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Different brackets prescription

A Project Submitted to
The College of Dentistry, University of Baghdad, Department of Orthodontics in Partial Fulfillment for the Bachelor of Dental Surgery

By

Noor Ali Abbas

Supervised By:

Assist. Prof. Dr. Haider Mohammed Ali
B.D.S., MSc.

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بسم الله الرحمن الرحيم

صدق الله العظيم

Certification of the Supervisor:

I certify that this project entitled “Different Brackets Prescription” was prepared by the fifth-year student “Noor Ali Abbas” under my supervision at the College Dentistry/University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry.

Supervisor’s name: **Assist. Prof .Dr. Haider Mohammed Ali**
B.D.S., M.Sc.
April 2022

Dedication

This study is wholeheartedly dedicated to my beloved parents, who have been my source of inspiration and gave me strength when i thought of giving up, who continually provide their moral, spiritual, emotional, and financial support, to my brothers, sister, friends, and classmates who shared their words of advice and encouragement to finish this study.

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List of abbreviations

Abbreviation	Deceptive
SL	Self-ligating
SWA	Straight wire appliance

Introduction

Brackets act as handles to transmit the force from the active components to the teeth, the aim of this review is to spotlight the orthodontic brackets and the way they assist the orthodontist to offer better treatment aesthetically, orthodontic brackets are an important component in order to deliver the precise force from the wire to the teeth, brackets should have the right hardness and strength, they ought to have a smooth arch wire slot to scale back frictional resistance and an otherwise `smooth surface to scale back plaque deposition **(Kannan *et al*., 2020).**

Orthodontic patients, including a growing population of adults, not only want an improved smile, but they also want better aesthetics during treatment, the development of appliances that combines both acceptable aesthetics for the patient and adequate technical performance for the clinician is the need of the hour, there has been a recent trend towards the development of smaller stainless steel brackets but although these generally provide the technical performance required by the orthodontist the aesthetic advantage over conventionally sized appliances is limited **(Kakadiya *et al*., 2017).**

With time so many clinicians put forward their own prescriptions of brackets, for effective use of these prescriptions many of them also advocated their own treatment mechanics and bracket position on teeth, some of these prescriptions were also even disowned after copyright of the patent was expired, other prescriptions were changed with time after hit and trials reveals the flaws within them, in many cases same prescription vary between different bracket manufacturers, order to avoid copyright and patent violation many manufacturers produce the same prescription with minor changes in tip and torque values, even different values in 0.018” and 0.022” slots of same prescription are sold by the manufacturers,this is due to more clearance between wire and slot in 0.022” slot so 0.022” slots are sometimes made in higher torque values than 0.018 “ slot **(Proffit *et al*., 2000).**

Many text books of orthodontics show charts containing only tip and torque and no importance is given to counter rotation and mesial offset,some bracket sold in the markets have prescriptions which are never endorsed by any clinician, meaning manufacturers also make their own prescriptions **(Sernetz, 1993).**

Aims of the study

The aims of the study are to answer one simple question:

(What is the best prescription for every case? Is it a single prescription or hybrid?**)**.

And this question will be answered by reviewing different bracket prescriptions in order to reach a goal of choosing the best prescription for every patient that facilitates the orthodontist work.

Chapter one

Review of literatures

1. Definitions

1.1. Brackets

Orthodontic brackets are important part of fixed appliances which are temporarily attached to the teeth during the course of orthodontic treatment; they are used to deliver forces from the wires or other power modules to the teeth (**Khans, 2015**).

1.2. Tip or Crown angulation

Crown angulation as the name indicates, is the angulation of long axis of the clinical crown (LACC) or facial axis of clinical crown (FACC), crown angulation is measured by the angle formed between LACC or FACC and line perpendicular to the occlusal plane Crown tip is expressed in degrees with positive (+ve) or negative (-ve) sign, positive sign indicate that gingival portion of the long axis of the crown is more distal to the incisor portion while negative sign indicates the opposite

(Kusy and Whitle, 1999).

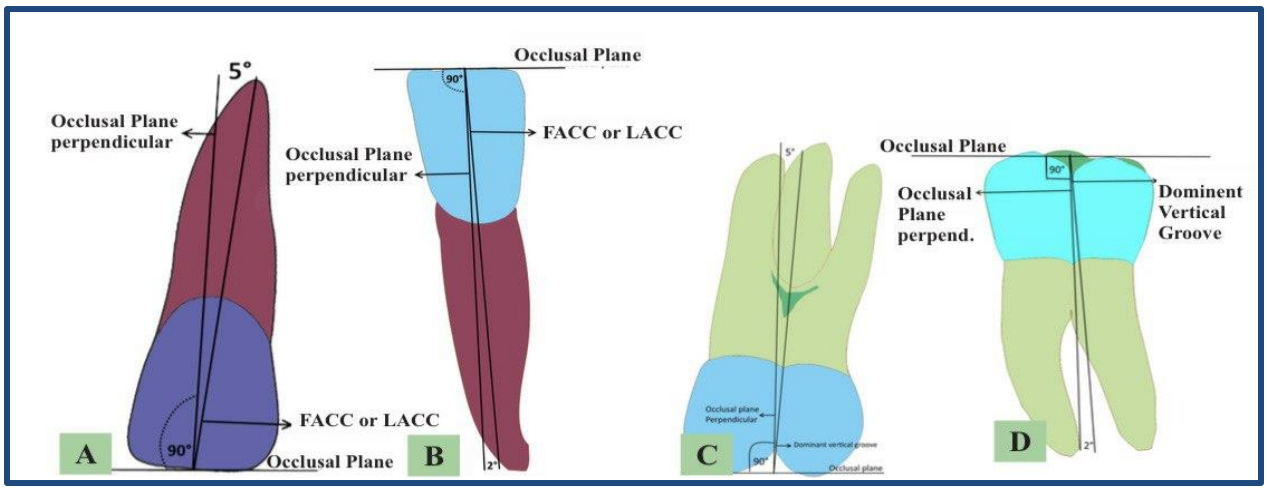

Figure (1) Tip or crown angulation **(Khans, 2015).**

1.3. Torque or Crown inclination (labiolingual or buccolingual inclination)

It was is inclination of long axis of clinical crown (LACC), crown inclination is measured by angle formed by a line tangent to the middle of the labial or buccal long axis or facial axis of the clinical crown (LACC or FACC) and a line that is 90° to the occlusal plane, Crown inclination is measured in degrees with positive or negative sign, a positive sign is given when gingival portion of the tangent line or gingival portion of crown is lingual or palatal to the incisor portion, a minus or negative sign is given when gingival portion of the tangent line or gingival portion of crown is buccal or labial to the incisor portion **(Dolci *et al*., 2013).**

