the patient in mind, we crafted a smooth, comfortable, and low profile bracket. Constructing an attractive fit in the patient’s mouth.

Creating beautiful smiles is effortless when the patient is comfortable and willing to SMILE BIG® for FLI® Twin brackets.
EXERCISES FOR SHOULDER IMPINGEMENT:

1. Shoulder Packing: Working on a movement of two to three inches only. You want to retract the shoulders and then keep them in that static position while performing a row. This will help to maintain optimal posture while also setting your shoulder girdle into correct position while working. Repeat 5-10x/side.

2. Sit and Wall Reach: Sitting with both feet together and make sure to align your lower back to the wall. Sometimes it helps to pinch a rolled up towel between your back and the wall. Hold your arms at 90 degrees and slide them up the wall without breakdown in posture. This movement is to be performed to maximum range of motion without breaking away from the wall. Move slow and repeat 5-10x’s.

3. T-Spine Rotation with Arm Reach: While lying on your side, flex the top hip about 90 degrees and support the knee with a foam roll or medicine ball if needed. Keep the foot on the ground and the head supported by a towel roll. Begin rotating the top shoulder toward the floor. Maintain contact with the foam roll / ball or floor as rotation occurs. Once maximally rotated, reach the down arm out at a 45 degree angle from the body. Reach the opposite arm toward the ceiling, 3-5x/side.

EXERCISES FOR SPINAL AND ROTARY MOBILITY:

1. Rib Grab with Spinal Rotation: While lying on your side, flex the top hip about 90 degrees and support the knee with a foam roll or medicine ball if needed. Keep the foot on the ground and the head supported by a towel roll. Lock down the knee on the roller as you rotate the top shoulder toward the floor while extending the top elbow towards the floor as well. Hold for a few seconds and repeat. 3-5x/side.

2. Quadruped with Bird Dog: Neutral spine on all fours. For core stability extend both opposite arm and leg simultaneously. Try to eliminate too much lordotic curve and movement via shifting or hand positioning.

3. Fascia Work: Foam rolling for trigger point and fascia release. When rolling it’s important to find the spots that are uncomfortable and then melt on to them. Remember to roll slowly and breathe.
EXERCISES FOR CORE ACTIVATION:

1. Quadraped Flexion & Extension: From the quadraped position, find a nice smooth movement pattern into a rounded back and hold for three seconds. Then move into an arched back as smoothly as you can. Once in this position, hold for three seconds and then engage your abdominal region and find a neutral spine while staying engaged. Repeat 5-10x’s.

2. Plank with T-Spine Rotation: From the prone position, find your neutral spine with core activation. Once settled in, work on slowly reaching an extended arm towards the ceiling. Rotation should reach 90 degrees and held for approximately 3 seconds. Repeat 3-5x/side.

3. Mountain Climber from Plank: From prone position and in a perfect plank, slowly drive same need to same elbow while maintaining balance and neutral spine. This exercise can be performed from high plank position as well. Remember to maintain stability throughout the entire duration of the movement. This is an advanced movement so lessen repetitions when needed. 5x/side.

EXERCISES FOR HIP AND LOW LUMBAR:

1. Dowell Stretch for Hip Flexors and Psoas: From a ½ kneeling position place the dowell outside your front foot. Gently lower your hips while transferring some of your weight forward to get the optimal stretch. Tension is a good stretch but there should be no pain. :30 hold/side, breathe.

2. Active Straight Leg Raise: Lying on your back, slowly raise one leg while maintaining rigidity in your core. Use the band above you from a 45 degree angle to pull down just below your chest. This will assist you in activating your core and hips to engage and assist with the leg raise and lower. 10 reps/side.

3. ½ Kneeling Lift: From the ½ kneeling position, work from the inside to the outside with a reverse chopping motion. Minimal weight is advised on this exercise. Maintain posture by flexing the down knee, glute, and core. This is an advanced exercise, 5-10x/side.
EXERCISE PRESCRIPTION FOR HEART HEALTH:

We like to address heart health using a few general guidelines. The first principle rule is to try and live by the 6 and sweat. We like to see our clients eat 6 meals/day and sweat almost every day of the week. Now this doesn't have to be interpreted as hard core as it reads. 30 or more minutes/day of some kind of activity will certainly suffice someone who's not used to being active. Activities can consist of the above movements in addition to cardio exercise. Eating 6 meals/day isn’t easy to read either. What we’re saying is every time food enters the body that would constitute a meal. See, not so bad. Nutrition will play a huge roll in all this so please do not discount that part. Eating the right foods is very important. We have many strategies on this methodology and you're welcome to email us at, askcoach@e3-fitness.com for additional guidelines and tools.

