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ARTICULATORS THROUGH THE YEARS REVISITED: FROM 1971-1990

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ABSTRACT

Articulating anything is like carving statue. On building a statue, a sculptor does not keep adding clay to his subject; actually he keep chiseiling at the unessentials until the truth is revealed without obstruction. That is the articulator, though an mechanical entity in itself is meaningless until that occlusion functions in the mouth in harmony with biologic factors that regulate the mandibular activity of the patient. This article presents Articulators from 1951-1970 that are based on innovation of semiadjustable, fullyadjustable and pantographic tracings. In this period, , three dimensional adjustable articulators that would accept and reproduce the measurements recorded by the pantograph, measuring device for recording all mandibular movements, adjustable condylar inclination, adjustable Bennett angles, immediate sideshift (I.S.S.) settings, protrusion and retrusion indicators were described.

KEYWORDS: **Bennett angles, Condylar inclination, Immediate side shift, Protrusion, Retrusion.**

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INTRODUCTION

An articulator serves as a patient in the absence of the patient because it can be programmed with patient records that allows the operator to fabricate a restoration that will be physiologically and psychologically successful. Some of these devices make no attempt to represent the temporomandibular joints (facebow transfer) or their paths of motion (eccentric registrations). Some instruments allow eccentric motion determined by inadequate registrations (positional registrations). Some utilize average or equivalent pathways. Some attempt to reproduce the eccentric pathways of the patient from three dimensional registrations. The dentist should understand the differences between these articulating devices, and determine which would be most satisfactory for the patient. Regardless of how simple or complex the articulator may be, its effectiveness depends on how well the operator understands its features, the accuracy of registering and transferring jaw relations and how the operator uses it.[1-3]

DATABASE SEARCH

The present review articles include studies on Articulators from 1951-1970 on innovation of semiadjustable, fullyadjustable and pantographic tracings. The Search Design included electronic journals from Pubmed, Google Scholar, Science Direct.

ARTICULATORS FROM 1971-1990 AND CURRENTLY IN USE [1-3]

1. Teledyne Hanau model-194 (1970-1971)
2. Dentatus ARO Articulator (1971)
3. Denar Mark II (1975)
4. Hanau H2 Arcon model-158 (1977)
5. Hanau model-165 Hanaumate (1977)
6. Hanau Radial Shift model-166 (1981)
7. Hanau Wide Vue183 and 184 (1981)
8. Hanau Modular Articulator system
9. The Panadent Articulator- By Lee SL,PSL,PCL Model (1978-1983)
10. Omni Articulator (1984)
11. SAM Articulator (1990)
12. Girrbach-Artex Articulators (1995)
13. Cyberhoby Fully Adjustable Articulator (1983)
14. SAM 3 Articulators (1990-2003)
15. Virtual articulators (1999-2009)
16. KavoProtor Articulators
17. Stratos Articulators

TELEDYNE HANAU MODEL-194 (1970) (FIGURE 1A) [1,4,5]

The Teledyne articulator, initially called the Hanau XP-51, was marketed by Hanau in the 1970's but was short lived. It is a semiadjustable articulator with the arcon feature, that is, the condylar element or ball is on the lower member and the condylar guidance in on the upper member. The intercondylar distance is fixed at 90 mm. The condylar mechanism includes, in addition to the adjustable superior wall (to set the condylar inclination with a protrusive record) and medial wall (to set the Bennett angle with lateral records), an adjustable posterior wall. After the Bennett angle is determined, this posterior wall can be adjusted to the position of the working side condyle in lateral movement with a formula. When adjusted, this wall contacts and forms a continuous guiding surface for the working side condyle. Further, the posterior wall combines to compensate for the lack of an intercondylar distance adjustment on the articulator. The angle formed is called the compensating angle. This compensating angle is formed by the transverse hinge axis of the Hanau XP-51 articulator and the adjustable posterior wall of the condylar housing. Two incisal guides are available, the Hanau universal guide and an incisal cup for fabricating a custom incisal guide.