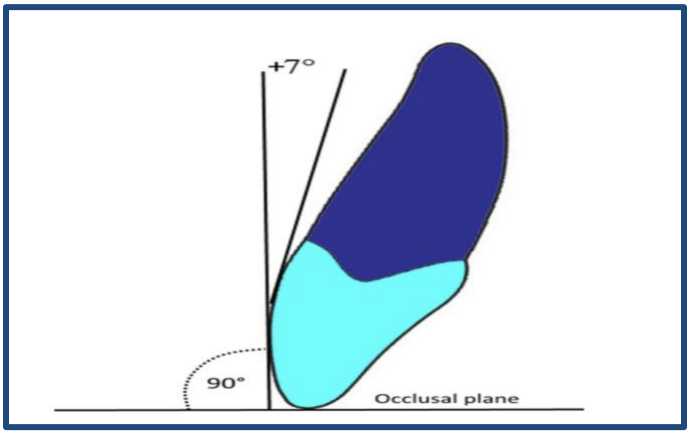

Figure (2) Torque or Crown inclination **(Khans, 2015).**

2. History

The origin of orthodontic brackets can well be coined with the origin of orthodontics and the human desire to align crooked teeth, the first written record to correct crowded or protruded teeth is found 3000 year ago **(Weinberger, 2001).**

Orthodontic appliances to correct maligned teeth have been found in Greek, Etruscan and Egyptian artifacts, these ranges from crude metal wire loupes to metal bands wrapped around individual teeth in ancient Egyptian mummies **(Wahl, 2005).**

Pierre Fauchard (1678 –1761) a French dentist was the first to make a scientific attempt to align irregular teeth by an appliance named Bandeau, this appliance was made of precious metal and it was shaped like a horse shoe to align teeth by arch expansion,

another French dentist used swelling threads and wooden wedges to separate crowded teeth, Horace H. Hayden (1769-1844) invented bands with soldered knobs to correct tooth rotation, in 1803, Joseph Fox invented a modified version of bandeau appliance that consisted of silver or gold rim, Harris in 1850 attached metal caps to molar and took anchorage from palate in his expansion appliance **(Chapman, 1955).**

Edward Hartley Angle (1855-1930) was the most dominant and influential figure in orthodontics and is regarded as the "Father of Modern Orthodontics." Angle developed four major orthodontic appliance systems which lay the basis of contemporary fixed braces **(Asbell, 1990).** These appliances were:

2.1. E Arch

The first device developed by Angle was E arch in late 1890s, this appliance was in fact a mix of ideas from previous expansion appliance, in this appliance a heavy labial arch extends around the arch with the end of the wire threaded and placed in the molar bands **(Asbell, 1990).**

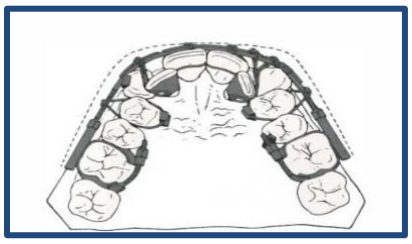

Figure (3) E-Arch **(Proffit *et al*., 2000).**

2.2. Pin and tube appliance

To have a better control over position of all the teeth and to achieve their bodily movement Angle banded the entire arch in his Pin and tube appliance, In this appliance small pins were soldered on the arch wire and these pins fit in the vertical tubes of the bands **(Johnson, 1934).**

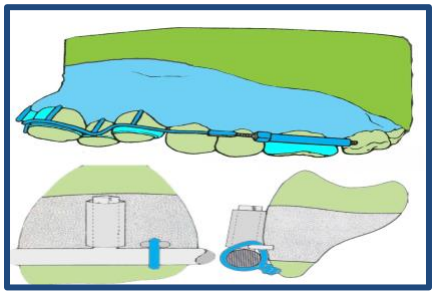

Figure (4) Pin and tube appliance **(Weinberger, 2001).**

2.3. Ribbon Arch Appliance

In 1916 Angle introduced his Ribbon arch appliance which was a modified version of pin and tube appliance, in this appliance the tubes were modified to provide a vertically positioned rectangular slot that was facing occlusally **(Lewis, 1950).**

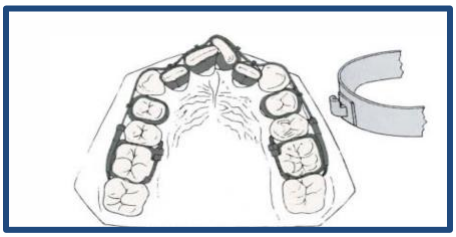

Figure (5) Ribbon arch appliance **(Proffit *et al.*, 2000).**

2.4. Edgewise appliance

Angle developed the edgewise appliance between (1923 to 1925) and that was introduced in orthodontics in 1928, these brackets were attached to bands and were made of soft gold, the edgewise brackets (0.022" x 0.028") had a horizontal slot instead of vertical slot in which the rectangular wire was rotated 90° to its previous orientation in ribbon arch appliance,(0.0215" x 0.0275") gold rectangular wire was inserted into the slot and retained in the slot by ligature wires **(Cross, 1996).**

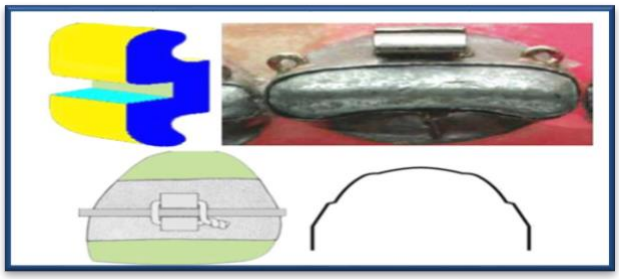

Figure (6) Edgewise appliance **(Cross, 1996).**

2.5. Labiolingual twin Wire

Which used bands on first molars and a combination of heavy lingual and labial archwires to which finger springs were soldered to move individual teeth, and the twin-wire appliance **(Kim *et al*., 2010).**

Figure (7) Twin wire appliance **(Johnson, 1934)**

2.6. Begg appliance

Given angles insistence on expansion of the arches rather than extraction to deal with crowding problems, it is ironic that the edgewise appliance finally provided the control of root position necessary for successful extraction treatment, the appliance was being used for this purpose within a few years of its introduction Charles Tweed, one of Angle's last students, was the leader in the United States in adapting the edgewise appliance for extraction treatment in fact, little adaptation of the appliance was needed, tweed moved the teeth bodily and used the subdivision approach for anchorage control, first sliding the canines distally along the archwire, then retracting the incisors**(EIMowafy, 2010).**

