THE BLACK BOX
OF ORTHODONTIC RESEARCH

First Edition

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The Black Box of Orthodontic Research.

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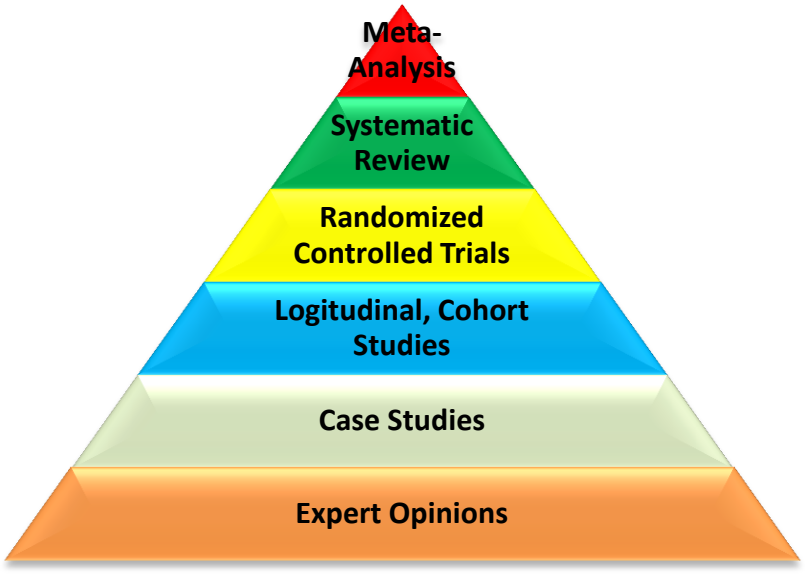
Preface

The black box of orthodontic research is considered as a reference for orthodontic professionals who look for validation and optimization of their basic knowledge, experience and updated research concerning the orthodontic field. The continuing development in orthodontic materials and mechanics led researchers from different countries to employ their efforts and capabilities to investigate any relation between these and their use in orthodontic treatment. Running multiple studies scenarios for different populations, needs to be organized and ranked according to article type and methodology incorporated to simplify the process of referencing and validating each orthodontic procedure used.

For this, it was my honorable opportunity to give a hand in this issue. For most orthodontic subjects encountered daily in practice, the most leading results, statements and conclusions of concern mentioned in literature will be documented in order of publishing time. Considering theses, beside focusing on the mentioned reference, will give orthodontists the complete picture of the idea.

It should be stated here that more focus on the leading orthodontic journals will be noticed. Those articles published with powerful methodology will be given a colored circle using different colors dependent on the hierarchy of the medical research.

Raed H. Alrbata



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Journals Abbreviations

Acta Odontologica Scandinavica: AOS

Andrews Journal: AJ

Australian Orthodontic Journal: AOJ

British Dental Journal: BDJ

British Journal of Orthodontics: BJO

Clinical Oral Implantology Research: COIR

Cleft Palate and Craniofacial Journal: CPCJ

Dental Record Journal: DRJ

Dentomaxillofacial Radiology: DR

International Journal of Adult Orthodontics and Orthognathic Surgery: IJAOOS

International Journal of Oral Maxillofacial Implants: IJOMI

International Journal of Paediatric Dentistry: IJPD

International Journal of Prosthodontics: IJP

Journal of Canadian Dental Association: JCDA

Journal of Clinical Orthodontics: JCO

Journal of Clinical Paediatric Dentistry: JCPD

Journal of Craniofacial Surgery: JCS

Journal of Dental Research: JDR

Journal of Esthetic Dentistry: JED

Journal of Oral Rehabilitation: JOR

Journal of Oral and Maxillofacial Surgery: JOMS

Journal of Orofacial Orthopaedics: JOO

Journal of Orthodontics: JO

Journal of Periodontology: JP

Journal of Plastic and Reconstructive Surgery: JPRS

Journal of Prosthetic Dentistry: JPD

Journal of the American Dental Association: JADA

Journal of the Korean Academy of Prosthodontics: JKAP

Journal of Wonkwang Dental Research Institute: JWDRI

Open Dental Journal: ODJ

Plastic and Reconstructive Surgery Journal: PRSJ

Puerto Rico Health Sciences Journal: PRHSJ

Quintessence International: QI

Scandinavian Journal of Dental Research: SJDR

World Journal of Orthodontics: WJO

Section one

Cephalometrics and Radiographic Analyses

Cephalometric Analyses Used in Orthodontics

Cervical Vertebral Maturation (CVM)

In this section, some of the reported researches concerning cephalometric analyses along with the technique of cervical vertebral maturation for growth prediction will be presented.