Make no mistake when we say:

“YOU CANNOT OUT TRAIN A POOR DIET!”

We try and do our best to show our members how life can really look like when they have balance between WORK, LIFE, and HEALTH. The positive impact that health can have on your work and personal lives is truly priceless. Because we have seen how this can work is why we believe this is so important. The ability to find your e3L, and what that is for you, will ultimately improve YOU. If we can do that, everything else will be rewarded. Try to implement some of this work into your regime and we guarantee that you, your family, and your team will love the addition, and the impact that it will create.

“CREATE FITNESS LEADERS WHO INSPIRE HEALTHY, POSITIVE LIFESTYLES.”

—E3 MISSION STATEMENT
THEIR TEETH, YOUR SPINE AND YOUR FUTURE

JOHN STEFFENS, DC, MAXIMIZED LIVING

“Most days I see between 30-40 patients a day. The days tend not to be too hectic, since I have a good staff. Most days I spend putting on braces, seeing patients for adjustment appointments, taking braces off, discussing treatment plans with patients and parents, and doing business type stuff (paying bills, staff issues, journal reviews, etc). With your own practice, you get to be your own boss, but there is a lot of responsibility, too”, writes one Orthodontist about his practice.

It’s manual labor too. Holding an instrument in your hand, you’re bent over and looking in mouths all day. Repetitive stress and strain can take their toll on the body. All day you’re stressing the importance of things like dental structure, incisor alignment, molar hygiene and periodontal performance, in which correction is key. These are the foundations of your art and of your trade. How well a patient follows your recommendations will affect their short term goals and long term benefits from your care. Yet all the while you are working on improving people’s mandibular function and dental alignment, you are constantly bombarding your own alignment through contorted working positions and repetitive stress.

Your schooling has provided you the diagrams to follow and perhaps you’ve consulted with specialists to assess your office settings. Despite all the proper training, the best chairs and stools, optimized patient positioning, and periodic breaks; the core essence of what you do all day is look down and work in a stressful position for your spinal column.

NORMAL SPINAL ANATOMY

The nervous system is the master control system of the body. The brain controls and coordinates all function through the spinal cord and nerves. These most vital and delicate tissues are surrounded and protected by the skull, vertebrae and sacrum. When looking at the spine from the front, the vertebrae must be straight up and down and when looking from the side they need to form three distinct curves – a cervical lordosis, thoracic kyphosis and a lumbar lordosis.
The correct alignment of the vertebrae permits the proper transmission of nerve impulses for optimal health; and precise arrangement of these sagittal curves increases the strength of the spine and its resistance to injury up to 26 times.

Musculoskeletal disorders have been cited as the number one reason for early retirement among dentists; with the neck, upper back and lower back accounting for the overwhelming majority of injury complaints. Your working positions truly are critical to your well-being. Being aware of the correct positions is one thing, but practicing and perfecting them is another. Ergonomics, repetitive motion, and aggravating previous acute traumas are all factors of injury prevalent in the dental field. Due to the stress of sedentary, sustained, stressful positions such as:

- Prolonged, compromised positions
- Repetitive, forceful movements
- Poor posture
- Ill-fitting chairs and equipment
- Fast-paced workloads

**THE THREE MOST COMMON CONSEQUENCES ARE LOSS OF THE CERVICAL LORDOSIS, LOSS OF THE LUMBAR LORDOSIS AND INCREASE OF THE THORACIC KYPHOSIS. NONE OF THESE IS A GOOD THING.**

**EFFECTS ON THE SPINAL CORD**

As just stated, your spinal cord is the lifeline of your body. Millions of messages are being sent from the brain, down the spinal cord and out of every cell in the body.

Loss of the normal alignment of the vertebrae puts pressure on the nervous system and affects signaling to the entire body resulting in poorly affected health.

Researchers at University of Kiel, Germany looked at the amount of tension that the spinal cord is subjected to due to the various positions of the spine. During flexion of the cervical spine, they found that the spinal cord lengths 12 mm on average, whereas the spinal canal lengthens 28 mm on average. This means the spinal canal gets longer than the spinal cord during flexion by 15mm, creating disproportionate stretching.
which occurs during flexion. When this pattern is present for any length of time it is referred to as pathological tension. How often are you looking down during your day?

Further studies have shown that this stretching can lead to deterioration of the spinal cord and nerves. It may also lead to many different neurological symptoms, thinning of the spinal cord, vascular changes and cell death, including demyelinating diseases of the nervous system.