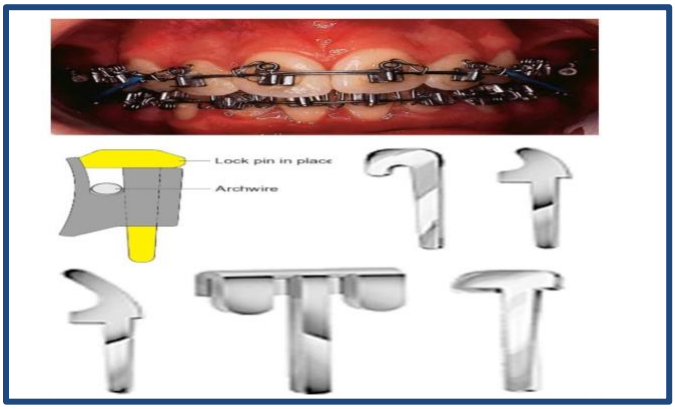

Figure (8) Begg appliance **(Begg, 1956)**

2.7. Contemporary Edgewise

The Begg appliance became widely popular in the 1960s because it was more efficient than the edgewise appliance of that era, in the sense that equivalent results could be produced with less investment of the clinician's time, developments since then have reversed the balance: the contemporary edgewise appliance has evolved far beyond the original design while retaining the basic principle of a rectangular wire in a rectangular slot, and now is more efficient than the Begg appliance, which is the reason for its almost universal use now **(Proffit *et al*., 2000).**

Figure (9) Contemporary Edgewise **(Proffit *et al*., 2000).**

2.8. Self-ligating brackets

The concept of self-ligation in orthodontic brackets came from begg technique of using brass pins to hold the wire within the bracket, self-ligating brackets are divided into

active and passive ligating brackets depending upon the mechanism of closure of ligating clip and holding the wire in slot **(Stolzenberg, 2003).**

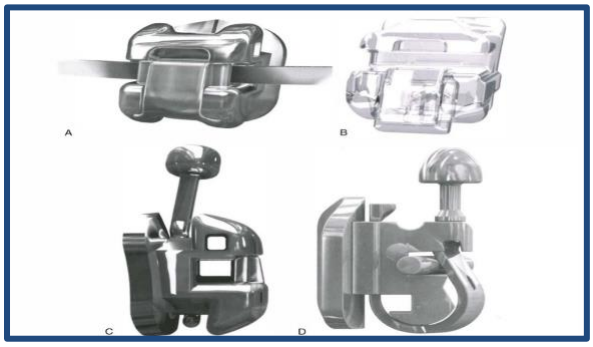

Figure (10) Self-ligating brackets **(Kim *et al.*, 2010).**

2.9. Lingual Brackets:

Lingual brackets have a long history but they were first reported in 1978 by Kinja Fujita in Japan, to avoid injury to lips and cheeks by the brackets for patients who practiced martial arts **(Fujita, 1978).**

Figure (11) lingual bracket **(Wahl, 2015).**

2.10. Customized labial brackets

Customized labial bracket uses CAD/CAM technology similar to customized lingual brackets, Not only brackets, but wires are also customized for each individual patient, as increased cost is involved in these brackets fabrication so these brackets have yet to gain popularity **(Kesling, 1989).**

3. Classification of the brackets according to materials

Ideal bracket in terms of material prospective should have following qualities: Biocompatible in oral environment, low cost , high modulus of elasticity , high corrosion resistance , no magnetic properties, no friction on bracket wire interaction , correct strength and hardness , resist staining and discoloration in oral environment , resist plaque deposition, and meet patient aesthetic demands **(Matasa, 2003).**

3.1. Metal Brackets

A. Advantages

Less expensive, sterilized and recycled, resist deformation and fracture, exhibit least friction at the wire bracket interface **(Kannan *et al*., 2020).**

B. Disadvantages

Not aesthetically pleasing, patient tends to have a metallic smile, they can corrode and cause staining of teeth **(Kannan *et al*., 2020).**

There are four main types of metal brackets used in modern orthodontics, these are:

a. Stainless steel brackets b. Cobalt chromium brackets

c. Titanium brackets d. Precious metal brackets

3.2. Plastic brackets

Plastic brackets are either translucent or transparent to fulfill aesthetic demand during treatment and to make the treatment less visible, plastic brackets are usually manufactured from plastic injection molding and are good alternative of metal brackets for patients having nickel allergy **(Brandt, 1979).**

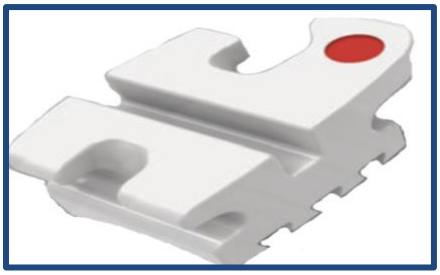

Figure (12) plastic bracket **(Brandt, 1979)**

Advantages

They were introduced to improve the aesthetic value of the appliances, plastic brackets are available in tooth colored or transparent forms **(Douglass, 1989).**

Disadvantages

Discolor particular in patients who smoke or drink coffee, poor dimensional stability, slots tends to distort, the friction between plastic brackets and metal arch wire is higher than metal of stainless steel brackets **(Kannan *et al*., 2020).**

3.3 .Ceramic brackets

Ceramic Brackets ceramics are broad class of inorganic materials which are neither metallic nor polymer, ceramics includes glasses, clays, precious stones and metal oxides, ceramic is 3rd known hardest material and is harder than stainless steel and enamel **(Douglass, 1989).**

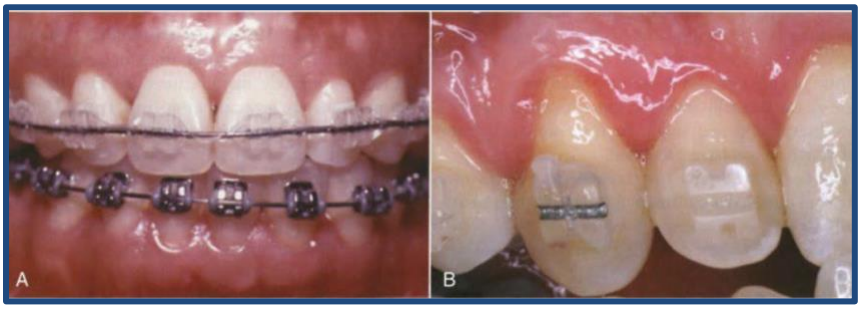

Figure (13) ceramic bracket **(Chatzigianni *et al*., 2010).**

Advantages

Superior aesthetic, high wear resistance and better color stability over the plastic brackets, because of short coming of plastic brackets ceramic brackets have gained increased interest especially in adults, ceramic brackets are inert and can safely be bonded in patients with nickel and chromium allergy **(Michalske *et al*., 1986).**

Disadvantages

Ceramic brackets provide high bond strength, Due to increase hardness there is difficulty in debonding, more chances of enamel damage and bracket fracture on debonding and tooth attrition, discoloration of ceramic brackets also occurs in cases with

longer treatment time and due to stress corrosion, ceramic, being the 3rd hardest material is harder than stainless steel wires, ceramic brackets are radiolucent and so can't be detected by x rays if accidentally aspired or swallowed during debonding **(Michalske *et al*.,1986).**

