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REVIEW ARTICLE

Contributions of Charles J. Burstone in Orthodontics

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ABSTRACT:

Charles Burstone was an educator, researcher, clinician, author but his greatest quality is his dedication to orthodontics. There is no known sector in Orthodontics where we do not find his contribution. He has a keen interested in biomechanics in orthodontics. In the present review, we aim to highlight some of the important contributions of him in the field of orthodontics.

Key words: Charles J Burstone, Orthodontics.

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INTRODUCTION

Charles Burstone was born in Kansas City, Missouri, on April 4; 1928, to Dr. Lester and Rose Burstone. Like his father and brother, Charles graduated from the School of Dentistry at Washington University in St Louis, in 1950. He joined the U.S. Air Force in 1951 and served as a captain in the Dental Crops in Korea. In 1953 receiving his certificate and master's degree in Orthodontics from Indiana University in 1955. He accepted a faculty position at Indiana University, subsequently becoming the Chairman and Prof. in the Department of Orthodontics in 1961. In 1970 Dr. Burstone was recruit to Connecticut and selected to head the Department of Orthodontics at the new dental school at the University of Connecticut in Farmington. He served as professor and Head of the Department of Orthodontics and chief of Orthodontic Services at John Dempsey Hospital in Farmington from 1970 to 1992. Dr. Burstone is a member of the International Association for Dental Research, American Association of Orthodontics, E.H. Angle Society, American society of Biomechanics, Diplomate American Board of Orthodontics, and Honorary societies of Sigma Xi and Omicron Kappa upsilon.[1-3]

Dr. Burstone has been the recipient of research grants from the National Institutes of Health and private industry. From the start of his career he has been awarded with various National and International awards:[4-6]

1956 - AAO Research Essay Award
1965 - Appointed to dental study section of US Public Health Service
1969 - President of Great Lake Society of Orthodontists
1979 - Director of American Board of Orthodontists
1983 - Strang Award by Connecticut Society of Orthodontists
1983 - Tokyo Medical-Dental Research Award
1986 - President of American Board of Orthodontists
1987 - Sociade De Ortodoncia De Chile Award
1990 - Robert Strang Memorial Lecture Award
1991 - Jarabak Lecture Award, University of Michigan
1994 - Inducted into Royal College of Surgeons in Edinburgh, Scotland
1999 - Ketcham Award by American Society of Orthodontists
2002-Jarabackscholar, Indiana university

Charles Burstone is an educator, researcher, clinician, author but his greatest quality is his dedication to orthodontics. There is no known sector in Orthodontics where we do not find his contribution. He has a keen interested in biomechanics in orthodontics.

CONTIBUTION IN SPECIFIC SECTOR IN ORTHODONTICS:

A) DIAGNOSIS AND TREATMENT PLANNING OF PATIENTS WITH ASYMMETRIES[7]

The diagnosis, treatment planning, and design of mechanics for the asymmetric patient requires the differentiation between problems of dental and skeletal origin. Although much information can be gleaned from a cephalometric analysis, the clinical examination and study models offer important clues in establishing the diagnosis of skeletal discrepancy.

Abnormal and asymmetric axial inclinations can either produce a dental asymmetry or, if compensatory in nature, may mask an underlying skeletal problem. The role of axial inclination in diagnosis is applied to the following situations: subdivision cases, unilateral cross bites, midline discrepancies, arch form deviations, and frontal cants to the occlusal plane.

By evaluating parameters such as axial inclinations of teeth and the amount of space available, valid judgments can be made to assist in developing an appropriate treatment plan.

The four main parameters were given by Burstone, they are:

i) Differential Diagnosis Based on Tooth Position: The Posterior Teeth
ii) Differential Diagnosis of Midline Discrepancies
iii) Arch Form Symmetry and Arch Correspondence
iv) Occlusal Plane Considerations

II. CEPHALOMETRICS FOR SURGICAL PATIENTS

I) CEPHALOMETRICS FOR ORTHOGNATHIC SURGERY[8]
II) AN EVALUATION OF SOFT-TISSUE CHANGES RESULTING FROM

LE FORT I MAXILLARY SURGERY[9, 10]