DENTATUS ARO ARTICULATOR (1971) (FIGURE 1B)[1,5]

The Dentatus ARO articulator was introduced in 1971. It is manufactured by A. B. Dentatus of Stockholm, Sweden, and distributed in the United States by the Kerr Mfg. Company of Detroit, Mich. The Dentatus ARO articulator has all the features of the Dentatus ARL, plus the unique feature of a movable arm that holds the mandibular cast. The universal joint and the locking device that attaches the movable arm to the base allow repositioning of the mandibular cast without remounting. The gauge block is used to center the lower member to the upper member, but once the mandibular cast has been repositioned the articulator or casts cannot be interchanged without the aid of centric relation records. The ARS model has fixed condylar guidance features of 30º tract inclination with a 15º Bennett angle and auditory pins to receive an ear facebow. The guidance slot is open on the posterior to permit separation of the upper and lower frames. It has a flat and a 10º incisal guide table.The ARD model condylar inclination adjusts from 0º to 60°, and the side shift angle adjusts from 0° to 40°. The other features are the same as the ARS model.The ARA model is similar in features to the others except that the condylar elements are part of the lower frame and the condylar guidance is part of the upper frame. The condylar inclination adjusts from — 70° to + 70°, and the side shift angle adjusts from 0° to 40°. Immediate side shift is standard on this model.Dentatus also manufactures an articulator called Balance. It is three quarters full size in overall dimensions and is a non arcon type articulator. There are four interchangeable slot guidance assemblies having fixed condylar path inclinations of 20°, 25°, 30°, and 40°. The side shift angle can be adjusted from 0° to 15°. Fixed incisal guide tables of 0º, 5°, 10°, and 15º are available. It will accept either an earbow or regular facebow. The side shift for all models is of the progressive type, and the horizontal condylar paths permit only rectilinear movement. These articulators are well made and are popular with those who prefer an axle slot type instrument.

DENAR MARK II (1975) (FIGURE 1C) [1,6]

This articulator was introduced in 1975. The articulator is a two piece instrument incorporating a positive locking mechanism that can hold the two members together and permit 85 degrees of hinge movement. The horizontal condylar inclination can be adjusted from 0 to 60 degrees. It has an immediate side shift (Bennett) adjustment of 0 to 4 mm plus a progressive shift adjustment of 0 to 15 degrees. The condylar elements are at a fixed 110 mm intercondylar distance. An adjustable intercondylar distance (110-122 mm) option is available. The posterior fossa wall is inclined posteriorly 25 degrees to allow for a backward movement of the rotating condyle as it moves outward during lateral side shift. A straight rear wall option is available.

HANAU H2 ARCON MODEL 158 (1977) (FIGURE 1D) [1,7]

The Hanau 158 model was introduced in 1977. The mechanical features are quite similar to the 96H2 but are arcon in nature. A special facebow is available for this model, but it will receive most other facebows.The horizontal condylar path is adjustable from 0° to 60°, and the side shift is adjustable from 0° to 30°.

HANAU MODEL 165 HANAUMATE /AVERAGE ARTICULATOR (1977) (FIGURE 1E) [1,7]

Based on fixed average value incorporated into its design. The condylar element is at 110 mm and has a 30º horizontal inclination, 15° progressive sideshift, and 10º inclination on the incisal guide table. The upper frame can be separated easily by loosening two locks. It will receive most facebows. Casts are mounted using quick release pins instead of mounting plates. There is excellent lingual visibility.

HANAU MODEL 166 RADIAL SHIFT (1981) (FIGURE 1F) [1,7]

This model 166 Radial Shift incorporates many of the features consistent with the findings of Lundeen. The condylar elements are on lower frame (Arcon) and fixed Inter Condylar Distance at 110 mm.The horizontal condylar guidance adjustable from 0° - 60° and has ¾ inch curvature. The Medial wall has precurrent side shift curvature of 3mm radius which is adjustable from 0-3 mm. The progressive angle is fixed at 6 degrees. It has a lock that protects against accidental sepration of the upper and lower frames. It comes with either an adjustable mechanical incisal guide table or a plastic incisal guide table. Both facial and earpiece facebows can be used with this articulator.