4. Classification of the brackets according to slot size

1. Slot size 0.018 2. Slot size 0.022

Usually clinician who favor loop mechanics for space closure prefer 0.018" slot while clinician who choose sliding mechanics for space closure favor 0.022" slot, as 0.018" slot is more efficient in torque expression, cases requiring greater torque expression are usually treated with 0.0.18" slot brackets, such case included class II div2, surgical case requiring decompensation and growth modification cases, according to a survey 54% of orthodontists prefer 0.022 inch slot size, 40.5% used 0.018 inch slot and 5% used a combination of above slots (biodimensional mechanics) or some other bracket style, to decrease confusion in selection of slot size there are increased efforts by some orthodontists to bring uniformity in slot size and give it a standard measuring unit **(Swartz, 2001).**

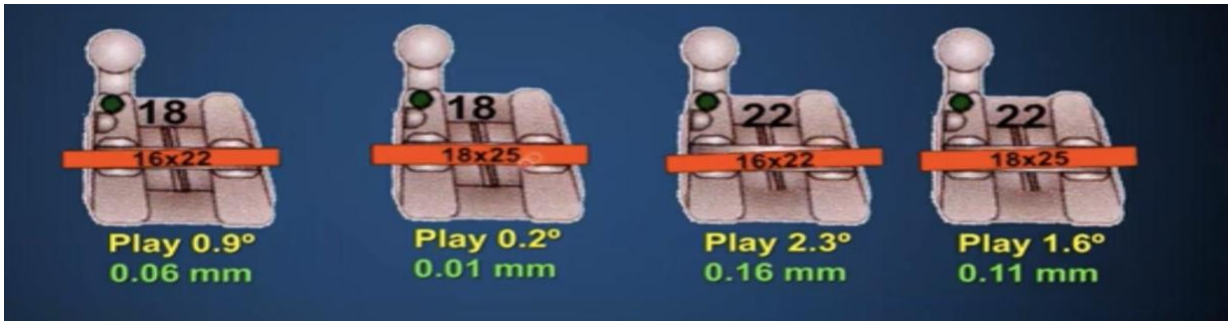

Figure (14) Slot size 0.018 and Slot size 0.022 **(Al-Huwaizi, 2021).**

5. Brackets prescription

5.1. Standard edgewise brackets

The brackets having no built in in/out, tip and torque are called standard edgewise brackets introduced by Angle, It was proposed that this appliance does not require wire

bending during treatment hence the name Straight wire appliance (SWA) was given to it **(Andrews, 1989).**

5.2. The preadjusted edgewise brackets

Have tip, torque, in and out bends built within the brackets, it was believed that these appliances don't require wire bending hence the name Straight wire appliance was given to them **(Weinberger, 2001).**

5.2.1. Andrew Prescription

Lawrence F. Andrew introduced the first preadjusted brackets where all the bending's needed in arch wire in standard edgewise bracket system were built within the brackets, it was proposed that this appliance does not require wire bending during treatment hence the name Straight wire appliance (SWA) was given to it **(Andrews, 1972).**

Andrew Prescription

1. Key I: Interarch Relationship
2. Key II: Crown Angulation or Mesiodistal Crown tip
3. Key III: Crown inclination or Torque
4. Key IV: Absence of Rotations
5. Key V: Tight Contact points
6. Key VI: Flat Occlusal plane or Curve of Spee

Table (1) Andrew prescription **(Profit *et al*., 2012)**

Teeth	**Central Incisors**		**Lateral incisors**		**Canine**		**1st premolar**		**2nd premolar**		**1st molar**		**2nd molar**	
	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip
Maxillary Arch	+7	+5	+3	+9	-7	+11	-7	+2	-7	+2	-9	+5	-9	+5
Mandibular Arch	-1	+2	-1	+2	-11	+5	-17	+2	-22	+2	-30	+2	-35	+2

5.2.2. Alexander prescription

Alexander's prescription by R.G. “Wick” Alexander (1978) using 0.018” slot brackets and 0.017x0.025” wire Alexander advocated individualizing bracket positioning for each patient to effectively use his bracket prescription, R. G. Wick Alexander developed the vari simplex discipline in 1978, the „vari“ indicates the variety of brackets used, „simplex“ signifies the principle of, Keep It Simple Sir, and discipline“is to reflect the idea that orthodontist must be knowledgeable in edgewise mechanics **(Alexander, 1983).**

Bracket selection

Each tooth has a particular bracket that is most effective **(Al-Zubair, 2015)**

1. Twin Brackets (Diamond brackets): are used on large, flat surfaced teeth maxillary central and lateral incisors
2. Lang Brackets: were invented by Howard Lang, used with the Diamond design on large, round-surfaced teeth at the corners of the arch – maxillary and mandibular cuspids
3. Lewis Brackets: are used on large, round-surfaced teeth that are not at the curve of the arch maxillary and mandibular bicuspids and on small flat surfaced teeth –mandibular incisors
4. Other Attachment: Twin brackets with a convertible sheath are used on maxillary and mandibular first molars, which are usually banded, the convertible sheath is easily removed when second molars are banded, converting the attachment to a bracket

Table (2) Alexander Prescription **(Profit *et al*., 2012)**

Teeth	**Central Incisors**		**Lateral Incisors**		**Canine**		**1st premolar**		**2nd premolar**		**1st molar**		**2nd molar**	
	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip
Maxillary Arch	+15	+5	+9	+9	-3	+10	-6	0	-8	+4	-10	0	-10	0
Mandibular Arch	-5	+2	+5	+6	-7	+6	-7	0	-9	0	-10	0	0	0

5.2.3. Ricketts prescription

Dr. Robert Murray Ricketts introduced the concept of Bio progressive therapy in 1976, the biological concept of growth was applied in the manner that would help normalize the physiology and improve the aesthetics, the term "bio" is used to suggest the strong biologic implications to be constantly borne in mind with the technique, and the term "progressive" stands for the treatment sequence, he gave importance to growth and orthopedic changes, in this technique**(Ricketts *et al*., 1979).**

Dr. Ricketts used a .0185 x .030-inch slot bracket for ease of wire placement and use of overlaid arches, the concept of utility arch and sectional arches was first evolved by Ricketts, with time so many clinicians put forward their own prescriptions of brackets, for effective use of these prescriptions many of them also advocated their own treatment mechanics and bracket position on teeth, Some of these prescriptions were also even disowned after copyright of the patent was expired, other prescriptions were changed with time after hit and trials reveal the flaws within them **(Ricketts *et al*., 1979)**.