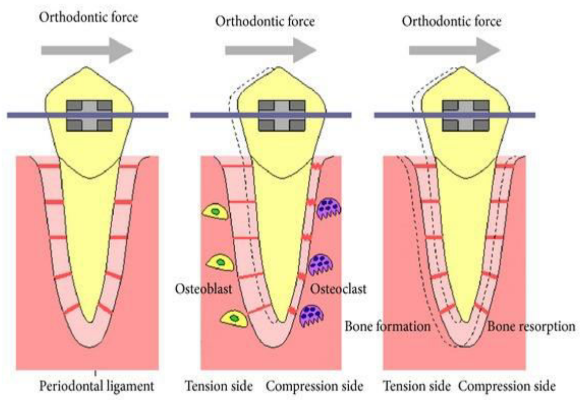
I) **CEPHALOMETRICS FOR ORTHOGNATHIC SURGERY**[10]**:**

This analysis was developed at university of Connecticut based on a system from Indiana University and further developed by addition at Connecticut by Dr.Charles Burstone et al. He presented it first in the journal of Oral Surgery, 1978 April followed by soft tissue cephalometrics analysis for Orthognathic Surgery in Journal of Oral Surgery, 1980

i) A cephalometric analysis especially designed for the patient who requires maxillofacial surgery was developed to use landmarks and measurements that can be altered by common surgical procedures..
ii) The first steps in the diagnosis of orthognathic surgical patient is to determine the nature of dental and skeletal defects.
iii) The commonly used orthodontic analyses are primarily designed to harmonize the position of the teeth with the existing skeletal pattern. Patients requiring orthognathic surgery usually have facial bones as well as tooth positions that must be modified by a combined orthodontic and surgical treatment.

III. BIOLOGY OF TOOTH MOVEMENT[11]

A significant component of orthodontic treatment involves bone remodeling and growth alteration by the application of orthodontic forces. Teeth and bones are stressed with concomitant remodeling of bone, periodontal ligament (PDL), periosteum, and sutures. The changes within the periodontium are well documented and demonstrate the adaptability of the PDL and the surrounding bone to both appliance-initiated as well as natural forces acting on the dentition. A highly relevant question can be posed: what is an optimal force system for orthodontic tooth movement and its concomitant bone remodeling? Although our discussion in this chapter will be limited to tooth movement, many of the same principles are certainly applicable to the broad range of bone remodeling associated with orthodontic treatment. An optimal orthodontic treatment must have at least two characteristics. First, it must move a tooth or teeth to a desired position. This characteristic is the displacement pattern of the tooth which can be described by the concept of center of rotation. The second characteristic of an optimal force system relates to the goal of producing an optimum biological response. Considerations include the rate of tooth movement as well as minimization of tissue damage. Although these two characteristic are intimately related, it is useful for discussion to separate them in discussing optimal forces.



TOOTH MOVEMENT: A CONCEPTUAL FRAMEWORK

According to C.J. burrstone, tooth movement, is a function of both externally applied forces and internally operating biological phenomena which alter strain patterns, PDL constitutive behavior, and PDL width.[12]

ORTHODONTIC FORCE SYSTEM

•STRESS IN PDL BONE
•STRAIN IN PDL BONE
•BONE REMODELLING

IV: ORTHODONTIC WIRES AND MATERIALS

A new nickel-titanium alloy has been developed especially for orthodontic applications by Dr. Tien Hua Cheng and Dr.C.J.Burstone at the General Research Institute for Non-Ferrous Metals in Beijing, China. This alloy has unique characteristics and offers significant potential in the design of orthodontic appliances. Its history of little work hardening and a parent phase which is austenite yield mechanical properties that differ significantly from nitinol wire. In addition, Chinese NiTi wire has a much lower transition temperature than nitinol wire.[13]

It is useful to compare the properties of the Chinese NiTi wire with both stainless steel and nitinol wires. Three wire characteristics will be described:

(1) the springback (the range of action of the wire)
(2) stiffness (the force or moment produced for each unit activation)
(3) the maximum moment (the largest bending couple that a wire is capable of delivering). [13]

V. APPLICATION OF BIOENGINEERING IN ORTHODONTICS

Data on the vertical loop retraction spring suggest that additional wire placed apically at the loop would have the effect of raising the moment-to-force ratio while simultaneously reducing the load-deflection rate. With this in mind, an experiment was carried out in which added wire was placed gingivally, forming a T loop. As one increases the gingival-horizontal length (G) of the loop, the moment-to-force ratio increases. It will be remembered that a standard vertical loop 6 mm. in height had a moment-to-force ratio of 2.2. When the additional horizontal wire is added, the moment-to-force ratio increases but never quite approaches 6, which is the vertical height of the T loop. With a horizontal length (G) of 50 mm., the moment-to-force ratio is 5.3.[14]