Cephalometric Analyses Used in Orthodontics

- Eastman correction can be applied if SNA is high/low and SN/MxP is normal. The correction states that for every 1 degree that the angle SNA falls below the standard value of 81 degrees, half a degree should be added to the ANB angle and vice versa. The correction is restricted for cases where the SN/MxP angle is the standard 8 ± 3 degrees.

Mills (1970). The application and importance of cephalometry in orthodontic treatment. The Orthodontist 32-47

- Jarabak ratio = PFH: AFH, The normal range is: 59 – 63%
  If ≥ 64: low angle case, deep OB;
  If ≤ 58: high angle case, reduced OB.

Jarabak & Fizzell (1972). Technique and treatment with the light wire edgewise appliance. Mosby Year Book, St Louis

- Wits appraisal: Assesses antero-posterior jaw discrepancy in relation to each other and not to cranial base. Useful if ANB does not reflect clinical findings. For Females: 0mm ±2mm= Class I, >2mm= Class II, <-2mm= Class III For Males: -1mm ± 2mm= Class I, >mm= Class II, < -3mm= Class III

Jacobson (1975). The Wits appraisal of jaw disharmony. AJO 67:125-138

- Esthetic Plane or "E" line: Is simply a line drawn from the tip of the nose to the tip of the chin. To have a pleasing facial profile, in the average Caucasian face, the lower lip would be 2 mm behind the line, and the upper lip 4 mm behind the line, with variations being normal for patients of different ethnic backgrounds.

Ricketts et al (1979). Bioprogressive Therapy, Denver, Rocky Mountain Orthodontics.

- Harmony (H) line: drawn tangent to soft tissue chin and upper lip. Should bisect nose.
  Lower lip to this line: -1 to +2mm.
  Tip of the nose to this line: +9mm.

Holdaway (1983). A soft tissue cephalometric analysis and its use in orthodontic treatment planning Part 1. AJO 84:1-28

- Zero median line: Perpendicular line from Nasion though Frankfort plane.
  Chin point should be at the line ± 2mm.

Gonzales-Ulloa and Stevens (1961). The role of chin correction in profile plasty. PRSJ 36:364-73

- Pitchfork analysis- superimposition of 2 or more lateral cephalometrics, registered on stable reference points to demonstrate skeletal and dental change.

Johnston (1996). Balancing the books on orthodontic treatment: An integrated analysis of treatment change. BJO 23:93-102

- Palatal rugae landmarks are as reliable as cephalometric structures for superimposition.

Hoggan and Sadowsky (2001). The use of palatal rugae for the assessment of anteroposterior tooth movements. AJODO 119: 482-8

Cervical Vertebral Maturation (CVM)

- The CVM method is modestly effective in determining the amount of postpeak circumpubertal craniofacial growth.

Fudalej and Bollen (2010). Effectiveness of the cervical vertebral maturation method to predict postpeak circumpubertal growth of craniofacial structures. . AJODO 137; 59–65

- Cervical vertebral maturation stages cannot accurately identify the mandibular prepubertal growth minimum and therefore cannot predict the onset of the peak in mandibular growth.

Ball et al (2011). Relationship between cervical vertebral maturation and mandibular growth. AJODO 139: e455–e461

- Cervical vertebral stage and dental age development is directly related to body mass index (BMI) percentiles. Orthodontists should consider weight status when evaluating growing children and adolescents because it can affect skeletal and dental development.

Mack et al (2013). Relationship between body mass index percentile and skeletal maturation and dental development in orthodontic patients. AJODO 143: 228–234

- Morphometric changes of the cervical vertebrae and the CVM method could not accurately identify the mandibular growth peak.

Gray et al (2016). Morphometric analysis of cervical vertebrae in relation to mandibular growth. AJODO 149: 92–98

- An association exists between the dental mineralization stages and the periods of the pubertal growth spurt, especially for second molars. Panoramic radiographs can be used as the first diagnostic tool to estimate the pubertal growth period.

Lopes et al (2016). Utility of panoramic radiography for identification of the pubertal growth period. AJODO 149: 509–515

Section Two

Materials Used In Orthodontics

Etching Materials

Bonding Materials

Self-etching Primers (SEPs)

Light Curing Devices

Orthodontic Brackets

Self-ligating Brackets

Archwires Used in Orthodontics

The main materials and equipments used in the daily orthodontic practice will be available in this section. Etching materials, bonding materials, brackets, archwires and light curing devices will be investigated for their performance, effectiveness, durability and safety.