Table (3) Ricketts prescription **(Profit *et al*., 2012)**

Teeth	**Central Incisors**		Lateral Incisors		**Canine**		**1st premolar**		**2nd premolar**		**1st molar**		**2nd molar**	
	Torque	tip	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip
Maxillary arch	22	0	14	8	7	5	0	0	0	0	0	0	0	0
Mandibular arch	0	0	0	0	7	5	0	0	0	0	0	0	0	0

5.2.4. Roth Prescription

Ronald H. Roth (1933-2005) put forward his modified version of Andrew prescription in 1976 which he called Roth Prescription of the Andrew Appliance **(Roth, 1987).**

Roth based his prescription on following principles (Sifakakis *et al*., 2013).

I. Small inventory, a single bracket set for all types of malocclusion

II. Overcorrection, especially in torque of brackets to accommodate relapse and diminution of force

III. Leveling of curve of spee to some extent by placing anterior brackets more incisal

IV. More torque in anterior brackets to accommodate torque loss by wire play

V. Super torque brackets for rapid correction of torque in class II div2 cases

VI. Roth proposed a new arch form called Tru-Arch to be used with his prescription; Roth advocated selection of arch wire is important as it effects the rotational position of teeth

VII. Different translation philosophy, according to Roth tipping of the teeth to some extent is accepted on round wires

VIII. Many auxiliary features were added to brackets such as double and triple tubes, addition of hooks for ease of mechanics

Maxillary arch:

1. Incisors

Roth3 justified his prescription by explaining that 5° extra torque was added to maxillary incisors keeping is line with his treatment philosophy of over correction and accommodating torque loss by wire play so without moving to full dimension wires the clinician can attain natural inclination of incisors **(Roth, 1981).**

2. Canine

For canines, Roth used -2° torque which was -5° less than Andrew prescription, this was done to avoid reactionary effect of building more positive torque into the incisors brackets, the final torque of canine would be -7° due to reactionary forces from the wire and because of wire play, also canine tip was increased by +2° to accommodate tip loss in extraction cases as distal translation of canine take place and it is also helpful to get better canine guidance **(Wadhwa, 2004).**

2. Premolars

Both first and second premolar tip was taken from minimum translation series brackets requiring mesial translation, premolar torque was taken from Andrew standard

SWA, Counter rotation feature was taken from minimum translation series brackets for distal translation **(Wadhwa, 2004**).

3. Molars

On 1 and 2 molars buccal root torque was increased from -9° to -14°, the increased torque can counter the effect of hanging of mesiolingual cusp on translation, so 0°tip was in fact 5° tip of Class I molar, otherwise actually giving a 0° tip to molars in class I position will result in poor angulation of molars **(Roth, 1987).**

Mandibular arch

Roth justification not much was changed from Andrew's in Roth prescription in lower dentition. Canine angulation was increased 2° in an effort to give canine guidance and give better canine class I relationship, distal tip and distal rotation was introduced in lower prescription because Roth believe that lower teeth settle more mesial than upper and also rotate while settling so using modifications will counter the relapse factor, both the lower molars have same torque, decreasing the tip in lower arch would also decrease the anchorage demands. Roth proposed that as his appliance rest on mesiobuccal cusp rather than buccal groove so same torque on molars is justified **(Roth, 1981).**

In super torque prescription only the lower canine's brackets are present, tip was maintained at norms while positive root torque was added to canine, this prescription values is only suited when the upper laterals and canines have pushed the lower canine inward. In that case usually the lower canine root is more labial and crown is lingual, the super torque prescription of Roth was indeed genius innovation and it will help to correct upper incisor inclination in less time but full torque expression built within the brackets should be avoided **(Roth, 1987).**

Table(4) Roth Prescription **(Profit *et al*., 2012)**

Teeth	Central incisors		Lateral incsors		Canine		1st premolar		2nd premolar		1st molar		2nd molar	
	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip
Maxillary Arch	12	5	8	9	-2	9	-7	0	-7	0	-14	0	-14	0
Mandibular Arch	0	0	0	0	-11	7	-17	0	-22	0	-30	1	-30	0

Table (5) super torque Prescription **(Khans, 2015)**

Teeth	Central incisors		Lateral incisors		Canine		1st premolar		2nd premolar	
	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip
Maxillary Arch	17	5	10	9	3	9,13	-14	0	-14	0
Mandibular Arch	0	0	0	0	3	5	-30	1	-30	0

Limitations of Roth Prescription

I. Inventory

Roth prescription like Andrew has a multiple inventory, Roth prescription started as a single bracket set but with time having hit and trials multiple options were available, the present day Roth prescription are available as Roth standard prescription available in option of upper premolar in mesial rotation or distal rotation, Roth super or extra torque for class II div 2 and Roth surgical for surgical cases **(Jain *et al*., 2013).**

II. Lack of variability

Cotemporary Roth prescription contain multiple bracket sets, but the level variability found in Andrew prescription is missing in Roth, in Roth prescription standard brackets are meant to treat most types of malocclusion, so we have one single bracket set for extraction and non-extraction cases, we are bound to use brackets with increased tip and counter rotation in non-extraction case where teeth are not supposed to translate, in translation or extraction case we use same brackets for every type of extraction and so translation of teeth **(Moesi, 2013).**

III. Root Parallelism

Like Andrew prescription Roth prescription also has problem with root parallelism especially in maxillary canines, the canine root comes very close to the premolar root after expression of tip, though it is claimed that not all the tip would be expressed because of wire play, yet wire play is less a problem with tip than torque **(Jain *et al*., 2013).**

Roth Surgical Prescription

All the values are same of standard series prescription except upper canine, the upper canine has -2° torque, 9° tip and 4° mesial rotation, This prescription values seem to be effective for class III surgical cases but not for class II **(Proffit *el al*., 2012).**

5.2.5. MBT Prescription:

MBT is an abbreviation for Richard McLaughlin, John Bennett and Hugo Trevisi, these three orthodontists from three different parts of the world worked together to introduce their own prescription of brackets called MBT prescription in 1997 **(Mclaughlin *et al*., 2005)**

MBT prescription was based on following principles (Moesi, 2013).