There are two important conclusions that can be drawn from this experiment: First, the moment-to-force ratio can never be higher than the vertical length of the loop that is used. Thus, if a higher moment-to-force ratio is required, it is necessary to use a greater vertical height. Second, additional horizontal wire placed gingivally will raise the moment-to-force ratio for any given loop length. At the same time, a very dramatic lowering of the load-deflection rate can be obtained. In moment-to-force ratio and load-deflection rate are plotted for a series of 8 mm. tall T loops. Note that the effect of adding horizontal wire lengths gingivally is much greater upon the load-deflection rate than upon the moment-to-force ratio and that the moment-to-force ratio approaches 8 but never quite reaches it.[15]

During orthodontic therapy, correction of deep overbite in patients with flared incisors is a difficult biomechanical challenge, since uprighting of incisors often lengthens the crowns vertically and increases the overbite. Deep overbite may be accompanied by intra arch spacing associated with flared incisors, or intra arch crowding requiring pre- molar extractions.[16] In extraction cases, alignment of the anterior teeth does not correct their axial inclinations or the deep overbite. In either extraction or non extraction therapy, the deep overbite must be corrected to ensure that full space closure is possible when the canine relationship is Class I; therefore simultaneous intrusion and retraction of the anterior teeth may be desirable to achieve optimum treatment results. During intrusion of the anterior teeth, control of their labiolingual axiaI inclinations during retraction is critical for successful completion of treatment.[17]

Among his countless other accomplishments:[18-21]

•Gave the concept of segmentation in orthodontics in 1962.

•In 1967, he developed the famous three piece intrusion arch

•Dr. C.J. Burstone has contributed to the field of diagnosis and treatment planning of orthodontic and orthognathic patients. His work studied under following topics of

1.Diagnosis and Treatment Planning of Patients with Asymmetries
2. Lip posture and its significance in treatment planning
3. Computerized interactive orthodontic treatment planning
4. Diagnosis and treatment planning of skeletal asymmetry with the sub mental-vertical radiograph
5. Soft-tissue profile Fallacies of hard-tissue standards in treatment planning and
6. Advances in diagnosis and detection of oral diseases.

•Generated numerical algorithm from the equations yielding a computer code which is capable of determining the static. dynamic and free vibration characteristics of a non-uniform. nonhomogeneous, anisotropic beam which has arbitrary curvature and arbitrary twist.

•Along with Koening studied the major factors that will allow the orthodontist to optimize the use of frictionless retraction springs for optimum anterior and canine retraction in the year 1976.

•Stated the principles of incisor and canine intrusion and has demonstrated the use of intrusion springs that are capable of intruding incisors with minimal side effects on the posterior teeth.

•In 1978 Burstone used Computer programs in orthodontics for cephalometric analysis and for data-retrieval systems. Cephalometric analysis using a computer program is a relatively well-defined problem. The skeletal landmarks are converted into coordinates in a geometric space and an analysis is chosen. A computer program can then be written to calculate the desired angles and distances. If standards are available for the analysis, then the results can be compared to a table of standards that are already stored in the computer

•Burstone along with Hanley conducted a study on Diagnosis and treatment planning of skeletal asymmetry with the submental-vertical radiograph and presented a system of cephalometric analysis for the assessment of skeletal asymmetry in the horizontal plane. The analysis is useful when diagnosis of the severity of a skeletal asymmetry is crucial in determining when orthognathic surgery or orthodontic therapy would be the most efficient mode of treatment.

•BAUM and CJ. BURSTONE grouped anticipated advances into short-term (~5 years), intermediate (-10 years), and long-term (-25 years) categories. SHORT-TERM ADVANCES includes Radionuclides in the Diagnosis of Periodontal Disease, Direct Imaging Methods, & Humoral Markers for Pain and Tissue Injury. INTERMEDIATE ADVANCES included Molecular Probes for Identifying Tumor Cells and Identifying Specific Therapies & Diagnostic Probes for Assessing Functional Capacity of Salivary Epithelial Cells.[25]

CONCLUSION

Deep overbite correction and space closure can be simultaneously achieved with the three-piece base arch intrusion mechanism in patients with flared incisors. The force system delivered on the anterior segment depends on the point of application of the intrusive force and its direction. This segmented approach to intrusion and retraction is clinically advantageous because it allows simultaneous control of tooth movement in the vertical and antero posterior planes. The low load deflection rate of this appliance delivers a constant intrusive force, and the levels of force can be kept low. The design of this appliance allows the clinician to deliver a well-controlled, statically determinate force system in which only minimal chair side adjustments are required.