Narrowing of the spinal canal coupled with abnormal or excessive motion of the cervical spine results in increased strain and shear forces that cause localized nerve cell injury within the spinal cord. Particularly at the cervicothoracic junction (where the greatest amount of flexion occurs) the spinal cord stretches 24% of its length, causing spinal cord strain, and in the presence of vertebral subluxations can cause transient or permanent neurological damage.

Forward head posture and chronic loss of the cervical lordosis has been correlated with spinal cord flattening. Demyelination, cell loss and atrophy were found on the anterior surfaces of the spinal cord. Demyelination progressed with worsening of the cervical curve and there was significant loss of blood vessels in the area. Continuous mechanical compression and vascular changes in the spinal cord is a bad thing.

Due to the chronic stress of sitting for long periods of time, lumbar lordosis is often lost as well. When seated and leaning slightly forward there is a 190% increase in the pressure on the intervertebral discs of the lumbar spine. The loss of lumbar curve leads to recurrent/chronic low back pain, degenerative disc disease, and a host of illnesses related to the organs of the lower body.

We know how important a great smile can be for growing children and adults. An unattractive smile can make an individual self-conscious about laughing or smiling and keep you from fully enjoying life. Misaligned teeth and jaws can also cause pain and adversely affect your ability to chew, talk, and keep your teeth clean and healthy. So when that young teenage patient walks in, what are your recommendations, Doctor? I’m guessing it’s to correct the problems now before they become bigger, and maintain those corrections for the rest of your life (or as long as you’d like to keep your teeth). They have a choice to make and it’s your job to help them make the right decision because you’ve seen through your experiences what the wrong choices will lead to.

In the beginning of the 20th Century, Thomas Edison said, “THE DOCTOR OF THE FUTURE WILL GIVE NO MEDICINE, BUT WILL INSTRUCT HIS/HER PATIENT IN THE CARE OF THE HUMAN FRAME, IN DIET AND IN THE CAUSE AND PREVENTION OF DISEASE.”
Unless you have had a lifetime of perfect ergonomics (and this includes all that time in graduate school); unless you have an ongoing restorative plan coordinated by a corrective care chiropractor; even if you’ve been living only a few weeks with subluxations in your spine, it is degenerating and getting worse every day that you’re not working on it. Recall WOLF’s LAW: There are “almost immediate physiological effects of changes in alignment on weight-bearing bones”. In their study a 9/16th inch pad was placed under one foot. After 2 weeks, MRI revealed numerous areas of increased marrow signal intensity indicating bone marrow changes. (1996, Hylan, Yochum and Barry)

And if you’re thinking you’re in the clear because you don’t have any current symptoms consider this: a study was conducted to look at spinal alignment in people who had experienced any kind of spinal trauma over the course of their life. Regardless of how they were currently feeling, the trauma group showed 98% had loss of the lordosis and abnormal segmental motion, while in the no trauma group only 4% had hypolordosis. Also, disc herniations were present in 28% of the trauma group versus only 2% in the no trauma group. Virtually all abnormal disc conditions were present in tandem with loss of the normal lordotic curves.7

I know your schedule is full, but I encourage you to commit to working on your health now, instead of waiting until it is lost. I can’t help but think of a guy like Steve Jobs who despite having an incredible net worth and unlimited resources available to him, neglected his health until it was too late. Matter has its limitations, so please don’t wait until you’re completely incapacitated to do something about your health.

"CREATE A CULTURE OF WELLNESS THAT STARTS WITH THE DOCTOR AND FILTERS DOWN FROM THERE. CREATE A CULTURE OF GREAT SMILES, HAPPY STAFF, AND HEALTHY PEOPLE READY TO SERVE YOUR COMMUNITY TO THE FULLEST."

YOUR FUTURE DEPENDS ON IT.
REFERENCES


NEW & IMPROVED VERSION

ROUNDED, REINFORCED CLIP
STRONGER BRACKET

WON’T BEND OR BOW WITH SEVERE MALOCCLUSION CASES

UPDATED INSTRUMENT
NEON COLORED ELASTICS & NEW LATEX-FREE OPTIONS
THEIR SMILE WON'T GO UNNOTICED

Energy Pak™ Elastics
- Hypo-allergenic LATEX-FREE option eliminates latex allergy concerns
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- Individual bags are simple to dispense and easy to identify
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FLI® DOUBLE TUBES
WHAT'S BETTER THAN A SINGLE TUBE?
DOUBLE TUBES...

NEW DOUBLE TUBES AVAILABLE IN THE FLI® TUBES LINE AT RMO®

- Low Friction Slot: Rounded slot floor for reduced friction without sacrificing torque
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