1. Light continuous force
2. Lacebacks, bendbacks and elastic module assisted retractions
3. Sliding mechanics on a 0.019”x0.025” SS wire in 0.022”x0.028” slot bracket
4. Use of specific arch form close to patient natural arch form, three different arch forms were advocated, these were tapered, ovoid and square arch form
5. Selection of brackets in specific malocclusions and alteration of prescription in some specific clinical problem.
6. Bracket positioning at specific height on the teeth taking guidance from bracket positioning charts and using specific bracket positioning gauges
7. Using curves in the wire to level curve of spee

MBT prescription:

Ul - Upper Central Incisors

The maxillary central incisor bracket is available in two torque options +17° and +22°, the +17° torque option is not new in orthodontics, it was already used before MBT prescription as part of Roth super torque prescription for class II div 2, the +22° torque is something new but an important part of MBT system as present in Roth was that you don't have to express all the built in torque of prescription, central incisor tip is kept at 4° **(Power *et al*., 2004).**

U2 - Upper Lateral Incisors

Lateral incisor torque is kept at 10°, if Andrew cephalometric study has been followed the lateral incisor torque should have been 13°,tip or angulation value of lateral incisor is taken from Andrew original norms, an input from different studies should have resulted in mean lateral incisor of 8°**(McLaughlin *et al*., 2005).**

U3 - Upper Cuspids

Canine torque is available in three different options -7°, 0° and +7°. -7° is the prescribed torque and other 2 options are to deal a certain group of clinical cases,-7° torque is clearly taken from Andrew standard SWA ,tip value in canine is also taken from original Andrew's original norms but mean tip value of 8° from different studies is also close to MBT prescription **(Power *et al*., 2004).**

U4&5 - Upper First and Second Bicuspids

1st and 2nd premolar torque is taken from standard SWA prescription values, input from different studies would also make this torque value as -7°, unfortunately changing the mechanics will change the torque values, tip value is also decreased from Andrew original norms and is taken from inventors own clinical experience, the mean value of tip from different studies is 0 for 1st premolar and 0 for 2nd premolar **(Power *et al*., 2004).**

U6&7 - Upper First and Molars

Torque values for 1 and 2 molar are same as that found in Andrew medium translation series molar brackets and that of Roth prescription, the mean input of different

studies is -14° for 1st and 2nd molars so torque values of MBT prescription for 1st and 2nd molar are more negative than Andrew original norms and combined input of different studies, tip of both molars is kept at 0° **(Dixon *et al*., 2002).**

L1&2 - Lower Central and Lateral Incisors

Lower incisors have class III incisors torque values of Andrew SWA, the mean input of different studies is -6° torque for lower central incisor and -6° for lateral incisor, tip in lower incisors is also decreased and is close to Andrew original norms, the mean tip of different studies would be 0 for central and 0 for lateral incisors

(Proffit *et al*., 2012).

L3 - Lower Cuspids

Lower canine torque is available in three options - 6°, 0° and +6°. The -6° is the standard prescription while the other two are recommended for some specific type of malocclusion, tip on lower canines 0 in MBT system is close to Andrew original norms and mean tip of different studies **(Jain *et al*., 2013).**

L4&L5 - Lower first and second Bicuspids

Negative torque on lower premolars is decreased and is far less than Andrew original norms and mean value of different studies, negative torque was decreased to match with decrease in negative torque in molar area, to support expanded maxilla and to prevent gingival recession in susceptible cases, bicuspid tip is same as that of Andrew standard SWA, taking mean value of different studies and standard SWA would result in 1st premolar tip of 2° and 2nd premolar tip of 2° **(Usmani *et al*., 2002).**

L6&L7 - Lower first and second Molars:

Negative torque on lower molars is decreased and is far less than Andrew original norms and mean of different studies, negative torque helps to prevent lingual rolling of the lower molars in case someone uses class II elastics or fixed functional appliances, 0° tip in lower 1st and 2nd molar is technically 0 tip because of difference in band

placement position in Andrew and MBT prescription, so tip values for molars are same as Andrew standard SWA **(Usmani *et al.*, 2002).**

Table (6) MBT Prescription **(Profit *et al.*, 2012)**

Teeth	Central incisors		Lateral Incisors		Canine		1st premolar		2nd Premolar		1st molar		2nd molar	
	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip
Maxillary Arch	17	4	10	8	-7	9	-7	0	-7	0	-14	0	-14	0
Mandibular Arch	-6	0	-6	0	-6	3	-12	2	-17	2	-20	0	-10	0

5.2.6. Damon Brackets

1.DAMON SL Brackets

Damon SL brackets ("A Company, San Diego, CA) had a slide that wrapped around the labial face of the bracket, the launch of Damon brackets in the mid-1990s made a definite step forward in popularity of self-ligating bracket, Damon SL brackets had two significant problems the slides sometimes opened inadvertently and they were prone to breakage **(Kakadiya, 2017).**

Figure (15) DAMON SL Brackets **(Paul, 2005).**

2. DAMON 2 Brackets

Damon 2 brackets (Ormco Corp.) were introduced to address the imperfections of Damon SL, Combined with the introduction of metal injection moulding manufacture & slight design changes, Damon 2 brackets are almost completely free from inadvertent slide opening or slide breakage, however, the brackets were not immediately and consistently very easy to open **(Mizrahi, 2006).**

Figure (16) DAMON 2 Brackets **(Mizrahi, 2006).**

3. DAMON 3 and DAMON 3MX Brackets

Damon 3 and Damon 3MX brackets (Ormco corp.) have a different location and action of the retaining spring, and this has produced a very easy and secure mechanism for opening and closing, in addition, Damon 3 brackets are semi-aesthetic, however, early production of Damon 3 brackets suffered three significant problems: a high rate of bond failure, separation of metal from reinforced resin components, and fractured tie wings, these three problems received rapid and effective investigation and correction **(Kakadiya, 2017).**

Figure (17) DAMON 3 and DAMON 3MX Brackets **(Kakadiya, 2017).**

Damon Prescription

Ul - Upper Central Incisors

+12° Torque +5° Tip 0° Rotation:

• The standard torque prescription selected when central incisors are in good position with minimal requirements for treatment mechanics +17° Torque +5° Tip 0° Rotation:

• Selected for division 2 cases

• Cases needing extensive Class II elastics - prevents loss of torque control resulting from elastic wear +7° Torque +5° Tip 0° Rotation

• Centrals requiring extensive uprighting

• Case needing extensive Class III elastics - prevents loss of torque control resulting from elastic wear **(Damon *et al*., 2003).**

U2 - Upper Lateral Incisors:

+8° Torque +9° Tip 0° Rotation:

• The standard torque prescription selected when central incisors are in good position with minimal requirements for treatment mechanics +10° Torque +9° Tip 0° Rotation:

• Selected for division 2 cases +3° Torque +9° Tip 0° Rotation:

• Laterals requiring extensive uprighting

• Lateral incisors that are blocked in lingual crossbite that will have too much torque as they move into normal position **(Mizrahi, 2006).**

U3 - Upper Cuspids:

0° Torque +6° Tip 0° Rotation:

• The standard torque prescription selected when the cuspids are in good position or labially inclined +7° Torque +6° Tip 0° Rotation;

• Any cuspid needing coronal uprighting

• Most extraction cases requiring first bicuspid space closure - prevents the cuspid crown from tipping lingual during space closure and helps position the root in medullary bone and away from the cortical plate **(Kakadiya, 2017).**

U4&5 - Upper First and Second Bicuspids:

-7° Torque +2° Tip 0° Rotation:

• The standard torque prescription selected for all upper first and second bicuspids **(Damon *et al*., 2003).**

U6 - Upper First Molar:

-9° Torque 0° Tip 10° Rotation:

• The standard torque prescription selected for all upper first molars **(Mizrahi, 2006).**

U7* - Upper *Second Molar:

-9° Torque 0° Tip 5° Rotation:

• The standard torque prescription selected for all upper second molars - this accent bracket is designed for easy archwire insertion **(Damon *et al*., 2003).**

L1&2 - Lower Central and Lateral Incisors:

-1° Torque +2° Tip 0° Rotation:

• The standard torque prescription selected for all lower central and lateral incisors with minimal requirements for treatment mechanics

• Most extraction cases to prevent loss of torque control when retracting anterior teeth

-6° Torque +2° Tip 0° Rotation:

• Extreme crowding in the lower anterior segment

• Cases needing extensive Class II elastics - prevents loss of torque control resulting from elastic wear (mentalis and orbicularis oris muscles also aid in controlling torque of the lower anteriors) **(Kakadiya, 2017).**

L3 - Lower Cuspids:

0° Torque +5° Tip 0° Rotation:

• The standard torque prescription selected when the cuspids are in good position or labially inclined + 7° Torque +5° Tip 0° Rotation:

• Any cuspid needing coronal uprighting

• Most extraction cases requiring first bicuspid space closure prevents the cuspid crown from tipping lingual during space closure and helps position the root in medullary bone and away from the cortical plate **(Mizrahi, 2006).**

L4 - Lower First Bicuspids:

-1 2° Torque +2° Tip 0° Rotation:

• The standard torque prescription selected for all lower first bicuspids

(Damon *et al*., 2003).

L5 - Lower Second Bicuspids:

-17° Torque +2° Tip 0° Rotation:

• The standard torque prescription selected for all lower second bicuspids **(Mizrahi, 2006).**

L6 - Lower First Molars:

-30° Torque +2° Tip 0° Rotation

• The standard torque prescription selected for all lower first molars

(Damon *et al*., 2003).

L7 - Lower Second Molars:

-10° Torque 0° Tip 5° Rotation

• The standard torque prescription selected for all lower second molars (Second molars usually require uprighting - using -10° torque with 7° of tube and archwire play finishes the second molar at a net 17° to 18°) **(Damon *et al*.,2003).**

5.2.7. Customized brackets

A customized appliance system uses digital models of the patient's arches to simulate the optimal position of each dental element and the ideal final occlusion, once the desired virtual result is achieved, the personalized archwires, brackets, and indirect-bonding transfer jigs are produced **(Saxe *et al*., 2010).**

As in other computerized treatment systems, insignia treatment begins with precise polyvinyl siloxane (PVS) impressions, extremely accurate computed-tomographic (CT) scans of the impressions, digital modeling of the dental arches, and a, virtual setup for ideal arch form and occlusion, the impression scanning, digital modeling, and initial setup are performed by technicians at Ormco, the clinician then makes adjustments to the suggested treatment plan as desired **(EI-Mowafy, 2010).** Using Insignia's Approver software to refine the:

• Torque, tip, in/out, intrusion, and extrusion of each tooth

• Arch form, within the patient-specific biological limits set by the osseous structure

• Smile arc

• Dental contacts in the final centric occlusion **(ANTONIO GRACCO *et al*., 2011).**

Unlike computerized methods that simply modify the thickness of the bracket adhesive, the Insignia system reverse-engineers the brackets themselves to the correct specifications in one of two ways, depending on the type of brackets selected by the orthodontist, Insignia SL brackets a customized version of the Damon Q* self-ligating model, are created by varying the thicknesses and angulations of the metallic bases **(EI-Mowafy, 2010)**

One important feature recently added to the Insignia system is called "Overcorrection", this program tracks the three-dimensional movements of the center of resistance of the roots and the center of the bracket slot for each tooth, then calculates the tooth's direction of rotation with respect to 3rd-order constraint, another unique feature of the Insignia system is its customization of arch form, based on skeletal mapping of the mandibular bone's cortical limits at the level of the center of resistance of teeth the Insignia arch wires are not preformed, but individually designed to maintain the teeth in trabecular bone as much as possible **(Andreiko, 2011).**

Figure (18) Insigna systems **(EI-Mowafy, 2010).**

Table (7) Bracket/Tube Prescription: Incisors Through Premolars, Brackets Prescription **(Proffit *et al*., 2012).**

Bracket/Tube Prescription: Incisors Through Premolars, Bracket Prescription

	MAXILLARY									
	CENTRAL		LATERAL		CANINE		FIRST PREMOLAR		SECOND PREMOLAR	
	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip
Alexander	15	5	9	9	−3	10	−6	0	−8	4
Andrews	7	5	3	9	−7	11	−7	2	−7	2
Damon (standard torque)	15	5	6	9	7	5	−11	2	−11	2
MBT	17	4	10	8	−7	8	−7	0	−7	0
Ricketts	22	0	14	8	7	5	0	0	0	0
Roth	12	5	8	9	−2	9	−7	0	−7	0

	MANDIBULAR									
	CENTRAL		LATERAL		CANINE		FIRST PREMOLAR		SECOND PREMOLAR	
	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip	Torque	Tip
Alexander	−5	2	5	6	−7	6	−7	0	−9	0
Andrews	−1	2	−1	2	−11	5	−17	2	−22	2
Damon (standard torque)	−3	2	−3	4	7	5	−12	4	−17	4
MBT	−6	0	−6	0	−6	3	−12	2	−17	2
Ricketts	0	0	0	0	7	5	0	0	0	0
Roth	0	0	0	0	−11	7	−17	0	−22	0

Table (8) Molar Tube/ Bracket Prescriptions **(Proffit *et al*., 2012).**

Molar Tube/Bracket Prescriptions

	MAXILLARY					
	FIRST MOLAR			SECOND MOLAR		
	Torque	Tip	Rotation	Torque	Tip	Rotation
Alexander	−10	0	13	−10	0	10
Andrews	−9	5	10	−9	0	10
Damon (standard torque)	−18	0	12	−27	0	6
MBT	−14	0	10	−14	0	10
Ricketts	0	0	0	0	0	0
Roth	−14	0	14	−14	0	14

	MANDIBULAR					
	FIRST MOLAR			SECOND MOLAR		
	Torque	Tip	Rotation	Torque	Tip	Rotation
Alexander	−10	0	0	0	0	5
Andrews	−25	2	0	−30	0	0
Damon (standard torque)	−28	2	2	−10	0	5
MBT	−20	0	0	−10	0	0
Ricketts	0	0	0	0	0	0
Roth	−30	1	4	−30	0	4

Chapter two

Discussion

Before the invention of the SWA, the bends were made in to the arch wire and that will be time consuming, required skills, difficult to control tooth movement and the finishing will be more difficult and less efficient.