REFERENCES

1 Burstone CJ.. Rationale of the segmented arch. Am J Orthod. 1962 Nov;48:805-22.
2 Burstone CJ. The mechanics of the segmented arch techniques. Angle Orthod. 1966 Apr;36(2):99-120.
3 Burstone CJ , Lip posture and its significance in treatment planning, AJODO, April1967, Volume 53 Number 4.
4 Burstone CJ , Malocclusion : New directions for research & therapy, SPECIALISE ISSUE / JADA, Vol.87 , October 1973.
5 Herbert A. Koenig And Charles J. Burstone, Analysis Of Generalized Curved Beams- For Orthodontic Applications, J Biomechanics-1974, Vol-7, P.429-435.
6 Burstone CJ, Koenig HA. Optimizing anterior and canine retraction. Am J Orthod. 1976 Jul;70(1):1-19.
7 Joseph C. Defranco, Herbert A. Koenig And Charles Burstone, Three-Dimensional Large Displacement Analysis Of Orthodontic Appliances, J Lhomerhnn~ra. 1976. Vol 9. ,,p 797401.
8 Burstone CJ. The segment arch approach to space closure. Am J Orthod. 1982 Nov;82(5):361-78.
9 Mansour S, Burtstone C, Legan H. An evaluation of soft tissue changes resulting from Le Fort I maxillary surgery. Am J Orthod. 1983 Jul;84(1):37-43
10 Goldberg AJ, Burstone CJ, Koening HA. Plastic deformation of orthodontic wires. J Dent Res. 1983 Sep;62(9):1016-20.
11 Burstone CJ, Goldberg AJ. Maximum forces and deflections from orthodontic appliances. Am J Orthod. 1983 Aug;84(2):95-103.
12 Goldberg AJ, Morton J, Burstone CJ. The flexure modulus of elasticity of orthodontic wires. J
13 Park YC, Burstone CJ. Soft-tissue profile—fallacies of hard-tissue standards in treatment planning. Am J Orthod Dentofacial Orthop. 1986 Jul;90(1):52-62.
14 Nelson KR, Burstone CJ, Goldbery AJ. Optimal welding of beta titanium orthodontic wire. Am J Orthod Dentofacial Orthop. 1987 Sep;92(3):213-9
15 Koening HA, Burstone CJ. Force system from an ideal arch—large deflection considerations. Angle Orthod. 1989 Spring;59(1):11-6.
16 Baum B J ,Burstone CJ.Advances in diagnosis and detection of oral diseases.Adv Dent Res 3(1):7-13 ,may 198
17 Tanne K, Nagataki T, Inoue Y, Sakuda M, Burstone CJ. Patterns of initial tooth displacements associated with various root lengths and alveolar bone heights. Am J Orthod Dentofacial Orthop. 1991 Jul;100(1):66-71.
18 Shroff B, Lindauer SJ, Burstone CJ. Leiss JB. Segmented approach to simultaneous instrusion and space closure: biomechanics of the three-piece base arch appliance. Am J Orthod Dentofacial Orthop. 1995 Feb;107(2):136-43.
19 Bhavna Shroff, Steven J. Lindauer and Charles J. Burston, Class II subdivision treatment with tip-back moments, European Journal of Orthodontics 19 (1997) 93-101.
20 Burstone CJ. Diagnosis and treatment planning of patients with asymmetries. Semin Orthod. 1998 Sep;4(3):153-64.
21 Tripolt H, Burstone CJ, Bantleon P, Manschiebel W. Force characteristics of nickel-titanium tension coil springs. Am J Orthod Dentofacial Orthop. 1999 May; 115(5):498-507
22 Charles J. Burstone , Biomechanics of Deep Overbite Correction, Semin Orthod 2001;7:26-33.
23 K.A. Eckrote, C.J. Burstone, M.A. Freilich, G.E. Messer, and A.J. Goldberg, Shear in Flexure of Fiber Composites with Different End Supports, J Dent Res 82(4):262-266, 2003.
24 Evan Steenbergen, C. J. Burstone, Prahl-Andersen, H. A. Aartman, The Role of a High Pull Headgear in Counteracting Side Effects from Intrusion of the Maxillary Anterior Segment, Angle Orthod 2004;74:480–486.
25 Norton L A ,Burstone C J. Biology of tooth movement.Florida,CRC Press;1988:321-34