HANAU WIDE VUE MODELS 183 AND 184 (FIGURE 2A) [1,7]

The Hanau wide Vue I and Hanau Wide Vue II are newest articulators. The Hanau models 183 and 184 are arcon in type and have similar features. The only difference is that Hanau wide Vue I has a closed condylar track and Hanau wide Vue II has an open condylar track which allows upper member to be removed. Wide Vue II has condylar retainers to avoid accidental separation of upper member. A micrometer protrusive-retrusive condylar adjustment is available which is accurate to 0.05 inch. The condylar elements are fixed at 100mm and guidance mechanism is of slot type. The horizontal condylar path angle is adjustable from —20° to + 60°, and the side shift angle is adjustable from 0° to 30°. Both have rectilinear guidances. The straight incisal guide pin or with adjustable foot is available. The straight pin has dual ends chiesel and spherical and extends above the upper member to act as a third point stability when inverting the articulator for mandibular cast mounting. Three incisal guide tables are available: mechanical, flat and pantacrylic table.

HANAU MODULAR ARTICULATOR SYSTEM (FIGURE 2B) [1,7]

This is a system with a series of interchangeable guidance assemblies. The basic frames of the articulator are produced in two forms, one with a fixed intercondylar width at 110 mm and an adjustable version with adjustable intercondylar width at 100, 110 125, and 140 mm. This system permits a choice in the degree and type of condylar guidances necessary to achieve optimum results based on the desires of the dentist and the complexity of the treatment needs. The choices include the following: Adjustable Bennett (side shift) The side shift is adjustable from 0° to 30°, has a ¾ inch radius superior condylar tracking surface, adjustable horizontal inclination from 0° to 90°, and latches. The latches lock the upper and lower frames in terminal hinge position, can be released to permit excursive translations without disengagement, and can be opened to allow for rapid separation of the frames. This has the same capabilities as the adjustable Bennett plus a micrometer adjustment of the posterior stop from 0 to 6 mm in protrusion. It has the ¾ inch radius superior wall and an adjustable medial wall from 0 to 3 mm in a curvilinear precurrent fashion (radial shift) or may be used as a progressive shift from 0° to 30°. The Modular System of Articulators permits a choice of three incisal guide pins and tables.Hanau makes several facebows which can be used with wide range of hanau models.The Spring Bow, introduced in 1986, has become very popular. It is an earbow type and features a spring steel design that will automatically center itself.(Figure 2c) [1,7] The Twirl Bow has a similar indirect mounting feature. This feature permits multi facebow records without tying up the frame between mounting of casts.(Figure 2d) [1,7] Another type is the 159- 2. It is designed to be used either as an earbow or as a facebow. (Figure 2e)

PANADENT ARTICULATORS (1978-1983) (FIGURE 2F) [1,8]

The Panadent System initiated a different approach to dental instrumentation. The principle is based on the work of Lee and others. Denar, TMJ, Whipmix, Hanau, and SAM have come out with their own versions based on the same fundamentals. A series of statistically

selected three dimensional analogs of condylar axis motion has been developed. The analog fossae feature curvilinear protrusive and mediotrusive pathways of approximately ¾ inch radius. There are five pairs in the set with precurrent side shifts of 0.5, 1.0, 1.5, 2.0, and 2.5mm and a 6° progressive angulation.The Panadent articulator design was introduced in 1978. The current models were introduced in 1983. The major modification in the latest models is the mechanical latch. This mechanism keeps the upper and lower articulator frames joined together yet permits an opening movement of 180º. The articulators use ¼ inch condylar elements, instead of the usual ½ inch size, which are fixed at a 110mm distance. There are three models-SL, PSL, and PCL. The latter two models are machined to within .01 mm accuracy, which permits the interchanging of mounted casts between different articulators. The PSL model has a less complicated straight incisal guide pin, as does the SL model. Both a plastic and an adjustable metal incisal guide table are available for all three models.The system was designed to select the correct analog and to determine the condylar path inclination with an extraoral quick analyzer tracing device. The analyzer is used to plot the condylar pathways and to register the amount of side shift. The appropriate analogs are then selected and inserted in the articulator. The analog fossae are then rotated to duplicate the slope of the pathways. The analogs can be mixed so that each side may have different amounts of side shift. The analogs and their angulations can be determined with positional lateral records. A pair of analog selectors is necessary when the checkbite system is used.