The preadjusted edgewise brackets have tip, torque, in and out bends built within the brackets, it was believed that these appliances don't require wire bending hence the name Straight wire appliance was given to them **(Weinberger, 2001).**

However, after invention of the SWA, the tip, the torque values were built in the brackets itself and that was the beginning of the new era.

We still don't have a prescription where a straight wire is used throughout the treatment and no wire bending is required. Also lack of consensus on ideal position of the bracket on the tooth limits the adaptation of a single prescription universally **(Jain *et al*., 2013).**

Tip expression depends on the arch wire stiffness (the stiffer the wire, the more tip expression), material, width and size of the brackets (good materials that will not be deformed easily and the larger the brackets with small inter-brackets distance will express the tip more and more), slot size whether we use 0.018 slot or 0.022 slot (the 0.022 require higher gauge to expree the tip).

Toque expression depends on arch wire stiffness (the stiffer the more toque expressed), arch wire fitness (play, arch wire size and slot depth), brackets quality, slot size and over correction.

It is clear that if the entire torque built within the bracket is expressed on engagement of full dimension wires, the final inclination of incisors would be same no matter from where one started **(Moesi *et al*., 2013)**

0.018 slot brackets allow full engagement of the wire which is a good choice in non-extraction cases and a crossbite of a lateral incisor.0.022 slot brackets allow plays for

sliding and allow larger stiffer wires which are excellent in extraction cases and en mass retraction.

Andrew advocated using full dimension rectangular wires for final expression of torque, but there are some practical limitations of using full dimension wires in the slot, Roth work was not an innovation rather it was awise selection of brackets from Andrews' work that favors mechanics used by Roth on most of the patients he treated at his office, Roth humbly named his prescription as Roth prescription of Andrew appliance, all the prescriptions work fine if one follows the inventor's advocated mechanics, all the prescriptions have their own limitations that needed to be compensated by wire bending or elastics to some extent, we still don't have a prescription where a straight wire is used throughout the treatment and no wire bending is required, also lack of consensus on ideal position of the bracket on the tooth limits the adaptation of a single prescription universally during treatment **(Moesi *et al*., 2013).**

Dr. Ricketts used a .0185 x .030-inch slot bracket for ease of wire placement and use of overlaid arches, the concept of utility arch and sectional arches was first evolved by Ricketts With time so many clinicians put forward their own prescriptions of brackets, for effective use of these prescriptions many of them also advocated their own treatment mechanics and bracket position on teeth, the increase in quality also comes with an increase in its cost, the orthodontist should wisely choose which bracket system would be best for the chosen case and also fulfill the aesthetics requirements of the patient, all the prescriptions work fine if one follows the inventor's advocated mechanics, all theprescriptions have their own limitations that needed to be compensated by wire bending or elastics to some extent **(Saxe *et al*., 2010).**

We still don't have a prescription where a straight wire is used throughout the treatment and no wire bending is required, also lack of consensus on ideal position of the bracket on the tooth limits the adaptation of a single prescription universally **(Wahl, 2005).**

Summary of Roth Appliance one set upper and lower canines with more tip (Overcorrection),upper anterior teeth with more torque (Overcorrection),decreased tip in both upper and lower buccal segment (Anchorage),upper molars with less torque (Molar control) Summary of MBT Appliance one set, less tip on upper and lower anterior teeth, proclined upper incisors, retroclined lower incisors, upright lower buccal teeth.

Damon system has high torque. Damon SL brackets ("A Company, San Diego,CA) had a slide that wrapped around the labial face of the bracket **(Kakadiya, 2017).**

Damon 2 brackets (Ormco Corp.) were introduced to address the imperfections of Damon SL, Combined with the introduction of metal injection moulding manufacture & slight design changes, Damon 3 and Damon 3MX brackets (Ormco corp.) have a different location and action of the retaining spring, and this has produced a very easy and secure mechanism for opening and closing **(Mizrahi, 2006).**

A customized appliance system uses digital models of the patient's arches to simulate the optimal position of each dental element and the ideal final occlusion, once the desired virtual result is achieved, the personalized archwires, brackets, and indirect-bonding transfer jigs are produced **(Saxe *et al*., 2010).**

Clinician should choose a prescription in which they find ease with mechanics advocated for that prescription, due to various limitation of all prescription some degree of wire bending and bracket position alteration is always required and clinician should remain mentally prepared for that, all the cases must be finished in light of Andrews' six keys or any other parameters set by local examination bodies or ethical councils (**Jain *et al*., 2013).**

Chapter three

Conclusions and suggestions

Conclusions:

1. The brackets having no built in in/out, tip and torque are called standard edgewise brackets, mean (Tip and Torque zero), then straight wire appliance were developed that, have tip, torque, in and out prescription built within the brackets.

2. Preadjusted brackets have tip, torque, in and out bends built within the brackets, it was believed that these appliances don't require wire bending hence the name Straight wire appliance

3. Andrew prescription, the first preadjusted brackets where all the bending's needed in arch wire in standard edgewise bracket system were built within the brackets, it was proposed that this appliance does not require wire bending during treatment hence the name Straight wire appliance

4. 0.018 slot size that enable full engagement the wire is easier for torque with stainless steel wires and give more control for torque than 0.022 slot size, 0.022 slot size allows play for sliding wire and allows larger stiffer wire.

5. Alexander's prescription, using 0.018” slot brackets and 0.017x0.025” wire Alexander advocated individualizing bracket positioning for each patient to effectively use his bracket prescription.

6. Dr. Ricketts used a .0185 x .030-inch slot bracket for ease of wire placement and use of overlaid arches, the concept of utility arch and sectional arches was first evolved by Ricketts.

7. Roth Appliance set upper and lower canines with more tip (Overcorrection), upper anterior teeth with more torque (Overcorrection),decreased tip in both upper and lower buccal segment (Anchorage),upper molars with less torque (Molar control).In conclusion less torque and more tip used Roth prescription.

8. MBT Appliance set has, less tip on upper and lower anterior teeth resulted in, proclined upper incisors, retroclined lower incisors, upright lower buccal teeth in conclusion more torque and less tip used MBT Prescription.

9. In Damon system depends on early using of elastics, expansion, stripping and more torque.

10. Customized brackets allows to see the teeth straightened in the virtual setup, and brackets are then designed to be placed on ‘‘straight teeth’’ in the desired final relationship with an unbent wire.

Suggestions:

1. Conduct a survey study to see the most common bracket prescription used in the college of dentistry, university of Baghdad clinics, and the possibility of using hybrid prescription.
2. Conduct a clinical trial study to see the tip effect of different bracket prescriptions of canine during leveling stage of the fixed orthodontics treatments.
3. Compare the different brackets materials with the prescriptions to find out the effect of good materials on the expression of the tip and torque.
4. Dig deep in literatures that concern about customized brackets.
5. Digital orthodontics is a new area that I highly suggested to cover it in the future research projects of the undergraduate students.

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