Etching Materials

- No significant difference in bond strength between etching for 15, 30, 60 and 90 seconds; etching for longer than 90 seconds may result in lower bond strengths.

Wang and Lu (1991). Bond strength with various etching times on young permanent teeth. AJODO 100: 72-79

- Polyacrylic acid produces slight etching of the enamel surface. Calcium sulphate dihydrate crystals are formed which bond securely to the enamel surface. These can provide a shear bond strength above the threshold of 6-8 MPa recommended by Reynolds but 30% lower than that achieved with phosphoric acid.

Bishara et al (2000). Effect of altering the type of enamel conditioner on the shear bond strength of a resin-reinforced glass ionomer adhesive. AJODO118: 288-294

- The most widely accepted choice for routine orthodontic bonding is the use of 37% phosphoric acid with a 30 seconds etch time.

Gardner and Hobson (2001). Variations in acid-etch patterns with different acids and etch times. AJODO120: 64-67

Bonding Materials

- The mean linear tensile bond strength of enamel is 14.5 MPa.

Bowen and Rodriguez (1962). Tensile strength and modulus of elasticity of tooth structure and several restorative materials. JADA 64: 378

- Fractures in enamel can occur with bond strengths as low as 13.5 MPa.

Retief DH (1974). Failure at the dental adhesive-etched enamel interface. JOR 1: 265-284

- The minimum bond strength needed for clinical use is 5.9 - 7.8 MPa.

Reynolds IR (1975). A review of direct bonding. BJO 2: 171-178

- The conventional resin primer system produce higher bond strength (10.4 MPa) compared to glass ionomer cement (6.5 MPa).

Bishara et al (1999). Shear bond strength of composite, glass ionomer and acidic primer adhesive systems. AJODO 115: 24-28

- No advantage or disadvantage of precuring the primer on the bonding strength.

Osterle et al (2004). Effect of primer precuring on the shear bond strength of orthodontic brackets. AJODO 126: 699-702

- The addition of chlorhexidine digluconate to conventional GICs does not negatively modify the mechanical properties and may increase the antibacterial effects around the GICs even for relatively long periods of time.

Farret et al (2011). Can we add chlorhexidine into glass ionomer cements (GICs) for band cementation? Angle Orthodontist 81: 496-502

- Light-cured composite resin was compared with chemical-cured composite resin: The polymerization mode did not influence the bracket survival rate significantly.

Mohammed et al (2016). Comparing orthodontic bond failures of light-cured composite resin with chemical-cured composite resin: A 12-month clinical trial. AJODO 150: 290–294

Self-etching Primers (SEPs)

- Self-etching primers are moisture insensitive and work in wet and saliva contaminated conditions whilst maintaining their initial bond strength long term.

Cinader (2001). Chemical processes and performance comparisons of Trans bond Plus self-etching primer.

- The use of the SEP produced a significantly lower but clinically acceptable bond strength (7.1 MPa) than Transbond XT (10.4 MPa).

Bishara et al (2001). Effect of a self-etch primer/adhesive on the shear bond strength of orthodontic brackets. AJODO 119: 621-624

- Weak evidence that the self-etching primer has a higher failure rate but is still well within the limits of clinical acceptability.

Ireland et al (2003). An in vivo investigation into bond failure rates with a new self-etching primer system. AJODO 124: 323-326

- The use of SEP is quicker than a conventional bonding technique. No difference in survival time between the two bonding systems.

Aljubouri et al (2003). Laboratory evaluation of a self-etching primer for orthodontic bonding. EJO 25: 411-415

- The bond strengths for the self-etching primer and Transbond XT and 35% phosphoric acid and Enlight were compared and found similar.

Grubisa et al (2004). An evaluation and comparison of orthodontic bracket bond strengths achieved with self-etching primer. AJODO 126: 213-219

- Pumicing was found to produce a statistically and clinically significant reduction in clinical bond failure rates when using SEPs.

Burgess et al (2006); Self-etching primers: is prophylactic pumicing necessary? A randomized clinical trial. Angle Orthodontist 76: 114–118

- The shear bond strength of flowable composites increases with filler content. However, they have lower shear bond strength than 3M Unitek Transbond XT.

Uysal et al (2008). Microleakage under metallic and ceramic brackets bonded with orthodontic self-etching primer systems. Angle Orthodontist 78: 1089–1094