THE OMNI ARTICULATOR (1984) (FIGURE 3A) [1,9]

It was introduced in 1984. The design allows one to easily exchange closed (tracking) fossa for open fossa with a positive locking latch. The purpose of this model is an attempt to better meet the requirements for complete, removable and fixed partial denture fabrication in one articulator. The Omni model is adaptable to a wide range of accessories of other models that can maximize its versatility. The Denar system of instruments has given the profession a good choice for all types of prosthodontic procedures. The Mark II works well in complete denture construction and the Omni may prove to be even better. With the use of the field inspection gage, transfer of casts are possible between the D5A, Mark II and Centric Lab Relator, this feature permits maximum work flow. All denar articulators (except the omni) can be calibrated to within (0.001) one thousandth of an inch of accuracy to each other. A special denar field inspection gage is used. Mounted casts can be transferred between calibrated articulators. With care, calibrated articulators will remain accurate for about ten mountings or remounts before recalibration is necessary. A kinematics facebow can also be used with this articulator. Three sets of premolded analogs are available which can be substituted for the mechanical fossa. The sets have 0.5 mm, 1.0mm and 1.5 mm of precurrent side shift with a 7 degree progressive angle to the medial wall, the superior wall has a ¾ inch curvature, the incisal pin is straight but has a curved surface at the vertical adjustable area which maintains a constant position on the incisal guide table which changes in height. The articulator comes with a choice of three types of plastic incisal guide tables or can use the mechanical table of the D5A.

SAM ARTICULATOR (1990) [10-11]

This German articulation system is durable, stable, and precise. One aspect of its popularity is the ability to interchange mounted casts from one instrument to another.

THE SAM 2 ARTICULATOR(FIGURE 3B) [10-11]

This articulator has three interchangeable condylar housings that incorporate different curvatures to the superior wall. The curved surface produces a relative change of inclination, depending on the character of the curvature. For instance, with housing 1 set at 45° at 3mm protrusion, the angle will be 50°, and at 10 mm, it will be 45° with housing 3 set at 30° and at 3 mm advancement, the angle will be 55°. The medial wall has four inserts, one rectilinear and three curvilinear, with increasing amounts of side shift all within the first 2 mm of movement. The incisal guide pin table is unique. The pin is attached to the lower frame and table to the upper frame. Such an arrangement becomes an analog for anterior guidance in the mouth. An accessory is the SAM Mandibular Position Indicator (MPI). The MPI consists of a modified upper frame with sliding cubes instead of condylar housing. Three dimensional measurements can be made in the same reference plane at the center of rotation. The data obtained can be compared before, during, and after treatment. The data can even be transferred to and superimposed on cephalometric radiographs. This becomes valuable when the interactions of occlusion and condylar positions are important. The articulator is a modular instrument. Available options can be added to the standard version to expand its capabilities, and many accessories available. The facebow is very similar to the earbow by Whipmix and Panadent. The axiography is the best available to the profession. The lower member of the axiograph can also be used as a kinematic facebow.This instrument has become popular with some orthodontics and has excellent possibilities in prosthodontics.

SAM 3 ARTICULATOR(FIGURE 3C) [10-11]

This adjustable articulator is manufactured with the highestlevel of precision technology available for dental articulatorinstrumentation. The instrument has a unique On-Off CentricLocking Device and condylar element covers to keep the lowerand upper members locked together during hinge and eccentric movement. The condylar curvatures (17.5mm dia), has 15mm greater vertical height than Sam articulator. It includes Protrusion Screws, Incisal Pin Extension, Tilt Support Rods, Bennett Inserts, and Curvatures 1 and 3.Condylar

Curvature Inserts (A) - 1 very flat (25mm dia.) and 3 quite curved (10mm dia.).Protrusion Screws (B) - Screw into condylar housing and advance condylar elements in increments of 1, 2, 3, 4, 5, and 6mm.Incisal Pin Extension (C) - Attached to the incisal table screw, it allows the upper member of the articulator to stay horizontal when opened.Tilt Support Rods (set) (D) - Allow the articulator to be tilted back at a 45° angle for a different view. Mounting Plate Extender (E) - Allows mounted models to be exchanged between a SAM 2 and SAM 3 Articulator

AXIOQUICK FACEBOW WITH AXIOMATIC TRANSFER FORKASSEMBLY(FIGURE 3D,3E) [10-11]

The single toggle locking mechanism simplifies the process of facebow recording. Secure as traditional dual toggle locking instruments, this assembly is fast and easy to use and lock in place. The anatomical simulation is exact. The transfer is flawless. The kit comes complete with the AxioquickFacebow, the Axiomatic Transfer Fork Assembly including the Transfer Fork, the Nasion Relator, and six hygienic earpiece caps. disposable earpiece Caps .

GIRRBACHARTEX ARTICULATORS: (1995)(FIGURE 3F) [10-11]

Pierrosilveranibiavati devised an original system to be applied to a semi individual articulator based on monson'stheory.This system was developed over the years and realized in 1995 in cooperation with the GirrbachArtex, pforzheim, Germany.

CYBERHOBY FULLY ADJUSTABLE ARTICULATOR (1983)(FIGURE 4A) [12-13]

The cyberhoby computer pantograph developed by Hobo and Takayama in 1983 is one of the electronic pantographs that measuresprotrusive and right and left eccentric movements by means of a small optoelectronic sensor fixed to maxilla. The sensor used in the computerpantograph is light weight and easily used in patients since the condylarpath data is computed for transferring the measurement, apparatus is notnecessary with the computer pantograph system.

VIRTUAL ARTICULATORS (RECENT ADVANCEMENT)(FIGURE 4B) [14-16]

Virtual technologies in dentistry provide better education and training by simulating complex contexts and enhancing procedures that are traditionally limited, such as work with mechanical articulator.

NEED OF VIRTUAL ARTICULATOR

The main goal of the virtual articulator is to improve the design of dental prosthesis, adding kinematic analysis to the design process. The mechanical articulator which is currently used in the fabrication of fixed dental prosthesis has numerous limitations. As the mechanical articulator follow border structure of mechanical joint and cannot represent the effects of resilience of the soft tissue or the time dependent muscle guided movement pattern of chewing, it cannot represent the real dynamic condition of the occlusion in mouth. Also many often problems regarding the technical procedures and dental materials decreases the accuracy of reproduction as

- The deformation of registering material (Eg. Wax, which is susceptible to heat)
- Repositioning the cast into bite impression without leaving any space
- The use of rigid and expanded plaster material and
- Maintenance of the mechanical articulator.

Because of these problems, the reproduction of dynamic, excessive contact seems to lower the reliability. Replacement of the mechanical articulator with the virtual articulator will solve these problems.

SELECTION OF THE ARTICULATOR

If relationship of the antagonist teeth at the patient of maxillary intercuspation is the only concern of the dentist then selection of the articulator will be greatly simplified. In this scenario the articulator capable of simple hinge movement will be sufficient for the designing of the prosthesis. But, the mandible does not act as a simple hinge, rather than this it is capable of rotating around axes in three planes. The occlusal morphology of any restoration for the mouth must accommodate the free passage of the antagonist teeth without interfering with the movement of mandible. So, selection of the suitable articulator is important stage in the designing of virtual articulator by this approach.

ADVANTAGES

The advantages of the virtual articulators are dynamic visualization of the occlusal surface is possible with the virtual articulator, whereas mechanical articulator offers only static presentation, offers a detailed 3D visualization of region of interest, possible to modify or introduce new setting according to the patient and helpful for patient's education. Though the research is still going on in this field three different approaches have been made till now.

SZENTPETERY'S VIRTUAL ARTICULATOR

It was introduced by Szentpetery in 1999. It is based on a mathematical simulation of the articulator movements. It is a fully adjustable 3D virtual dental articulator capable of reproducing the movement of an articulator. It offers possibilities that are not offered by some of the mechanical articulators as curved Bennet angle movements which make it more versatile than mechanical articulator. But as it is a mathematical approach, it behaves as an average value articulator and so not possible to obtain easily the individualized movement paths of each patient.

VIRTUAL ARTICULATOR OF KORDASS AND GARTNER

It was introduced by Kordass and Gartner in 2003, based on the exact registration of mandibular movement with the help of jaw movement analyzer. This virtual articulator system requires digital 3D representation of the jaws as input data generates an animation of the jaw movement and delivers a dynamic and tailored visualization of the collision points. If a device for the registering of the patient specific jaw movements is available as e.g. the Zebras jaw motion analyzer, the recorded jaw motion can be integrated into animation. Jaw motion analyzer is a device used for the acquisition of Mandibular movements.

VIRTUAL ARTICULATOR BASED ON MECHANICAL DENTAL ARTICULATOR

It was introduced by graphic design and engineering project developments, the University of the Basque Country in 2009. The project was focused on developing a different virtual articulator based on mechanical dental articulator, knowing which setting parameters can be registered and transferred to the patient. Problems or the limitation of the previous approaches to develop virtual dental articulator were considered in this project. It is more simple approach than the virtual articulator developed by Kordass and Gartner and at the same time more accurate result can be obtained than the Szentpetery's virtual articulator.

STRATOSARTICULATOR [14-16]

The name Stratos stands for precision articulators with convincing quality and ergonomic design. IvoclarVivadent offers a range of articulators which are the result of consistent further development and exact coordination with customer requirements. They come with a comprehensive assortment of accessories.

STRATOS 100: THE AVERAGE VALUE ARTICULATOR

The stratos 100 is a simple average value articulator with very convenient handling. Teeth can be set up easily and quickly in conjunction with the setting up template. Its indications are removable denture prosthetics, BPS system.

STRATOS 200: THE SEMIADJUSTABLE ARTICULATOR

The Stratos 200 is a semiadjustable articulator with various setting options due to exchangeable joint inserts. It has been especially designed for use in fixed (crowns and bridges) and removable denture prosthetics (BPS system).

STRATOS 300: THE INDIVIDUAL ARTICULATOR

The Stratos 300 is a state of the art precision articulator with individual setting options. With its wealth of possible variations, it represents the optimum basis for exact functional simulations for demanding, high quality dentures. It has been especially designed for use in Removable denture prosthetics, BPS System, fixed crowns and bridges, implant supported dentures, functional diagnostics.

UTS 3D TRANSFERBOW (FIGURE 5A)

The Universal Transfer bow System (UTS) is very efficient, economic and precise. In less than three minutes, an experenced user is able to transfer the arbitrary position of a patient's maxilla into the Stratos.

KAVOPROTAR ARTICULATOR (FIGURE 5B) [14-16]

The articulator and face bow system from Kavo is designed so that work can be carried out using either the Frankfurt horizontal plane (FH) or Camper's plane. The nasal support provides an average alignment of the face bow with respect to the two planes. The face bow can also be individually aligned to the required reference plane by using the reference pointer (Infra-orbital point, Subnasal point). In the articulator, the face bow is always inserted in the same position on the lateral reference pins and on the incisal pin (set to zero).The bite fork will, however, vary in its position depending on the patient's anatomy. In the PROTAR articulator, the models are almost parallel (deviations ± 10º) with the Camper's plane.

FIGURE LEGENDS

Figure 1a: Teledyne Hanau

Figure 1b:Dentatus ARO Articulator

Figure 1c: Denar Mark II

Figure 1d:Hanau H2 Arcon

Figure 1e:Hanau Model 165 Hanaumate Articulator

Figure 1f: Hanau Model 166 Radial Shift

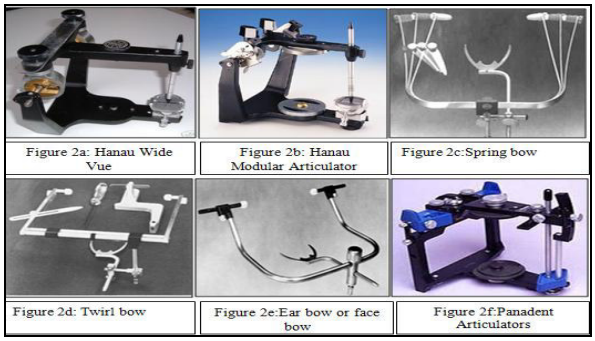

Figure 2a: Hanau Wide Vue | Figure 2b: Hanau Modular Articulator | Figure 2c:Spring bow

Figure 2d: Twirl bow | Figure 2e:Ear bow or face bow | Figure 2f:Panadent Articulators

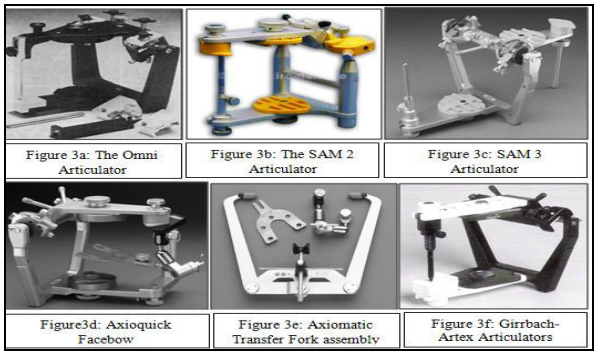

Figure 3a: The Omni Articulator | Figure 3b: The SAM 2 Articulator | Figure 3c: SAM 3 Articulator

Figure3d: Axioquick Facebow | Figure 3e: Axiomatic Transfer Fork assembly | Figure 3f: Girrbach-Artex Articulators

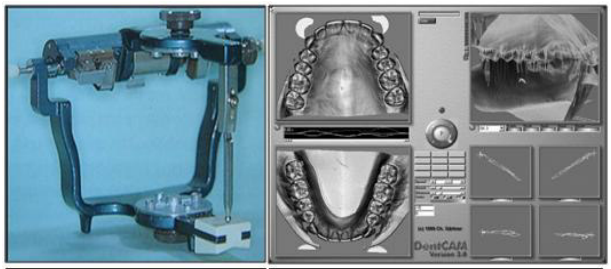

Figure 4a: Cyberhoby Fully Adiustable Articulator | Figure 4b:Virtual Articulator Based On Mechanical Dental Articulator

Figure 5a: UTS 3D Transferbow | Figure 5b:Kavo Protar Articulator

CONCLUSION

Dentists have over 300 different articulators to choose from, and their Evolution through the years has given an insight of the researchers trying to develop a mechanical device that simulates the jaw movements. The history of the development of Articulators is filled with many interesting theories and conflicting concepts. In the last two or three decades, there have been concurrent tendencies either to reduce the articulator to a simple hinge or to make them more and more complex so that to record all Mandibular movements. The success or failure of the final restoration is more dependent on the operator of the Articulator than on the Articulator itself. In other words, a semi adjustable articulator in the hands of a knowledgeable clinician may be of greater assistance in treatment than may a fully adjustable articulator in the hands of an inexperienced operator.

CONFLICT OF INTEREST

Conflict of interest declared none.

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